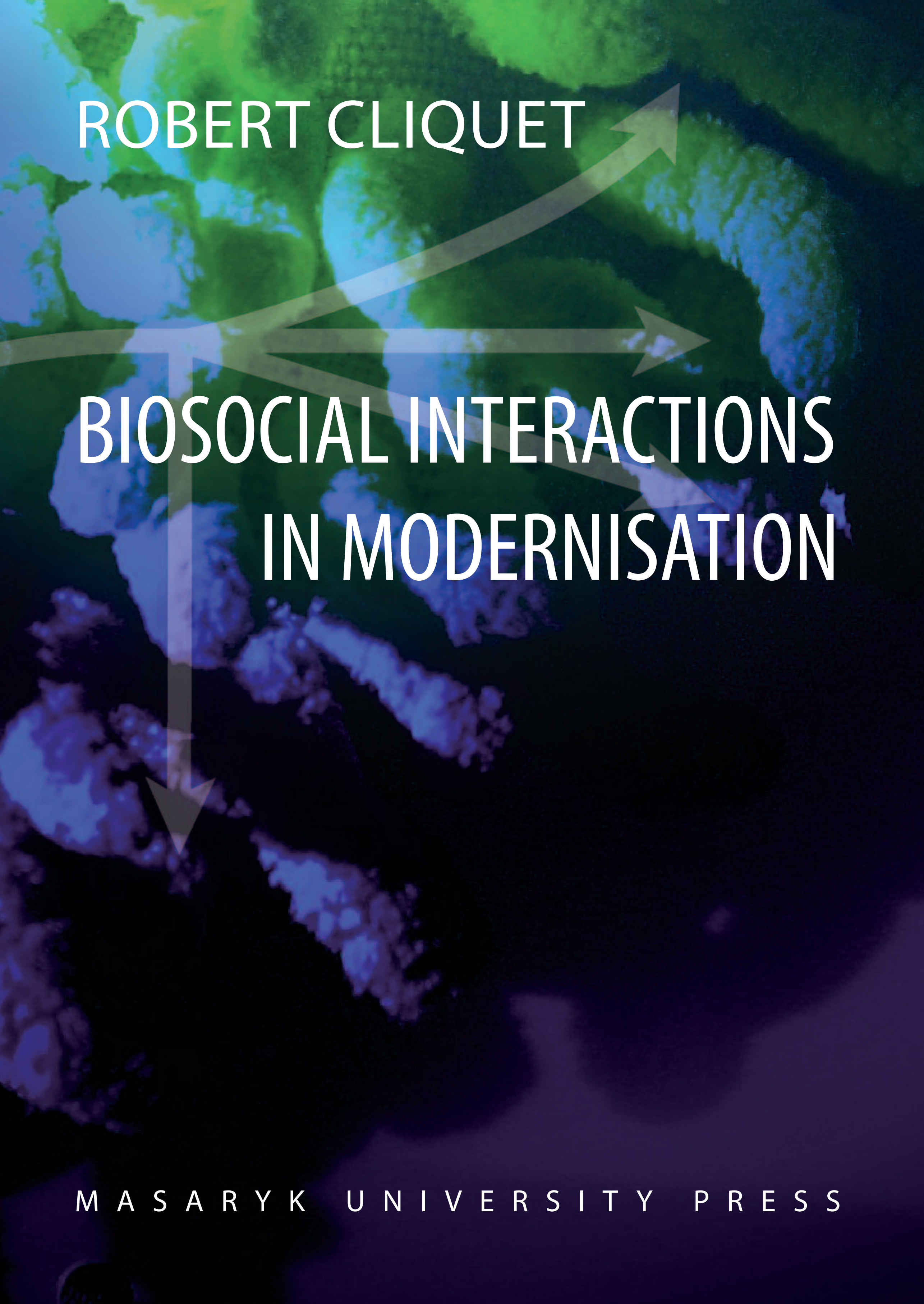

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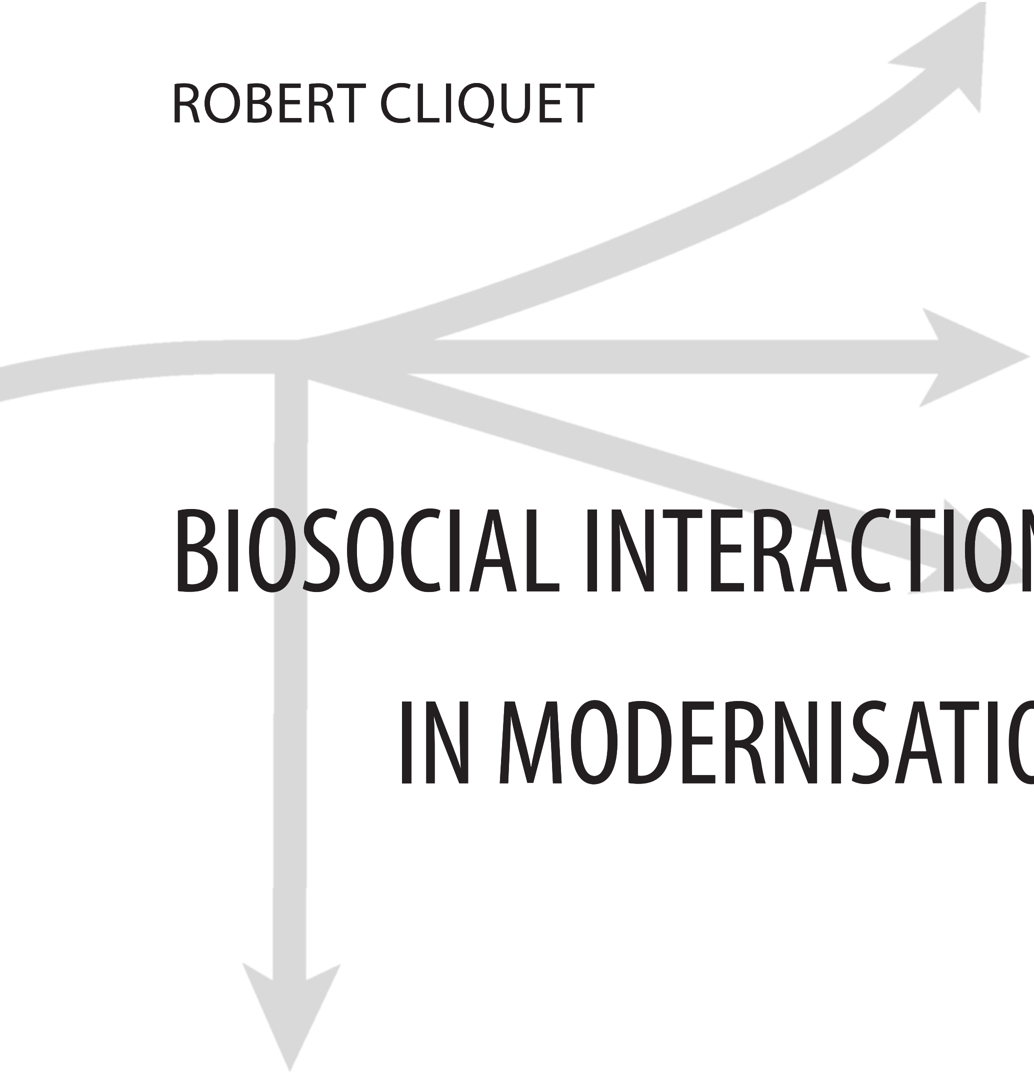

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ISBN 978-80-210-5809-5 (eBook)
ISBN 978-80-210-4986-4 (Paperback)
DOI: 10.5817/CZ.MUNI.M210-5809-2012

Production Editor Alena Mizerová
Language Editor Benjamin Vail
Cover design Eva Lufferová
Published by Masaryk University Press, 2010
Printed by Tiskárny Havlíčkův Brod, a.s.

For Wim, Kate, An, and Dušan

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Preface

Contemporary societies are facing a number of challenging problems directly resulting from the fact that the human genome that evolved in the living conditions of our remote past – the so called ‘Environment of Evolutionary Adaptedness’ – is in many respects maladapted to the fundamentally new and novel environment created by modern culture in the past few centuries.

This book examines major societal problems resulting from the clash between humanity’s evolutionary heritage and biosocial challenges in the modern context. With the goal of dealing with these issues in a comprehensive and coherent way, the subject matter is approached from the perspective of the major sources of biosocial variation: individual variation, age variation, sexual variation, family variation, reproductive variation, social class variation, racial variation, and intergenerational variation. The book relates these key sources of human biosocial variation to maladaptive social practices in the modern world, such as ‘individualism’, ‘ageism’, ‘sexism’, ‘familism’, ‘pro/anti-natalism’, ‘classism’, ‘racism’, and ‘dysgenism’.

For each source of variation, our analysis starts with the biological evolutionary background of the issue, then looks at its variability-specific biosocial interrelations, and examines the confrontation between the variability-specific evolutionary human heritage and the challenges and adaptive pressures of the novel environment that is created by the modernisation process.

The human species is the subject matter for many different scientific fields, some of which developed largely independently from each other, and in a number of cases even in relative isolation. The same is true also for the social sciences, where the absence of appropriate attention to human evolutionary history may result in the establishment of explanatory paradigms which fail to recognise the complex biosocial origins and nature of many socially maladaptive practices.

This book is intended mainly for readers with a social science background, and for students in the humanities and social sciences. However, it is also hopefully useful for people with biological interests in general. Due to the success of the natural sciences, the socio-cultural forces that influence human behaviour are often underestimated and the explanation of complex behavioural manifestations is reduced to lower levels of organic organisation.

Natural scientists often have insufficient knowledge about socio-cultural mechanisms and processes that influence ontogenetic development and intergenerational change.

I hope this book will inspire students and teachers from a variety of scientific disciplines to reflect on, and broaden the perspective from which we understand and deal with many present-day social challenges that are of a dual biosocial nature and are deeply rooted in our remote evolutionary past.

This book has its origins in my teaching of bio-anthropology and social biology to students in the social and behavioural sciences (sociology, law, criminology, psychology, history, philosophy and ethics) at Ghent University (Belgium), as well as from research and policy advising I did as the general director of the former ‘Population and Family Study Centre’ (CBGS), a Flemish governmental scientific institute located in Brussels (Belgium).

Prof. em. Dr Robert Cliquet,
Fruška Gora, summers 2000–2009

Acknowledgements

My gratitude goes first to the late Prof. Dr Lucien De Coninck of Ghent University, who inspired and supported me in my early research about social biology and who gave me, at the beginning of my university career, the opportunity to substitute for him in teaching a course originally called ‘Biology Applied to the Social Sciences’. Other university teachers who had a decisive influence on the development of my social biological interests, and consequently on the orientation of this book, include Prof. Dr John Huizinga of the Institute of Human Biology at Utrecht University in the Netherlands, Prof. Dr Ilse Schwidetzky of the *Institut für Anthropologie* at Johannes Gutenberg Universität in Mainz, Germany, and professor of anthropology Dr Harry Shapiro and professor of genetics Dr Theodosius Dobzhansky, both of Columbia University in New York City.

I owe a substantial debt to many generations of students in the social and behavioural sciences whom I had the opportunity to lecture. Many ideas explored in this book took shape during interactive discussions on the various themes addressed in my lectures on social biology.

As member of the board of directors, and later as general director, of the former Flemish Population and Family Study Centre (CBGS) in Brussels, Belgium, I took ample advantage of the institute’s multidisciplinary staff composition and interdisciplinary research programme to expand my research in the social and behavioural sciences, far beyond my own basic training in biology and bio-anthropology. I was fortunate to have had the opportunity to work in close collaboration with colleagues from various scientific backgrounds.

I am grateful to my colleagues and friends who read, critically commented on, and gave suggestions for improving the draft manuscript of this book, or some of its chapters. Prof. Dr David Coleman (Professor of Demography at Oxford University, UK) read and richly commented on Chapter 3 about ‘Age Variation and Ageism’ and Chapter 6 on ‘Reproductive Variation and Pro/anti-natalism’. Dr Lieve Vanderleyden (a social gerontologist, formerly senior researcher at the Population and Family Study Centre, Brussels) also read Chapter 3 and made valuable suggestions. Prof. Dr Petra De Sutter (at the Centre for Infertility, Faculty of Medicine and Health Sciences, Ghent

University, Belgium) read and usefully commented Chapter 4 on ‘Sexual Variation and Sexism’. Prof. Dr Kathleen Kiernan (Professor of Social Policy and Demography at the University of York, UK) read and made suggestions for Chapter 5 on ‘Family Variation and Familism’. Senator Prof. Dr Marleen Temmerman (head of the Department Obstetrics at the Faculty of Medicine and Health Sciences, Ghent University, Belgium) read and commented critically on Chapter 6. Prof. em. Dr Pierre Van den Berghe (of the Department of Sociology at the University of Washington, Seattle, United States) read and gave expert advice on Chapter 8 on ‘Racial Variation and Racism’. Prof. em. Dr Robert Vlietinck (of the Centre for Human Genetics at the Catholic University Leuven, Belgium) critically looked at Chapter 2 on ‘Individual Variation and Individualism’ and Chapter 9 on ‘Intergenerational Variation and Dysgenism’.

Dr Kristiaan Thienpont (my successor in teaching bio-anthropology and social biology at the Department of Population Sciences at Ghent University, and currently Director of the Department for Social Work at the University College *Arteveldehogeschool* in Ghent, Belgium) read the whole manuscript and made many suggestions for completing the text based on his research and teaching experience in social biology. Prof. em. Dr Frans Kerstholt (of the Faculty of Social and Behavioural Sciences at Tilburg University, The Netherlands) also put great effort into reading the entire manuscript and making suggestions to clarify the text for social-science readers.

Finally, I thank my beloved wife and colleague, Dr Dragana Avramov (Director of Population and Social Policy Consultants in Brussels, Belgium), for having encouraged me through discussions and with advice over many years to write this book and for painstakingly reading the various versions of the manuscript and making invaluable contributions to improve and refine my work.

This book might not have been published in its present form if Prof. Dr Ladislav Rabušic, Dean of the Faculty of Social Studies at Masaryk University in Brno, Czech Republic, had not invited me to lecture on social biology at his Faculty. He suggested having the manuscript published by Masaryk University Press. I am grateful to the publisher, particularly Dr Alena Mizerova, for cooperation in the production process. A special word of thanks goes to Dr Benjamin J. Vail of the Sociology Department at Masaryk University who was responsible for the English language editing of the book and who considerably improved the readability of the text.

Prof. em. Dr Robert Cliquet

CHAPTER 1

EVOLUTIONARY BACKGROUND OF BIOSOCIAL INTERACTIONS

INTRODUCTION

The human species is the study subject of many different fields of science, several of which developed largely independently and in a number of cases even in relative isolation. This is particularly the case for some social sciences where the failure to take into consideration biological evolution often resulted in the establishment of theories and views which underestimate the complex biosocial origin and nature of the human personality and its biosocial relations (Van den Berghe, 1990). Much of theoretical and analytical sociology and related fields are biased when they do not take into account our evolutionary heritage and our genetically based biological variation. Some explanatory paradigms proceed as if 1859, the year in which Darwin published his epoch-making *On the Origin of Species*, had never happened or as if they had no knowledge of the second Darwinian revolution which took place in the second half of the twentieth century (Wright, 1994).

Is it credible when social sciences study sex and gender without understanding the mechanisms of sexual selection or the origin and evolution of our sexual dimorphism and the different reproductive strategies of both sexes? Can family structures be understood without insight into mating strategies, and can parental investment and fertility behaviour be discussed without knowledge of selective processes and 'inclusive fitness' theory? Can social mobility be analysed without knowledge of polygenetic inheritance? Can intergroup conflict be dealt with without considering the evolutionary background of the in-group/out-group syndrome? Obviously not.

Can one imagine biological anthropologists studying the hominisation process without taking into account the emergence and development of human society? How could biologists understand processes of social selection and assortment if they did not take into consideration social stratification and social mobility? How could they study interpopulation variation (in-group/out-group behaviour), if they were to leave out consideration of state formation? How could they approach contemporary patterns of reproductive behaviour without taking into consideration modernisation? Could they understand sexual behaviour without taking into account the effects of culturally induced value and norm systems? Obviously not.

Both the human physique and behaviour that we observe today are largely the result of interactions between biological and socio-cultural processes and should be studied in concert with each other. Human behaviour is always biological and socio-cultural at the same time (Jaspers, 1956).

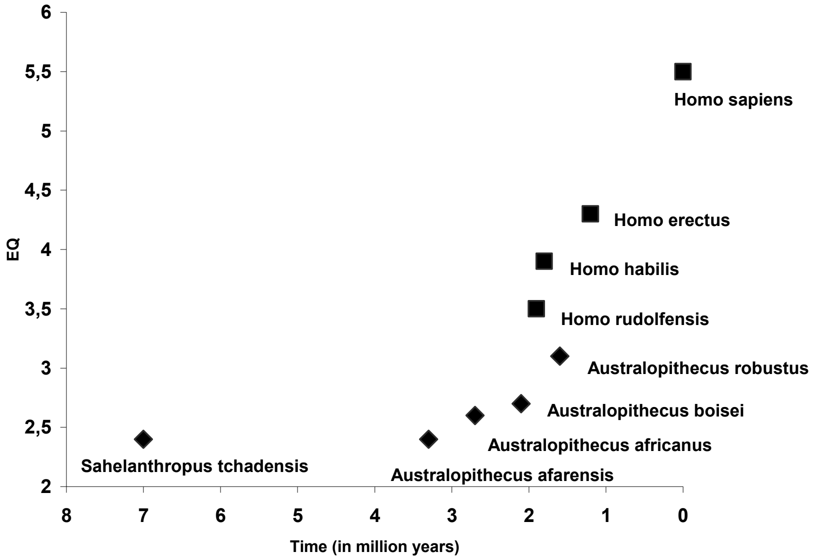

Figure 1.1 The hominisation process. Source: Cliquet and Thienpont, 2002. Legend: EQ = encephalisation quotient (also called brain-to-body mass ratio) is the ratio of the actual brain mass to the expected brain mass of a typical species that size.

BIOLOGICAL EVOLUTION AND THE SOCIO-CULTURAL DEVELOPMENT OF HUMANKIND

Humans' biosocial nature is the result of biological evolution and its associated socio-cultural history. The hominisation process took place over a period of six to seven million years during which a prehominid anthropoid was transformed, over a series of successive hominid waves, to the present-day *Homo sapiens sapiens*. This transformation was initiated by the acquisition of bipedalism and was mainly characterised by a gradual and substantial increase in brain capacity and the associated development of language, social life and culture (Figure 1.1).

The study of the parallelism between the biological evolution of hominids and the development of human culture during the hominisation process has resulted in several anthropological theories of bio-cultural co-evolution (e.g. Dobzhansky, 1962; Durham, 1991; Richerson and Boyd, 2005; McElreath and

Boyd, 2007). The hominisation process was not only accompanied by the emergence of the specific human type of culture – euculture as opposed to protoculture of some animal species – but also by a gradual increase of the complexity of that culture and of the speed with which successive cultural phases followed each other (Figure 1.2).

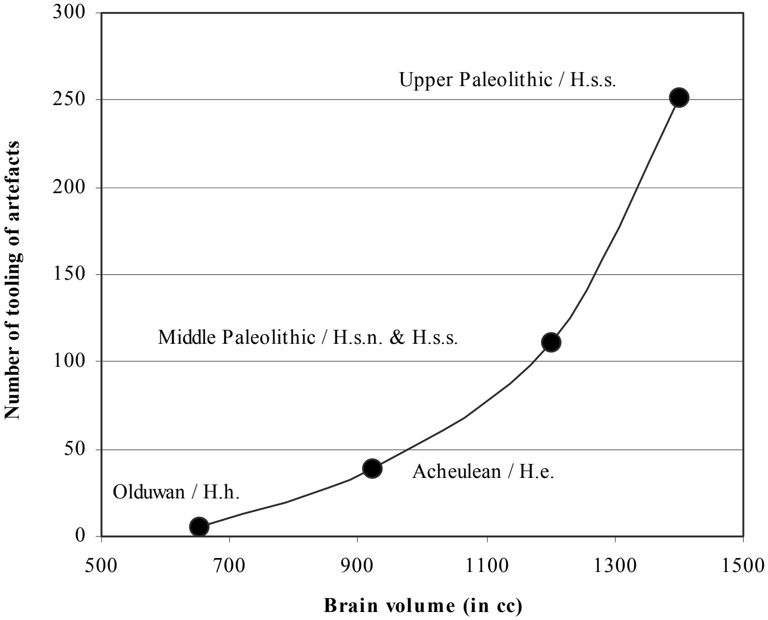

Figure 1.2. The relationship between hominisation (measured by brain size) and cultural development (measured by the amount of tooling of artefacts). Source: Cliquet and Thienpont, 2002.

Bio-cultural co-evolution appears to reflect a neurological-cultural associative-causal relationship, and a feedback-causal relationship. The hominid brain not only produced culture, but the adaptive advantage of this production also increased the selective pressure on the brain and favoured the accumulation and dissemination of mutations allowing for the brain's further growth. This increasing encephalisation[1], in turn, stimulated the further increase in cultural innovation and complexity. This neurological-cultural feedback system produced an accelerated growth process, while the bio-cultural co-evolutionary system

---

[1] Encephalisation refers here to the tendency of the human evolutionary lineage toward larger brains through evolutionary time.

implies that today’s human genome is partially a product of the culture which developed in the course of hominisation. In other words, *Homo sapiens sapiens* is the result – obviously unconscious – of a process of ‘αὐτοποίησις’ (= self-creation in Greek).

During the last phase of hominisation – the *Homo sapiens sapiens* stage – a discrepancy appears between the evolutionary tempo of neurological progress on the one hand and that of socio-cultural complexity on the other hand. Encephalisation, as measured by the size of the brain, seems to have stopped, whereas cultural acceleration has continued to progress, especially since the advent of the agricultural phase of human history, and even more since the Industrial Revolution. The paradoxical divergence between the apparently stagnating encephalisation of *Homo sapiens sapiens* and the remarkable cultural growth in recent millennia can be explained by the transition from an individual-level increase in neurological capacity to a biosocial type of ‘encephalisation’. Just as brain growth during hominisation was characterised by an exponential increase in the number of multiple interconnected neurons, resulting in an exponential enhancement of the associative capacity of the individual human brain, the more recent phases of cultural development in human history have been made possible by an exponential increase of the number of multiple interconnected individuals in demographically growing human societies. Hence, individual-level encephalisation has been complemented by biosocial interconnectivity, resulting in an exponential increase in the overall capacity of growing and evolving human societies. This biosocial ‘encephalisation’ obviously applies only to cultural forms which can be developed via social mechanisms, such as technology and social organisation. It does not apply to cultural expressions which remain dependent upon individual creativity (Cliquet and Thienpont, 2002).

Due to two interconnected specific biological features of *Homo sapiens sapiens,* postnatal growth and development of our species has become strongly dependent upon socio-cultural structures. These features were, on the one hand, the shift from programmed behaviour based on fixed instincts and inherited action patterns toward a conscious control of behaviour through the development of the large brain hemispheres, and, on the other hand, the relatively short human pregnancy duration which caused women to give birth prematurely, before the baby's brain had fully matured. Both the biosocial dependency of the human children and adolescents and the interdependency of adults increased and became more prolonged as human culture and society became more complex.

Initially the cultural explanation of the enlargement of the brain in the course of the hominisation process strongly referred to technology: the increasing neurological capacity of the hominids resulted from selective pressures in response to tool making (e.g. Oakley, 1959; Washburn, 1960). In recent decades, the causal explanation of increasingly complex social life has gained prominence in the cultural theory of hominid brain enlargement (e.g. Etkin, 1963; Holloway, 1981) (Figure 1.3).

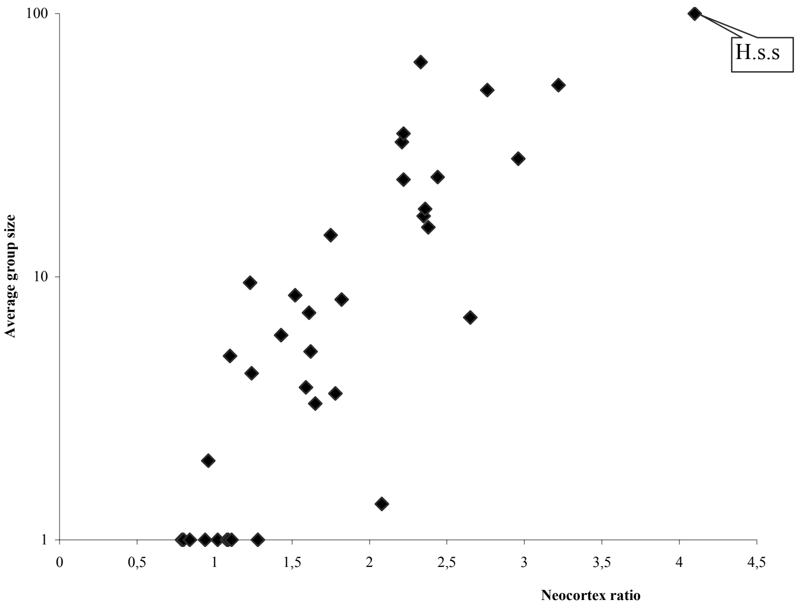

Figure 1.3. The relation between the neocortex ratio (= the proportion of the neocortex to the rest of the brain) and the average group size amongst 38 different species of Primates. Source: Durham, 1991.

A BRIEF HISTORY OF THE STUDY OF BIOSOCIAL INTERACTIONS

Biosocial research was established as social biology within the framework of biological anthropology mainly to address the specificity of the biosocial problems that emerged or became more apparent in modern society. Biological anthropology studies the natural history of hominids in general, whereas social biology concentrates on the specific interactions amongst biological and socio-cultural structures and processes.

Historically, the topics of investigation covered by social biology were studied long before it became a well-delineated scientific discipline. According to W.M.S. Russell (1976), interest in social biological issues dates back more than six hundred years. The field can be seen as originating in 1375 with the publication of Ibn Khaldun's An Introduction to History. Russell considers this to be the first textbook on social biology, in which demographic, ecological and cultural phenomena were interrelated. But according to Straass (1976), criminal anthropology (Gall, 1757–1828) should be seen as the oldest branch of social biology.

In his remarkable '*Physique sociale ou Essai sur le développement des facultés de l'homme*', Adolphe Quételet (1835; 1869) describes the task of science – without using the name social biology – as the study of the laws that govern human development, and the examination of their effects on social life.

Various labels have been used in the past to name this biosocial research field: 'anthroposociologie' (in France), 'Sozialanthropologie' (in Germany), social biology, biosocial science, and recently also sociobiology and biosociology in the Anglo-Saxon world. The variety of appellations used to designate biosocial science has been accompanied by diversity in its contents.

It is generally acknowledged that the term social biology first appeared in German scientific literature. Later, it was also used in English and French literature. Tönnies (1920) was the first to use the term '*Sozialbiologie*'. He identified it as one of the three components of what he considered to be general sociology, namely social biology, social psychology, and sociology *sensu stricto*. He considered social biology to be the biological study of human beings in their social and cultural environment.

Elster (1923) was the first author to write a full-length book entitled '*Sozialbiologie*'. Although he mainly focussed on population science and social hygiene, he warned against a narrow or lopsided conception of social biology. He argued that both physical and psychic phenomena should be considered, he wanted both genetic and environmental factors to be studied, and, last but not least, he was of the view that the sociobiological foundation as well as the sociobiological impact of culture and economy should be considered.

Many of the early authors, however, limited the field of social biology to the study of the biological processes and features of socially identifiable groups such as occupational groups or social classes. This was also the meaning that was originally given to '*Sozialanthropologie'* in Germany (cf. Ammon, 1895; Plitzner, 1899; Fischer, 1910).

Some authors conceived of society as a living organism. They merely saw an analogy between biological and social processes (cf. Ammon, 1895; Schallmayer, 1903; Bouthoul, 1957), and, hence, identified social biology with the theory of social biologism.

Other authors limited their conception of social biology largely to the study of the biological effects of demographic processes (e.g. Dale, 1949; Sauvy, 1960). Still others limited it to the study of the relations between social processes and genetic phenomena (e.g. Saller, 1956). Becker and Jürgens (1970) coined the term "social genetics" for this field.

In the second part of her book '*Grundzüge der Völkerbiologie*', devoted to the topic of '*Sozialbiologie*', Schwidetzky (1950) stressed the need for studying the reciprocal relations between biological and social phenomena, expanding an idea that was already present in Elster's (1923) book and even in de Lapouge's (1887) definition of '*anthroposociologie*'. This idea of reciprocity reveals the truly interdisciplinary status of social biology, highlighting its location between the biological and the socio-cultural sciences. This orientation prompts not only the investigation of the possible effects of biological phenomena – genetic as well as non genetic – on social life and culture, but also the study of the influences that social and cultural structures and processes can exert on the organic development and evolution of humankind.

Reciprocity is the idea which, nowadays, is reflected in scientific journals such as 'Biodemography and Social Biology', 'Journal of Biosocial Science', 'Evolution and Human Behavior', 'Human Nature: An Interdisciplinary Biosocial Perspective', 'Behavioral and Brain Sciences', 'Politics and the Life Sciences', etc., and in the annual symposium monographs on social biology of the Galton Foundation. Furthermore, social biologists are involved in all major research domains of biological anthropology – sexual, ontogenetic, individual, family, interpopulational, and intergenerational variation – and publish in a broad variety of biological, anthropological, genetic, medical, psychological, demographic and sociological journals.

The term social biology, and more particularly its components – the words 'social' and 'biology' – require some further clarification. The word 'social' obviously refers to the relations between conspecifics, either at the individual or at the group level.

Whereas the field of biosocial research was formerly mostly limited to the study of the relations between biological processes and social phenomena in the strict sense of the word, this relationship is nowadays more often conceived in a broader perspective, including other cultural structures and processes as well. The motto of 'Social Biology', the journal of the Society for the Study of Social Biology, is eloquent in this respect (Fuller, 1983):

> *"To further knowledge of the biological and socio-cultural forces affecting human populations and their evolution ."*

In contrast, the term 'biological' has always been used in its broad meaning, including genetic as well as non-genetic phenomena. Nevertheless some scholars have paid more attention either to the first, or to the second. It is essential to keep in mind that biological phenomena consist of (phylo)genetic[2] and ontogenetic[3] processes and that biological determinants of life processes can be of a genetic or of an environmental nature. Examples of biological-environmental factors are: nutrition, environmentally induced disease, and the prenatal maternal environment. Biological-environmental factors are, of course, only one facet of the environment, which is additionally composed of physical and socio-cultural components.

Milestones in the establishment of modern social biology include the development of demography (Graunt, 1662; Malthus, 1798), evolutionary theory (Darwin, 1859; Wallace, 1859), genetics (Mendel, 1865) and more particularly population genetics (Chetverikov, 1926; Fisher, 1930; Wright, 1931; Haldane, 1932), quantitative genetics (Fisher, 1918; Mather and Jinks, 1971), ethology (Tinbergen, 1963; Lorenz, 1970) and ecology (Ehrlich *et al.*, 1977; Hens *et al.*, 1998). Obviously, the development of the basic scientific domains – biological anthropology on the one hand and sociology on the other – were of essential importance.

The development of evolutionary theory and more particularly the discovery of the principle of natural selection by Darwin and Wallace in 1859 considerably stimulated the development of sociobiological thinking, among others leading to a line of thought which has become known in the literature under the name '(Pseudo)-Social-Darwinism' (cf. Hofstadter, 1944; Tort, 1992) – an issue which will be discussed in Chapter 7.

However, sociobiological research got its most important boost with the accelerated development of evolutionary theory which has taken place since the early 1960s and is known as 'the second Darwinian revolution' (cf. Wright, 1994; Machalek and Martin, 2004)[4].

THE STUDY OF THE BIOLOGICAL EVOLUTION OF SOCIALITY

In the final decades of the twentieth century considerable progress was made in the field of human evolution, particularly with respect to the human evolutionary

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[2] Phylogeny (from Greek: 'phylum' and 'genesis') refers to the intergenerational evolution of a species or a group of species.

[3] Ontogeny (from Greek: 'on' and 'genesis') refers to the development of the individual from conception to death.

[4] Junker (2003) labeled the modern synthetic evolutionary theory of the 1930s as the 'second Darwinian revolution', but his German publications remained apparently unknown in the Anglo-Saxon literature. In Junker's numbering, the sociobiological revolution of the 1960s–1970s should have been labeled the 'third Darwinian revolution'.

mechanism. Paleo-anthropology not only progressed with the discovery of numerous new hominid fossils, but also shifted from a predominantly descriptive to a causal-analytical science, interpreting its empirical data within the framework of evolutionary theory. This development was strongly stimulated by the interdisciplinary integration of approaches and findings from other research fields such as population genetics, molecular genetics, demography, ethology, ecology, archaeology, cultural anthropology, and, last but not least, primatology.

Largely independent of the developments in biological anthropology, zoologists made considerable progress in the study of the social behaviour of animal species and interspecies comparison of animal behaviour (e.g. Scott, 1958; Wilson, 1975; Barash, 1977; Trivers, 1985). Of particular relevance to (biological) anthropology and the human social sciences in general is the behavioural research on primates (e.g. Zuckerman, 1932; Campbell *et al.*, 2006).

In the 1960s and 1970s evolutionary biology made a great leap forward with the development of a number of refined or new concepts and theories about the biological evolution of sociality. Examples are: inclusive fitness (Hamilton, 1964), kin selection (Maynard Smith, 1964), individual versus group selection (Williams, 1966), reciprocal altruism (Trivers, 1971), parental investment and sexual selection (Trivers, 1972), evolutionary stable strategy (Maynard Smith and Price, 1973), sex allocation theory (Trivers and Willard, 1973), Red Queen Theory (Van Valen, 1973), parent-offspring conflict (Trivers, 1974), the Machiavellian hypothesis (Alexander, 1974; Humphrey, 1976), the multiplier effect (Wilson, 1975), evolution of sex theory (Maynard Smith, 1978), evolution of co-operation (Axelrod and Hamilton, 1981), evolutionary game theory (Maynard Smith, 1982), etc. The innovation was so striking and fundamental, especially for the understanding of many aspects of the evolution of sociality, that some authors already now refer to that period as the ‘second Darwinian revolution’ (cf. Horgan, 1995; Machalek and Martin, 2004).

From the 1970s onward the new biological concepts and theories concerning the evolution of social life have been applied also to human social behaviour (cf. Gregory *et al.*, 1978; Chagnon and Irons, 1979; Crook, 1980; Cartwright, 2000; Harpending *et al.*, 2005). Alexander (1974; 1979a) did pioneering work in generating ingenious hypotheses and theories with regard to various issues such as the evolution of morality in intergroup competition, the relationship between biological evolution and culture, human parental investment and nepotism, and scenario building, consciousness, and human communication (Irons, 2005; Flinn *et al.*, 2005).

Specifically human-oriented sociobiological theoretical work and empirical research concern a broad variety of issues such as the selfish gene (Dawkins, 1976), altruism and nepotism (Alexander, 1979a; Bellow, 2004), cheating behaviour (Trivers, 1974), cheating detection (Cosmides and Tooby, 1992), self-deception (Trivers, 1991; 2000), dominance (Omark *et al.*, 1980), jealousy (Daly *et al.*, 1982), hidden ovulation (Daniels, 1983), mating behaviour (Buss, 1994), cuckoldry and mate guarding (Hiatt, 1989), incest avoidance and incest taboo (Van den Berghe, 1980), kinship systems (Van den Berghe, 1979), sexual dimorphism and reproductive strategies (Daly and Wilson, 1978), rape (Thornhill and Palmer, 2000), paternal confidence (Gaulin and Schlegel, 1980), paternity security and avunculate[5] (Greene, 1980), parental investment (Rossi, 1977), sex ratio and male surmortality (Trivers and Willard, 1973), parent-offspring conflict (Trivers, 1974) infanticide (Dickemann, 1981), child abuse (Lenington, 1981), adoption (Silk, 1990), menopause (Peccei (1995) and senescence (Hamilton, 1966), suicide (Mascaro *et al.*, 2001), in-group/out-group relations, xenophobia and racism (Reynolds *et al.*, 1987), ostracism (Gruter and Masters, 1986), wary cooperation theory (Alford and Hibbing, 2004), co-operation and international politics (Axelrod, 1984), aggression and war (Shaw and Wong, 1989), and biopolitics (Somit, 1976).

The term ‘sociobiology’ was coined by the animal behaviourist J.P. Scott (1958). A comprehensive definition was developed in 1975 by of E.O. Wilson in the book ‘Sociobiology: The New Synthesis’. In this epoch-making oeuvre on the behaviour of social species Wilson defined sociobiology as the study of the biological evolution of social behaviour, in which knowledge from ethology, ecology, and genetics is incorporated in order to show how social species adapt to the environment by evolution (Wilson, 1975, 4):

> *“Sociobiology is defined as the systematic study*
> *of the biological basis of all social behaviour.”*

In some literature the terms sociobiology and social biology are used interchangeably. The recent developments in the evolutionary study of social behaviour in animal species, including the human species, have however resulted in a difference in the subject matter. Social biology deals with the interrelationship of biological and socio-cultural phenomena in the human, whereas sociobiology concentrates on the biological evolution of social life in animals and hominids.[6]

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[5] Avunculate: the relationship between a person and his/her maternal uncle, or, on the other side, between the person and his/her sororal nephew or niece.

[6] In the decades following the publication of Wilson’s ‘Sociobiology’, several other names have been introduced to label the evolutionary study of (human) social behaviour, e.g. socioecology, evolutionary ecology, ecological anthropology, (human) behavioural ecology. This occurred partly as a consequence of the ideological controversy that arose about sociobiology, partly on the basis of some differences in theoretical or methodological approach (Borgerhoff Mulder, 1991; Smith, 1991; Cronk, 2006).

Sociobiological research, in particular since the 1960s, plus findings based on the interspecies comparison of social behaviour are of great importance for understanding human behaviour. Sociobiology has considerably stimulated the study of human social relations, and their evolutionary origin and development. It contributes to the understanding of the biosocial constraints and conflicts in modern society, since many problems result from the fact that the human mind with its specific evolved psychological mechanisms emerged as an adaptation to Pleistocene living conditions, – the so called ‘Environment of Evolutionary Adaptedness’ (EEA) (Bowlby, 1969; Symons, 1979; Irons, 1998).

The development of sociobiology also underpinned the emergence of modern evolutionary psychology. An evolutionary approach to social and cultural behaviour requires in-depth study at the individual level of the way in which the brain functions to create social and cultural adaptations. Indeed, evolutionary psychology studies the evolved human psychological mechanisms regulating individual behaviour resulting in social and cultural dynamics (cf. Tooby and Cosmides, 1989; 1990; Griffiths, 2008). Evolutionary psychology endeavours to produce a synthesis of modern evolutionary biology and modern psychology (Buss, 1999; Barrett *et al.*, 2002), focusing on the cognitive-mental level as mediator between social reality and individual behaviour. It seeks to identify specific cognitive mechanisms that were designed to solve specific adaptive problems in the environment in which they emerged. A fundamental proposition of evolutionary psychology is that the mechanisms of our social cognition were adaptations to the hunter-gatherer culture of the Pleistocene past. This implies that our brain, with its basic mental content-specific cognitive mechanisms, is not adapted to the present environment of high population density and social complexity that we experience in modern culture (Dunbar, 2007). Today the neuro-cognitive behavioural sciences contribute significantly to evolutionary psychological theory. The processing of social cognition appears to occur via specific neuro-cognitive processes and sections of the brain (Bechara, 2002). All in all, although evolutionary psychology makes a specific contribution to the study of the evolution of social behaviour, much of what is currently published under the heading of evolutionary psychology belongs in fact to sociobiology.

In some cases, the concept of evolutionary psychology is used not to complement but to replace the term sociobiology, apparently in order to avoid the association with a field that has been accused of biological determinism and reductionism, racism, sexism, etc. (Webster, 2007). According to Silverman (2003), the renaming of the journal ‘Ethology and Sociobiology’ in 1997 to ‘Evolution and Human Behavior’, was perhaps motivated not only by a desire to signal a more multi-disciplinary approach to the evolutionarily inspired study of human behaviour, but also by the recent aversion to sociobiology which has been expressed in some quarters. However, we suspect that the eagerness and ease with which the term sociobiology is being exchanged for evolutionary psychology, especially in the United States, might also have to do with the fact that the more individual-oriented psychology is politically more fashionable than the more socially oriented sociobiology.

The second Darwinian revolution is not only influencing psychology. This approach is also slowly being introduced to sociology. Crippen (1994) coined the term 'Neo-Darwinian Sociology'; Ducros (1981) and Walsh (1995) use the term 'biosociology' as a new paradigm. Machalek and Martin (2004) even perceive the emergence of a nascent 'evolutionary sociology' that integrates sociobiological reasoning with contemporary sociological thought (see also Maryanski, 1998; Lopreato, 2001). In his 'Evolution of Human Sociality', Sanderson (2001) set out to synthesize sociological theories with key findings from biology into an overarching scientific paradigm. In their recent work on 'The New Evolutionary Social Science', Niedenzu, Meleghy, and Meyer (2008) develop new bases for understanding social change and the world's future through a better integration of the life sciences and social sciences.

Another offshoot of the recent sociobiological revival is bioeconomics, a field that uses an expanded microeconomics to examine animal behaviour, human behaviour, and animal and human social institutions (e.g. Koslowsky, 1999; Landa and Ghiselin, 1999; Yarbrough, 2005; Corning, 2005; Hammerstein and Hagen, 2005; Hodgson, 2007). There is even a revival of evolutionary ethics (e.g. Katz, 2000; Lahti, 2003; Boniolo and De Anna, 2006), the appearance of a sociobiological psychiatry (e.g. Wenegrat, 1990; Stevens and Price, 1996; McGuire and Troisi, 1998), and an evolutionary political science (e.g. White, 1972; Alford and Hibbing, 2004; Fowler and Schreiber, 2008).

The evolution of social behaviour

The application of the heuristic method offered by evolutionary theory to the study of the origin and evolution of sociality has resulted in important and fundamental insights into the causes and varieties of social behaviour. It has become clear that human sociality is not just a cultural invention that developed autonomously. The fact that social behaviour occurs in many animal species and is universal in the human species allows us to suppose that it has a fundamental biological meaning, namely an adaptive value.

From an evolutionary point of view, the adaptive value of sociality raises a fundamental question: how is social life that is based on group cooperation to be reconciled with the individual competition that results from natural selection (Williams, 1966; Barash, 1977)?

Paradoxically, sociality does, in particular circumstances of internal or external nature, favour individual survival and the transmission of genes. Without excluding completely the prevalence of competition, co-operation fulfils the same function as competition: expressed in present-day evolutionary terms, it promotes the ‘inclusive fitness’ of the individual.

Barash (1977) distinguishes eight biological advantages of social behaviour: copulation, rearing offspring, protection against predators, food detection, social facilitation, biological conditioning of the environment, division of labour, and learning and cultural transmission. Social life also has disadvantages, such as increased risk of infection, increased risk of detection, and crowding. However, among social species the advantages must have been greater than the disadvantages. The decisive factor, however, always relates to the reproductive advantages sociality ultimately has for individuals. Alexander (1979a, 65) summarised this as follows:

> *“Even when humans live in variously co-operative and socially complex groups they do so because, historically, group-living has enhanced the reproductive fitness of individuals.”*

Of fundamental importance to evolutionary theory for the understanding of social behaviour, in particular that of humans, are biological concepts and theories regarding the evolution of altruism. The biological definition of altruism is behaviouristic and not ethical in nature: altruism is behaviour that reduces the fitness of a cooperating individual compared to the fitness of individuals who behave selfishly.

Darwin’s (1859) theory on natural selection states that genetically influenced characteristics in a population (species) maintain or spread themselves by means of a relatively higher reproduction of the carriers of the relevant genes. This concept of Darwinian or reproductive ‘fitness’ explains the maintenance or spreading of virtually all genes that promote adaptive characteristics, whether they be of a morphological, physiological or psychological nature. However, there is one exception: genes determining or influencing biological characteristics that produce – obviously in interaction with environmental factors – altruistic behaviour. Such behaviour implies that the genes of the altruist, who sacrifices himself for others, will be more or less reduced in the gene pool of the next generation(s), and will eventually become completely eliminated by natural selection. Nevertheless, altruistic behaviour exists in all social species and clearly appears to have great adaptive advantages. Altruistic behaviour remains a paradox in Darwinian evolutionary theory.

Darwin was aware of the fact that behavioural traits that lead to reproductive self-sacrifice cannot be maintained evolutionarily by means of differential reproductive success. He was concerned that characteristics, such as the presence of sterile casts among the eusocial insects – i.e. wasps, ants, and bees (*Ordo Hymenoptera*) and termites (*Ordo Isoptera*) – could not be explained by natural selection. With his characteristic discernment, Darwin hypothesised that, on the basis of the genetic relationship between reproducing and non-reproducing individuals, some kind of 'family selection' occurred whereby such altruistic characteristics nevertheless could spread, but he did not elaborate this idea.

In the 1930s, Fisher (1930) and Haldane (1932) suggested that genes that favour altruistic behaviour can be selected for if the beneficiaries would be genetically sufficiently related to the altruist, so that such genes could nevertheless increase.

The definitive breakthrough of this idea occurred in the 1960s when the British biologist Hamilton developed in a series of brilliant contributions (Hamilton, 1964; 1970; 1971; 1975) a fully-fledged theory about kin selection. Hamilton proved in a formal mathematical way that the altruistic behaviour of an individual who lowers his personal reproductive fitness, can be positively selected for when his altruistic behaviour increases the reproductive fitness of related persons to such a degree that his genes are increased in the next generation via related beneficiaries. Hamilton showed that natural selection promotes altruistic behaviour between relatives when the benefit (B) for the recipient relative, weighted for the degree of relatedness (r), is larger than the cost (C) for the altruist himself:

$$rB > C$$

Hamilton developed the concept 'inclusive fitness' in reference to the degree to which genes are transferred to the next generation thanks to the ordinary reproductive fitness of an individual and the fitness of his relatives, which is the result of his altruistic behaviour. Thus Hamilton amended the classical theory of natural selection by broadening the concept of fitness from 'reproductive fitness' to 'inclusive fitness'. In this way he gave an explanation for the possible genetic transmission of altruistic behavioural characteristics by means of differential reproductive behaviour of individuals.

Maynard Smith (1964) introduced the term 'kin selection' to Hamilton's theory on 'inclusive fitness'. Contrary to what some authors have argued, the concept 'kin selection' is not limited to the effect an altruist has on the reproductive behaviour of relatives. It includes also the reproductive success of the altruist himself. Hamilton's theory also implies that the degree to which the reproductive behaviour of an individual is associated with nepotistic behaviour towards his own offspring, the principle of inclusive fitness extends nepotism to other close relatives (Alexander, 1979a).

The theory about ‘kin selection’, together with ‘inclusive fitness’, is a very important study theme in sociobiology, and in general, in evolutionary theory. It offers a coherent explanation for the genetic transmission of characteristics that promote social behaviour transcending the parent-offspring bond. Some authors (Dawkins, 1978; Kurland, 1980) are even of the view that the application of Hamilton's theory of kin selection on social behaviour gives sociobiology its present specificity and originality and distinguishes it from classical ethology and comparative psychology. ‘Kin selection’ and ‘inclusive fitness’ are, indeed, intensively studied issues in sociobiology. As early as 1980 Kurland published in ‘Ethology and Sociobiology’ a review paper on ‘kin selection’ with a biblio-graphy of more than 300 titles. However, it is unjust to associate sociobiology with one or another specific theory or paradigm. Conceived as the evolutionary study of social behaviour, sociobiology is a much broader field than simply the development of theories.

Building upon Hamilton’s theory of kin selection, Trivers (1971) developed, in his paper on ‘The Evolution of Reciprocal Altruism’, an evolutionary model explaining the occurrence of altruistic behaviour between non-relatives, thus extending the evolutionary theory of altruism from kin to non-kin.

The idea of the importance of reciprocity in spurring behaviour for the evolution of social life had already been advanced by earlier authors – among others Darwin (1871) himself and Williams (1966), but it is only with Trivers’ contribution of 1971 that this question was dealt with in a more extensive and thorough way, and that a theory was elaborated which coherently links up with the present-day evolutionary synthesis. Trivers’ contribution, moreover, represented the point of departure for a large number of other scholars such as Alexander (1974), Axelrod and Hamilton (1981), Axelrod (1984), Wilson and Sober (1994), Nowak and Sigmund (1998), Gintis (2000), to further elaborate or refine the evolutionary study of reciprocity and develop it into a genuine evolutionary theory of co-operation. Countless contributions have meanwhile been produced further refining or specifying the population genetic mechanisms that favour the origin and persistence of intraspecific cooperation and altruism in humans and other species (e.g. Lehmann and Keller, 2006). Recently Nowak (2006) distinguished and compared five possible mechanisms for the evolution of cooperation – kin selection (Hamilton, 1964), direct reciprocity (Trivers, 1971; Axelrod, 1984), indirect reciprocity (Nowak and Sigmund, 1998; 2005), network reciprocity (Nowak and May, 1992; Ohtsuki *et al.*, 2006) and group selection (Wilson and Sober, 1994; Traulsen and Nowak, 2006).

In addition, in recent years progress in neurobiology has allowed exploration and understanding of the neural bases of some of the most distinctive cognitive and behavioural attributes of the human species, including altruism (cf. Baschetti, 2006; Rilling, 2008).

In socially hierarchical societies, social co-operation can be induced by yet another mechanism, the forcing of subordinates to such behaviour. Krebs (1983) speaks in such cases about ‘forced altruism’. Indeed, the importance of social coercion in the development of helping behaviour should not be underestimated, especially not in the human species.

Van den Berghe (1979) is of the view that social coercion is to be considered one of the three major foundations – together with kin selection and reciprocity – of human social life. It is a behavioural pattern that is specific to the human species and that developed in particular on a mass scale in the demographically expanding and culturally growing societies of the last 5000 to 6000 years. Social coercion of conspecifics, resulting in intra-species parasitism, is a unique phenomenon for the human species. In the animal kingdom slavery prevails among some ant species, but the enslaving concerns only other species, not the same one (Wilson, 1975).

Social coercion as a factor of community formation is of a different nature than the two other systems, i.e. kin selection and reciprocity. Nevertheless, according to some authors, there are some fundamental points of correspondence, at least as far as concerns its ultimate effects. The mechanism lying at the base of social coercion, i.e. dominance behaviour, would have, in addition to several proximate advantages, the ultimate effect that it allows for a higher reproductive fitness. Hence, Tiger and Fox (1971, 28) conclude in their highly disputed, but in many respects stimulating book ‘The Imperial Animal’: *“*Politics is about genetics*”*.

In the course of the 1980s behavioural ecological research gave nuance to the sociobiological adage of the ‘maximisation of inclusive fitness’ by linking it to available resources. Rather than pursuing a blind maximisation of their inclusive fitness, individuals strive for optimalisation in the light of available resources. One of the essential questions is how individuals divide their limited available resources (food resources, property, money, power) between somatic efforts (all investments in livelihood) and reproductive efforts (all investments in mating and reproducing). Sociobiological models have been applied with increased reliability on human societies by using socio-economic status as the operationalisation of differential resources. Hence, the interest in the sociobiological literature of the 1980s and 1990s in reproductive behaviour according to social status (cf. Betzig *et al.*, 1988).

Just as the modern evolutionary synthesis of the 1930s took enormous advantage of the mathematical developments in population genetics (cf. Wright, 1968), the use of mathematical models in explaining the evolution of social behaviour (cf. McElreath and Boyd, 2007) and bio-cultural coevolution (cf. Boyd and Richerson, 1985) has led to what has recently been called 'mathematical sociobiology' (Gintis, 2008).

The recent controversy about sociobiology

The publication in 1975 of 'Sociobiology, The New Synthesis' by Harvard entomologist Edward Wilson initiated a scientific and, even more, an ideological controversy, particularly in the United States. Why did Wilson become the stumbling block, and not Ghiselin who, for example, had published, one year earlier, 'The Economy of Nature and the Evolution of Sex' (1974) – a much more provocative sociobiological book, as can be judged from its often quoted aphorism:

> *"Scratch an 'altruist', and watch a 'hypocrite' bleed."*

Wilson's 'Sociobiology, The New Synthesis', which appeared to some people as a new science, was followed by a tide of sociobiological, methodological, philosophical, and ideological publications in which sociobiological theories were further elaborated, discussed and popularised, but also criticised and opposed. This discussion, which largely transgressed the boundaries of the narrow scientific setting, can be seen as a resurgence of the Darwinian debate of the nineteenth century, with its present-day Darwins and Wallaces on the one hand, its Owens and Agassizs on the other hand, as well as its inevitable Wilberforces.

Explaining this controversy, particularly the fact that its ignition occurred in response to the appearance of Wilson's 'New Synthesis' and not another sociobiological publication, is neither easy nor simple. Wilson's 'New Synthesis' was a masterly compendium that was very positively reviewed by the profession, not that it was accepted without any critique (e.g. Baerends *et al.*, 1976). Indeed, the last chapter on the human species was insufficiently nuanced and elaborated. More particularly, a number of delicate issues such as human sexual dimorphism, dominance, and aggressive behaviour were not fully developed in an evolutionary perspective. Also, human bio-cultural duality was insufficiently elucidated. Last but not least, Wilson (1975, 4) advanced in his book positions on the relations between sociobiology and other social sciences that, as he should have foreseen as a sociobiologist, were likely to arouse territorial anger in other social science fields:

> *"One of the functions of sociobiology, then, is to reformulate the foundations of the social sciences in a way that draws these subjects into the Modern Synthesis."*

Later Wilson (1978) wrote in his book 'On Human Nature' in a much more nuanced and detailed way about specific human sociobiological issues.

Several factors ignited opposition to the new sociobiology. Opposition came from some social scientists, from circles inspired by Marxism, feminism, and from among religious believers. Obviously, different views and approaches also exist within the profession, but this was certainly not the cause of the largely ideologically inspired public debate. Sociobiology was criticised for being overly deterministic and unduly reductionist, for providing biological arguments in support of the capitalist social order, sexism, and racism, and for undermining religious beliefs (e.g. Allen *et al.*, 1975; Sahlins, 1977; Smith, 1984).

Meanwhile it has been amply argued that sociobiology is neither overly deterministic nor unduly reductionist (cf. Ruse, 1979), and also that it does not support sexism, racism or capitalism (cf. Cliquet, 1983) – which is not to say that, just as in other scientific fields, some sociobiological scholars might not share such views.

Sociobiological research and analysis cannot be accused of excessive determinism or reductionism because genetic factors are partially involved in the phylogenetic evolution and ontogenetic development of social behaviour. Researchers are not sexist because genes or androgens influence sexual dimorphism and behaviour. Researchers are not racist because they conclude that population genetic factors are partially responsible for the existence of interpopulation biological differences. One is not necessarily an advocate of a capitalist social order because one's research leads to findings that biologically based or genetically influenced forms of inter-individual or inter-group competition are related to socio-economic competitive processes. In fact, many sociobiologists study sexual differences, racial variation, and intergroup competition in order to fight sexism, racism and classism.

However, one must admit that some sociobiologists have at times been too eager to popularise and compare, in an insufficiently nuanced way, complex human behavioural patterns with those of other animal species (e.g. Barash, 1979), and thus have contributed to the suspicions and fears of a resurgence of social biologism.

The opposition to sociobiology coming from religious believers is indeed easy to understand. The recent developments in evolutionary theory, particularly with respect to the emergence and evolution of social behaviour in hominids, undermine and pre-empt the foundations of many dogmatic beliefs (Dawkins, 1996; 2006).

The determinist, sexist, and racist charges against sociobiology will be discussed in the respective chapters dealing with these issues. But at this point, the reductionist charges already deserve some comment.

The theory of reductionism is a cherished notion in the philosophy of science, but is, especially with respect to the relations between biological and social theories, characterised by a great deal of confusion as pointed out by Van Der Steen (1982), and by oversimplification as stressed by Ayala (1974). Reductionism aims at explaining a phenomenon of a specified degree of complexity by a theory about phenomena of a lower complexity. This has proven to be a very fruitful and forceful methodological approach in modern science, which has advanced scientific progress. Wherever sociobiologists succeeded in explaining complex phenomena on the basis of simpler mechanisms – such as the explanation of the emergence of sociality on the basis of selective processes occurring at the individual level – they provided a valuable contribution to scientific progress. However, the reductionist approach is certainly not the only strategy to be used. In some cases a more holistic approach is necessary.

The empirical sciences can be hierarchically classified according to the range of topics that they study. Physics and chemistry have the broadest basis because all bodies have physico-chemical properties. Biology has a more restricted range because it related only to living organisms. Sociology has an even more restricted basis: it relates only to living organisms that are characterised by a social life. Although it is important to test the relations between facts and between theories about those facts at different organisational levels with the aim of obtaining insight into the evolution of the hierarchical construction and differentiated structure of reality, the facts at a specified level of organisation can only be explained within the context of the system in which those relations occur (Hull, 1974). The study of the segregation and recombination of genetic phenomena at different hierarchical levels – molecular, cytological, individual and population – is illuminating in this respect. The facts at those different levels are mutually consistent, but only part of the phenomena at the higher levels of organisation can be explained by those at the lower levels (Ruse, 1979).

The opposition between reductionism and holism or organicism is, in light of the acquired insights about evolution and the hierarchical structure of (living) matter, quite incomprehensible. It has more to do with ideological confrontations (e.g. vitalism versus materialism) or territorial behaviour (e.g. the natural versus cultural sciences) than with present-day scientific knowledge.

Many critics of sociobiological theories seem to confuse reductionism with evolutionism. The theory that a phenomenon evolves over time, changes its appearance, and possibly increases its complexity in a series of subsequent stages, does not imply that the outcome of the evolutionary process is reducible to one of its former stages. Knowledge of the process of evolution, however, may be of considerable value for understanding the emergence of the phenomenon under consideration, and for identifying the common features and determinants of the subsequent stages of the evolutionary trend. Social irreducibility and biological continuity are not mutually exclusive (Guille-Escuret, 1994). Adopting an evolutionary approach, indeed, does not imply that social sciences such as sociology, cultural anthropology, economics, and history should be dismissed or minimised. On the contrary, these disciplines are fundamentally important for understanding human evolution because they study both the context for and the costs and benefits of the evolutionary process (Dunbar, 2007).

The recent opposition to innovations in sociobiology that accompanied Wilson's 'New Synthesis' is the result of the coincidence of a number of circumstantial factors and the existence of a number of more fundamental causes.

The publisher of Wilson's well-written and marvellously illustrated book, in which the author synthesised the sensitive issues dealing with the evolution of social behaviour, had launched an intense publicity campaign. Barlow and Silverberg (1980) showed that the publicity attracted a broader readership to the issues, which were saliently presented. However, special care is necessary in popularising scientific findings and theories (Hull, 1974).

A left-radical collective called 'Science for the People' at Harvard University, where Wilson was working, initiated the debate about Wilson's 'New Synthesis' by publishing the paper, 'Sociobiological Study Group of Science for the People' (1975). Some members of the group (Allen *et al.*, 1975) went so far as to evoke the Nazi gas chambers, thus applying the age-old *ad hominem* tactic of putting one's opponent in an unfavourable light by associating him with a criminal ideology.

At that time the Marxist ideological and scientific-epistemological premises of the well-known population geneticist Richard Lewontin, who was also working at Harvard, clashed with Wilson's. Both protagonists symbiotically sustained the controversy over sociobiology with a view of furthering their long-range scientific-cum-moral agendas (Segerstraele, 1986).

The revival of the feminist movement in the 1970s was associated with a profound suspicion of the biological sciences (e.g. Sayers 1982; Connell 2000). Feminists argued that social biology provides ideological cover for the abuse of women, by making 'natural' arguments that strengthen conservative political positions, maintain the social status quo in gender relations, and legitimate sexual discrimination.

Finally, there has been acceleration in the development of the biological sciences, while the social and behavioural sciences have lagged behind. The success in different fields of biology – evolutionary theory, sociobiology, molecular genetics, ecology, and medicine in general – sharply contrasts with slower progress in social sciences (e.g. Tooby and Cosmides, 1992).

There are, however, even more fundamental causes of the recent confrontations over the new developments in sociobiology.

There are, first of all, the eternal theoretical-scientific and epistemological debates related to the appropriate formulation of hypotheses, theories and model building, distinguishing between association and causation, the making of analogies and homologies, proximate and ultimate determinants, avoiding the naturalistic fallacy, and inappropriate forms of reductionism, etc.

In the second place, there is the complex compartmentalisation of the scientific industry, resulting in segregated sciences developing and progressing in relative isolation to each other rather than approaching complex phenomena in an overall, integrated manner. The mutual lack of knowledge of social and biological scientists about each other's activities is often amazing and disquieting.

According to Van den Berghe (1991) the social sciences, and especially sociology, appear to be particularly vulnerable in this respect. Some social scientists are victims of bio-illiteracy and are unaware of evolutionary concepts that help to explain social behaviour, despite the potential of such concepts to aid the understanding of major social problems (Thayer, 2004). In most universities, fields such as bio-anthropology, genetics, social biology, and ecology are absent in the sociological *curricula*, at a time when those sciences are making such considerable and socially significant progress. Even worse, many sociology courses and textbooks, as shown by Machalek and Martin (2004), give a distorted account of sociobiology, displaying an incredible lack of knowledge about present-day bio-anthropology, genetics, sociobiology, evolutionary psychology, and evolutionary theory in general.

However, the ignorance of some social scientists is not only the result of intellectual inbreeding, the use of specific methodologies, or of the increasing technical sophistication of the biological domains. It is also due to the salient ideological prejudices about biosocial interrelations, which remain obstinately cherished, as argued by authors such as Van den Berghe (1991), Ellis (1996), Lopreato and Crippen (1999), Machalek and Martin (2004) Barkow (2006). Several issues must be stressed in this respect.

First of all, some social scientists (e.g. Sahlins, 1976) reproach biology, and more particularly evolutionary biology, and its offshoots such as sociobiology, for questioning the high value, if not sacred autonomy, of culture. Others, (e.g. Smith, 1984) believe that sociobiology challenges the respected Durkheimian irreducibility of the social fact. In spite of the well-established bio-cultural co-evolution paradigm in bio-anthropology (cf. Boyd and Richerson, 1985; 2005; Durham, 1991; Cavalli-Sforza and Feldman, 1981; Lumsden and Wilson, 1981), some continue to believe that social phenomena take place within an autonomous system that can only be explained by other social phenomena, as postulated by Durkheim (1895), and believe that cultural behaviour is independent of the laws of biology and psychology, as advanced by Murdock (1932). Lowie (1917) formulated this old view in a salient way:

“*Omnis cultura ex cultura*”.[7]

Tooby and Cosmides (1992) have dubbed this socio-culturally inbred approach the ‘Standard Social Science Model’ (SSSM), in contrast with the ‘Integrated Causal Model’ (ICM), which accepts and exploits the connections between all branches of science to better study the interplay of causes among all the factors that bear on a phenomenon. Relating cultural phenomena to biological processes does not thereby imply that all or most cultural variation can be explained by biological determinants only. Similarly, studying the involvement of biological forces in social processes or structures does not mean that society is totally or largely reducible to biological phenomena. In bio-anthropology and human sociobiology, there is no such thing as an ‘Exclusive Genetic Deterministic Model’ (EGDM), as Machalek and Martin (2004) have sarcastically called this sociological chimera.

Another recurrent reproach against sociobiology concerns the fact that the biological approach undermines or pre-empts the foundations of institutionalised religious or societal ideologies (cf. Dawkins, 1996; 2006; Thornhill and Palmer, 2000). Many people continue to nurture an anthropocentric view of human nature that is irreconcilable with theories questioning the autonomy of human behaviour. This anthropocentricity[8] goes hand in hand and is also partly caused by a myopic temporocentricity[9] (Van den Berghe, 1991). Concentrated on the study of industrial society, which is, in the totality of human history and evolution, obviously a very recent phenomenon, sociology has the tendency to lose sight of the real temporal dimension of human existence and evolution.

A related prejudice concerns the salient teleology in the social sciences (Van den Berghe, 1991). Anthropocentric and cultural-autonomic views imply beliefs in the overall purposefulness of human nature and action. The discoveries of evolutionary biology concerning the opportunistic nature of evolution consequently are perceived as particularly demystifying (Provine, 1971). More particularly, there is resistance to the idea that virtues such as altruism are not the result of self-creation or of divine origin, but instead have their roots in our animal past. For many, evolutionary theory remains emotionally and intellec-

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[7] All culture comes from culture

[8] Anthropocentricity: considering human beings as the most significant entity of the universe.

[9] Temporocentricity: being focused on our time-bound limitations.

tually repugnant and challenges human vanity (Van den Berghe and Barash, 1977):

> "*Sociobiology commits what, to many social scientists, is the ultimate insult: it asserts that at least some of our behaviour is understandable without any reference to what we say, think or feel.*"

The dominating ideology of many social scientists is still founded in a lopsided and naively simplistic environmentalism (Tooby and Cosmides, 1992), resulting in what Daly and Wilson (1988) have termed 'biophobia', and Weiss (1991) 'Neo-Lysenkoism'. Possible biological, particularly genetic, determinants of (social) behaviour are thought to be either nonexistent or unchangeable and, hence, inappropriate or unusable for the social scientists' interventionist goals aimed at improving human existence and effecting societal change (cf. Applebaum and Chambliss, 1997; Bryjak and Soroka, 1997). Consequently, only social means are considered to be instrumental in devising social policies whilst biological, and especially genetic, variation and determinants are disregarded. Within the political spectrum, this attitude is more prevalent among advocates of the (extreme) left. For example, in the works of Gould (1981; 1996); Rose *et al.* (1984); Rose and Rose (2000), sociobiology is presented in a distorted, if not caricatured way.

The erroneous belief that biological, particularly genetic, factors are unchangeable is also found and fostered among the ideologically and politically (extreme) right wing (cf. Arnhart, 1998; 2005). Here, the supposed lack of change in biology is used to underpin the conservation of the established political power and their control of economic resources. The biological is seen as natural, often even as supernatural, and consequently – trapped in the naturalistic fallacy – valued as such. In the end, it appears that the biological argument is often used by both left and right, either in a negative or a positive way, to conserve or to change power and resource distribution.

The ideological prejudice of the 'Standard Social Science Model (SSSM)' includes a strong moral appeal (Tooby and Cosmides, 1992). The Model opposes explaining racial, sexual, class and individual differences by genetic differences fearing that this would provide arguments in favour of discrimination. Supporters of the SSSM consequently are considered to be opponents of such forms of discrimination whilst considering others to be 'politically incorrect'.

Last but not least, many scientists are unable or unwilling to escape a number of sociobiological factors related to our basic primate biogram.[10] Salient individual and group competition, selfishness and nepotism, dominance and territorial behaviour, are warp and weft of human social life. The pertinent paper

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[10] Biogram: the total package of a species' typical adaptation patterns (Count, 1973).

of science philosopher David Hull (1978) on ‘The Sociology of Sociobiology’, should have been entitled ‘The Sociobiology of Sociology’.

THE SIGNIFICANCE OF A BIOSOCIAL APPROACH FOR THE SOCIO-CULTURAL, BEHAVIOURAL AND LIFE SCIENCES

Notwithstanding the evolutionary continuity which exists between the human species and other forms of life, and the gradual differences which distinguish humans from their closest relatives, the other primates, the human species distinguishes itself from the rest of the living world by its specific dual nature – biological and socio-cultural. This biosocial duality of human nature is a highly integrated system, the two components of which function in mutual dependency. People working in either one of those fields need to have an adequate knowledge of the other.

Those working in the socio-cultural and behavioural sciences, all of whom study or deal with particular features or phenomena emanating from the living organism, should understand how the human organism functions, as philosopher Rosenberg (2005) pointed out:

> *“The social sciences must be biological ones, owing simply to the fact that they focus on the causes and effects of the behavior of members of a biological species, Homo sapiens.”*

Policies aimed at influencing the life course of people or change their intergenerational development, should have both an adequate knowledge of the biology and the evolution of the human species and insight in the way human-biological and socio-cultural processes are interrelated.

In order to bridge the existing divide, it is necessary to overcome ideological resistance, misconceptions and prejudices about (human) biological, especially sociobiological facts, and integrate in the conceptual frameworks of the socio-cultural and behavioural fields contemporary innovations in the biological sciences, particularly evolutionary theory. A starting point would be to include in the curricula of the social, behavioural and philosophical faculties of our universities socially oriented courses on biological anthropology, human genetics, social biology/sociobiology, evolutionary psychology, and behavioural ecology.

Students in the (human-)biological sciences need to overcome the ideological belief that ‘social science is no-science’. Due to the success of the natural sciences in modern culture, scientists in these fields too often underestimate or even ignore the socio-cultural forces that influence human behaviour and reduce complex behavioural manifestations to lower levels of organic organisation.

Often they have insufficient knowledge about socio-cultural mechanisms and processes influencing ontogenetic development and intergenerational change. Although it is important to study biological mechanisms at ever lower levels of organisation, the relations between the structures and processes of different levels of organisation can only be approached and explained within the context of the organisational system within which those relations occur (Hull, 1978).

FACTS AND VALUES IN BIOSOCIAL INTERACTIONS

At several moments in its history, the field of social biology, and more recently sociobiology, has been charged with being ideologically oriented or taking ideological positions with respect to particular sociobiological problems or processes. The advocates of what Tort (1985) called a "pseudo-social-Darwinism" wanted to organise society and socio-economic relations between social classes on the basis of the knowledge they claimed to have about biological processes in general and biological evolution in particular. Also, the eugenics movement is – by definition – clearly value-oriented. It wants "to improve the inborn qualities of the human race and develop them to the utmost advantage" (Galton, 1869/1883). It has a vision of how the human species should be ontogenetically developed and how it should further evolve phylogenetically. Many present-day sociobiologists are overtly or covertly of the view that evolutionary knowledge should direct, or at least help us, to organise society and to orient the future of humankind.

Social biology is in this respect not different from sociology, economics, psychology, criminology, political science, etc. – all fields that constantly, though often tacitly, take value-laden positions. Many social scientists follow faithfully the mainstream political orientation or power structure of their society. This was very strikingly apparent with most scientists in the former centrally planned economies, it is salient today in many Islamic countries, and it can be seen in some social science literature in the West.

Social biology has some good reasons for relating biological facts and social values. Human value systems are not only the result of the hominisation process; they also contributed to the biological evolution of hominids, and are of fundamental importance for the future phylogenetic evolution and ontogenetic development of the human species. Human value and norm systems are themselves subject to evolutionary processes, particularly to Darwinian selection.

The evolutionary origin and function of ethics

The gradual shift from a largely genetically programmed – instinctive – control toward a conscious control of behaviour during hominisation required the development of more complex forms of social organisation whereby cooperation and task division – among others between the sexes – increased in importance and transcended the boundaries of close blood relationship. This development necessitated the establishment of value and norm systems.[11]

Religions and ideological belief systems are cultural instruments that underpin sociobiological functions to justify values and norms which are indispensable for onto- and/or phylo-genesis, to impose them and to transfer them to future generations (Kieffer, 1979; Reynolds *et al.*, 1983; Crippen and Machalek, 1989; Goodenough, 1990; Wilson, 2002). In addition to their promotion of valued social behaviour, religious and other ideologies often also support, usually in a subtle or hidden way, the individual or group interests of the ruling or dominating establishment (Alexander, 1987).

During hominisation, value and norm systems not only needed to keep within reasonable and liveable limits biological drives that result in dominance, aggressiveness, greed, stubbornness and pride, dishonesty, cowardness, desire, rage and anger, spite and revenge, but also to promote co-operative and other socially functional characteristics (Campbell, 1975). Biological control systems had to be complemented or replaced by socio-cultural ordering systems. Value and norm systems consequently must be considered as exo-somatic organs that fulfilled for the socialising hominids the same survival functions as their somatic organ systems. Without those exo-somatic control systems, ontogenetic development as well as further phylogenetic evolution of the socially dependent, large brain-steered hominids was impossible. Among such organisms behaviour is no longer exclusively genetically programmed and requires, consequently, cultural intervention to guarantee survival.

Ethics essentially relates to the regulation of social life. Nevertheless, ethical goals can be located at different levels, such as individual development, societal relations, and intergenerational continuity.

The necessity of the development of culturally fixed and transmitted values and norms steering the ontogenetic development of the individual needs no extensive argumentation. The helplessness of the human infant requires many

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[11] Values are understood here as enduring beliefs about specific modes of conduct or end states of existence that are personally or socially preferable. Norms are behavioural rules or ethical values according to which one ought to behave. The ensemble of values and norms in a culture constitutes its ethics, a domain of human thought that deals with good and bad (Rokeach, 1973)

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years of intensive, culturally determined learning and socialisation. Even the motivation for learning and socialisation must be stimulated by means of value and norm systems. The human no longer knows instinctively what and how to teach his offspring.

The societal functions of value and norm systems equally need little clarification. The egocentric drives of the individual must be moderated and mastered for successful social life, so that sociality, and also the individual emancipation of all group members, can be optimised. A more difficult issue concerns the desirable value and norm systems regulating the relations between groups of individuals, and in particular between societies. In-group/out-group relations belong to the most difficult issues in ethics.

The function of value and norm systems at the intergenerational level must be temporally differentiated: short- and long-term periods must be distinguished. For the short term – generational change in the narrow sense of the word – it is not difficult to demonstrate the indispensable role of value and norm systems. Just as in the case of ontogenetic development, the reproduction of a new generation is not completely genetically programmed. If they do not see or learn in one way or another, people do not even know how to copulate in a biologically functional manner. Value and norm systems also influence the number of children to be born and raised.

Long-term ethical goals are more difficult to justify on the basis of objective scientific arguments. The acceptance of this type of goal depends on the way in which life is conceived. From the point of view of the individual's perception, ethical values do not extend beyond five or six generations – grandparents, parents, self, children, grandchildren, great-grandchildren. However, when the levels of personal perception and experience are transcended, and the advances of modern science, particularly with respect to knowledge about the evolution of life, are taken into consideration, ethical systems may take on a different dimension. From an evolutionary perspective human life has a temporal dimension that extends over a period of several million years and is characterised by a process of hominisation, the essential feature of which consists of increasing encephalisation, resulting in a growing capacity for controlling life and the environment. From this perspective, the long-term ethical goal might consist in the furthering of the hominisation process.

Biological structures and processes allow us to define to a certain extent the contents of human value and norm systems. However, in a number of circumstances biological conditions do not suffice to define ethics. The human species needs complementary cultural models to orient its ontogenetic development and phylogenetic evolution. Cultural variation, hence, is possible but implies at the same time that the socio-biological future of the human species is to a certain degree variable and lies largely in our hands. This possible variation in cultural options for the future essentially concerns two dimensions: quality and equality.

The ontogenetic development and phylogenetic evolution of the human species can be realised at different levels of quality of life. Ontogenetically, the development of human potentials – physical, mental, emotional, social – can be oriented in different directions and each one of them can be minimised or maximised. Phylogenetically, the future can be steered in the direction of the prolongation of the hominisation process, or of its stabilisation, or even of its regression and termination (Figure 1.4).

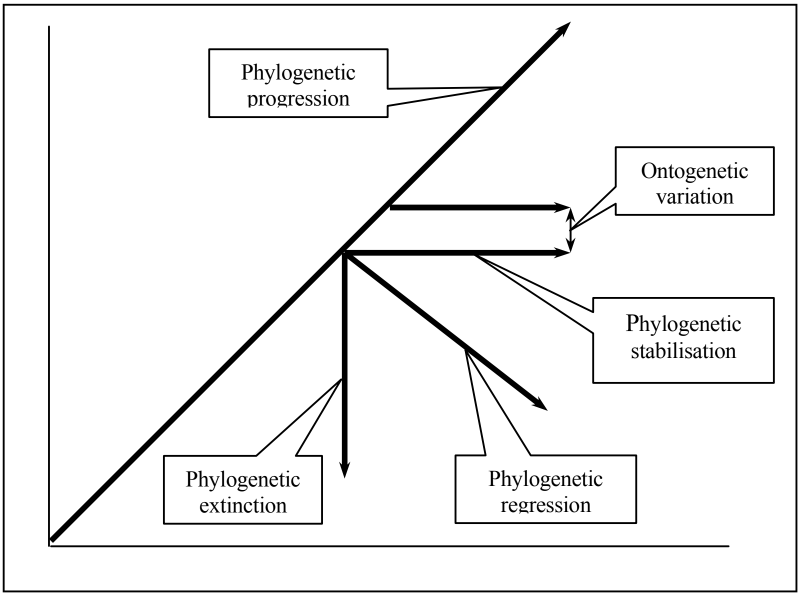

Figure 1.4. Alternative paths of phylogenetic and ontogenetic development

Ontogenetic and phylogenetic quality of life can be distributed equally or unequally over various population categories – sexes, age groups, social classes, ethnic and racial groups, and successive generations.

Answering questions related to quality and equality requires the making of ethical choices. Such choices are, however, socio-biologically not completely independent from each other.

Ethical choices are, just like cultural innovations in general and physical biological features, dependent on the evolutionary mechanism, and specifically Darwinian selection (cf. Bajema, 1978; Alexander, 1979b; Cavalli-Sforza and Feldman 1981; Lumsden and Wilson 1981; Boyd and Richerson, 1985).

Ethical innovations can be compared to genetic mutations. Just as genetic changes influence biological variability, ethical mutations increase or change cultural variation within or between populations. An important difference between genetic mutations and cultural innovations is that the former are chance phenomena, whereas the latter can also be the result of non-chance processes. Another important difference is that the former can only be transmitted via biological parents, whereas the latter can be transmitted – vertically as well as horizontally – by non-parents. This is the reason why cultural change can progress so much faster than biological evolution. Whereas biological evolution functions on the basis of Darwinian principles, cultural change occurs on the basis of Lamarckism[12].

New ideas can, just like genetic mutations, be subject to genetic drift. Biological mutations can easily be lost by chance fluctuations in small populations (Wright, 1931). Similarly, new cultural ideas can disappear by chance, simply because people do not grasp the importance of a novelty. An historical example in genetics is the Mendelian laws. They were discovered in 1865 by Gregor Mendel, but were in fact lost. They were rediscovered in 1900 when three scholars – Correns, De Vries and von Tschermak – brought them again to the fore.

Migration is obviously a mechanism that can contribute to the geographical spread or social dissemination of cultural as well as for genetic innovations.

Ethical ideas can, finally, much like biological characteristics, be promoted or eliminated by selection. Many ethical and other cultural ideas in human history have been the subject of negative selection, especially when they run counter to established interests or when they have had a maladaptive effect.

The theory of evolution is itself an example. Since classical times this idea emerged several times, but was each time opposed or discarded. An example is the idea that humans existed before the times of the biblical Adam. In 1655 Isaac de la Peyrère produced 'A theological System upon that presupposition that men were before Adam'. He was imprisoned for heresy, obliged to renounce to his

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[12] The term 'Lamarckism' refers to Lamarck's (1809) theory of the biological inheritance of acquired characteristics. Modern biology has refuted the Lamarckian principle in favour of Darwinian selection, but the intergenerational transfer of acquired characteristics applies very well to culturally transmitted characteristics.

views, and died in a monastery. With him disappeared – at least temporarily – his innovative idea (Popkin, 1987).

Cultural ideas can also be positively selected, especially when they have adaptively advantageous effects. In general, it can be stated that ethical ideas, like genetic variants, are under selective pressure. Cziko (1995) speaks in this context about universal selection. Ideas that promote adaptation, which optimise 'inclusive fitness', will be promoted, whereas variants which influence unfavourably the ontogenetic development and genetic survival, will be eliminated, together with their inventors or carriers. This applies obviously only to values and norms which are, directly of indirectly, of vital importance to intergenerational continuity.

This does not mean that all values and norms that spread or are maintained, are adaptive or optimise inclusive fitness. Some can be neutral; other can even have unfavourable effects, but nevertheless temporarily survive. In pre-scientific cultural phases, when no adequate insights existed into the causes of evolution, many cultural practices spread – some founded on lucid insight, but most, however, emanating from superstition and resulting in inefficiency, if not in misery. Many examples of relatively maladaptive cultural practices are known: drug abuse, smoking behaviour, necrophage customs, mutilations (e.g. female genital mutilation), celibacy, the one-child family, nutritional customs resulting in qualitative undernutrition, etc. (Cavalli-Sforza and Feldman, 1981). Some of these maladaptive behavioural patterns can spread or maintain themselves temporarily because genetic selection against them is weak, or because their genetic elimination is biologically or culturally compensated by other factors. The degree of maladaptation must, moreover, be evaluated at different levels of organisation – individual, population, generation – and according to time dimensions – short vs. long term – and must be situated in the total ecological context in which the phenomenon prevails.

The 'Is/Ought' controversy

Attempting to define the ultimate goal of value and norm systems in terms of ontogenetic development and phylogenetic evolution implies the rejection of the philosophically unbridgeable transition from fact to value – the notorious 'Is/Ought' controversy – and sinning against Hume's (1739–1740) 'guillotine'[13] and Moore's (1903) 'naturalistic fallacy'[14]. Many philosophers and ethicists maintain that a logical transition from fact to value is impossible. Science – the

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[13] Hume's 'guillotine': the difficulty of deducing an 'ought' from an 'is' (Hume, 1739–1740).

[14] 'Naturalistic fallacy': the impossibility of defining what is 'good' in terms of one or more natural properties (Moore, 1903).

study of what ‘is’, cannot make inferences about ethics – the prescription of the ‘ought’ (Curry, 2006).

First of all, it should be made clear that a simple transition from facts, and especially from isolated or static facts, to values is not always possible. It is not because the human species experienced during the largest part of its existence phenomena such as disease and hunger that these phenomena must be considered as natural, or as good, and consequently that they ought to be preserved. The natural fallacy has too often been used as a handy instrument to preserve existing abuses, mainly regarding social inequalities and inequities, with the aim of safeguarding the position of privileged groups in society.

Whilst a simple transition from fact to value is not always possible, a universal rejection of the is-ought transition is also not useful. The mistake made by opponents of the ‘Is/Ought’ transition is embedded in the formulation of the problem itself, especially in the understanding of the concept ‘Is’. Too often this concept is considered to be a static or chaotic situation, whereas the ‘Ought’ is supposed to be dynamic and ordering. However, life is anything but a static or chaotic phenomenon. Life is essentially a generic process, ontogenetically as well as phylogenetically; it is also an ordered phenomenon. The realisation of this organised genesis – onto or phylo – requires a design. Human life cannot ontogenetically develop itself or evolve phylogenetically when the species-specific building blocks – physical, organic, and socio-cultural – and the programmes that combine these components into functional structures and processes are not available. As argued above, value and norm systems need to interfere and mediate where genetic programming no longer suffices to achieve the generic processes. A large part of the living conditions, which are culturally induced for the realisation of ontogenetic and phylogenetic programmes, is determined by the genetic specificity of the human species. All important ethical and ideological challenges turn out to be biosocial challenges as well.

THE SOCIAL BIOLOGY OF MODERNISATION

In bio-anthropology, it is now generally accepted that the specific human genome emerged as an adaptation to living conditions that existed in the Pleistocene era, the ‘Environment of Evolutionary Adaptedness’ (EEA), which does not mean that no further genetic change would have occurred in the recent past, particularly since the invention of agriculture (cf. Cochran and Harpending, 2009).

With the onset of industrial culture, the human species entered a phase in its evolution and history that, in many respects, is a developmental threshold. Mankind has created an evolutionarily novel environment of technologically advanced societies inhabited by anonymous millions, very different from the primordial environment of small face-to-face bands of hunter-gatherers. Changes such as the development of modern science with its technological applications, the shift towards industrial modes of economic production, and the creation and use of new energy sources, provoked a giant leap forward in the making of culture and society, now generally labelled as the modernisation process.

The most fundamental feature of modernisation consists of the development of science which brought not only a more thorough knowledge and understanding of reality, but which made possible more effective ways of intervening in life, society and the environment. This interventionist nature of modern culture fundamentally changed humankind's biosocial and bio-cultural relationships, bringing about new challenges but also offering new opportunities for the future. The achievements of science and technology increasingly allow humans to master biosocial processes. In combination with the humanistic principles of the Enlightenment, modernisation may result in a sustained enhancement of quality of life, provided that the sources of biosocial variation are understood and maladaptive practices countered.

This book relates key sources of human biosocial variation – namely individual, age, sexual, family, reproductive, group, between-population, and inter-generational variation – to maladaptive social practices in modernisation, such as 'individualism', 'ageism', 'sexism', 'familism', 'pro/antinatalism', 'classism', 'racism', and 'dysgenism'[15].

Each source of variation is examined in the context of its biological evolutionary background. Variability-specific biosocial interrelations are confronted with the variability-specific evolutionary human heritage and the challenges and adaptive needs of the novel environment emerging from the modernisation process. We believe that this should be the perspective from which every treatise dealing with human phenomena should be approached. Human life is an intergenerational process, and social organisation is an instrument to promote that process, in its ontogenetic as well as its phylogenetic components.

The thread of thought throughout this book concerns the discrepancy between the genetic predisposition that is adapted to the ancient, Pleistocene environment in which humans emerged and the present, evolutionarily novel environment to which they must adapt via socialisation, value change and technological

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[15] Dysgenism: a term coined by Saleeby (1910), originally referring to the high fertility of the socially undesirable, but now used for any genetic trend that is opposite to what is considered as eugenic evolution (see Lynn, 1996).

intervention, because they are unable to adequately adapt genetically quickly enough.

Indeed, many challenges confronting modern societies today, or that are anticipated in the near future, may result from the fact that the human body – particularly the human brain with its psychological mechanisms specifically evolved as adaptations to Pleistocene living conditions – is in many respects no longer well adapted to the powerful process of increasingly rapid cultural change that started with the appearance of agriculture some 10,000 years ago, and that accelerated tremendously with the appearance of modern culture some 250 years ago. This resulted in a significant discrepancy between the original 'Environment of Evolutionary Adaptedness' (EEA) and the evolutionarily novel environment created by modern science. It is important to keep in mind that the EEA era covered 95 percent of the total time of existence of *Homo sapiens sapiens.* If the *Homo erectus* stage is included in the calculation, the EEA era of existence accounts up to 99 percent.

Although there exists today considerable between-country variation in the degree, or stage, of achievement of technology-driven modernisation, it can be observed that modernisation is seizing virtually all nations and cultures on the planet, with the exception perhaps of some remote and isolated hunter/gatherer populations. The processes that advanced industrial societies have experienced are, therefore, also of importance to developing countries, many of which are experiencing a much more rapid modernisation than western countries ever did. Hence, there are good reasons for developed as well as for developing countries to understand the social biology of modern(ising) society.

The substance of the social biology of modernising society can be studied in a number of different ways. One can look at the social biology of the various socio-cultural changes such as industrialisation, urbanisation, secularisation, individualisation, democratisation, etc. One can concentrate on the various levels of social organisation: family relations, community relations, social class relations, interethnic and interracial relations, international relations.

With the goal of covering as broadly as possible the social biology of modernising society and establishing a framework which allows study of the different issues in a bio-anthropologically relevant way, the topics discussed in this book are structured according to the main research fields in biological anthropology. From this perspective, the key sources of human biosocial variation are: individual, age, sexual, family, reproductive, social class, between-population, and inter-generational variation.

The issues to be dealt with in the book are approached from the point of view of social biology. We see this scientific discipline as the study of the reciprocal relations between biological and social phenomena, conceived from an evolutionary perspective – resulting in synergy between disciplines as originally conceived by social biology's founders and as directed by the new impetus it has received from the evolutionary approach of recent times. This does not mean that every biosocial problem or challenge in modern society finds its origin in the evolutionary past of the human species, but keeping the evolutionary background of biosocial interactions in mind may allow us not only to understand the proximate, but also the ultimate factors involved in biosocial (dis)functionalities or (mal)adaptations.

Social biology is a vast scientific domain in which biosocial interactions can be approached from different angles or studied at different levels, such as the individual, family, population, or intergenerational levels. In this book we deliberately limit ourselves to the study of phenomena that show inter-individual – i.e., social – variation. We will not deal with biosocial problems of intra-individual ontogenetic development, although this is undoubtedly an equally fascinating and legitimate domain of biosocial research (cf. Burgess and MacDonald, 2004; Ellis and Bjorklund, 2005), especially with the current explosion in genome sequencing (cf. Robinson *et al.*, 2008). Its treatment would, however, require a considerably different approach and expertise; in fact, it would be the subject of another book.

The major types of biosocial variation

Biosocial phenomena are studied in all the working fields of biological anthropology. From this vantage point, one can consider the social biology of the origin, present existence and future of humankind; one can consider the social biology of hunting/gathering, agricultural, or industrial populations; one can consider the social biology of sexuality, reproduction, family relations, social life, age variation, interpopulational differences and intergenerational processes.

The subject matter of biological anthropology is the study of human biological variation in time and space. This broad definition covers all aspects of human biological differentiation, ontogenetically as well as phylogenetically.

Some types of human biological variation, such as sex and age, are strictly related to the biology of the individual. Other sources of variation are the result of biosocial group formation, such as family, class, and interpopulation variation. Since the aim of this book is to deal with the social biology of human biological variation in modern society, the classification of the sources of variation is conceived in a sociobiological context, and, consequently, deals not only with individual, but also with group differences.

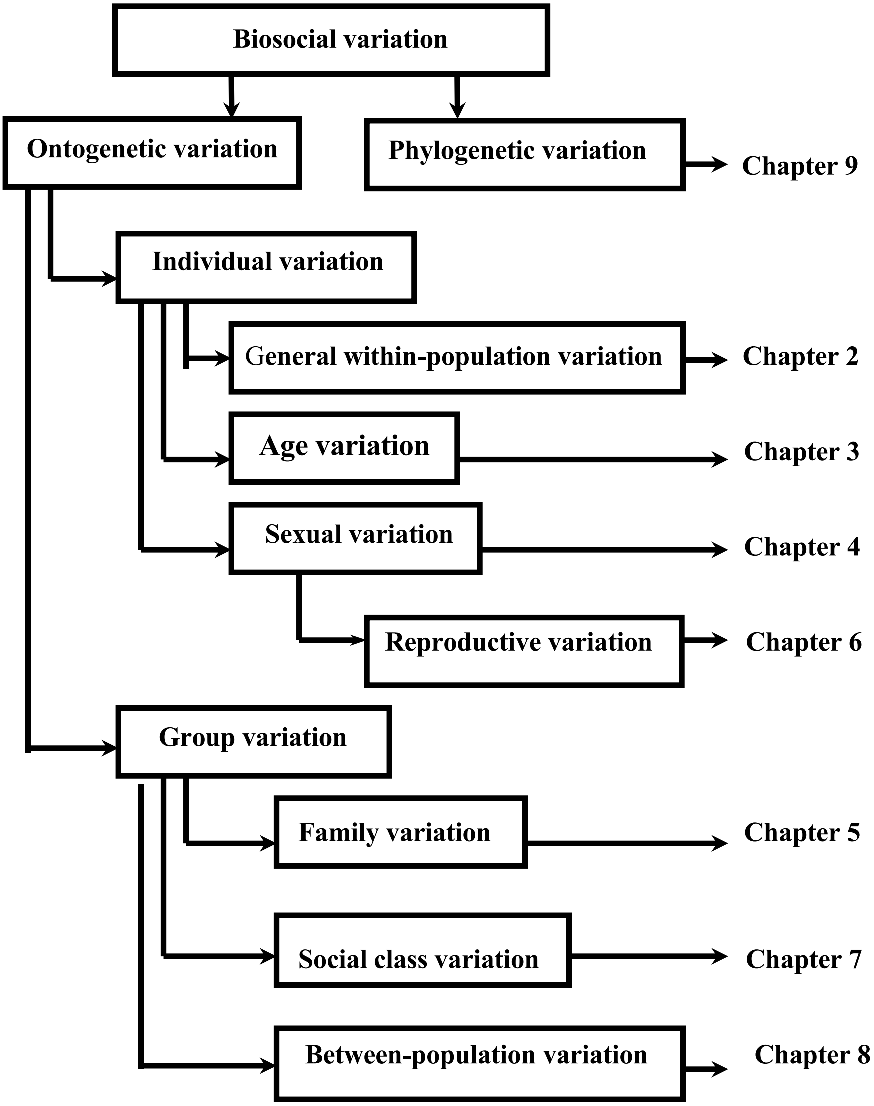

Figure 1.5. Sources of biosocial variation

The main distinction within human biological variation consists of the difference between ontogenetic or intragenerational variation and phylogenetic or intergenerational variation. Both can be further subdivided, but here the exercise will be continued only for ontogeny, since each aspect of ontogenetic differentiation has its phylogenetic counterpart (Figure 1.5).

Ontogenetic variation can, first of all, be subdivided according to the sources of individual and group variation. Individual forms of variation include general individual variation, sexual variation and age variation. Each one of these can further be subdivided. Of particular sociobiological relevance in modern culture is the subdivision of sexuality in sexual variation *sensu stricto*, and reproductive variation.

Among the types of group variation, three categories are distinguished: family variation, within-population group variation, and between-population variation.

Family relations include partnership and parenthood. Within-population group variation can include different categories of group formation. The most important of these relates to socio-economic-status (SES) differences, including social stratification and social mobility, but also other within-population divisions such as religious, other ideological and political group formation can be distinguished.

Between-population variation includes national, ethnic, and racial differentiation. In some cases, these sources of variation can also be present within populations.

Finally, phylogenetic variation concerns inter-generational differences. Given the scope of this book, this issue will be largely limited to biosocial problems of the future evolution of humankind.

The major biosocial challenges in modern culture

In modern culture, virtually each one of the above listed sources of biosocial variation raises, as a consequence of the interaction between human biology and the living conditions related to modernisation, one or more major challenges, either because modern societies continue to cherish traditional value and norm systems that have become dysfunctional in today's novel environment, or because modern living conditions enable the emergence of new maladaptive social practices (Table 1.1).

The species-specific gene pool of humankind emerged during the hunter/gatherer stage of cultural development, a process which took place over several million years. During the agricultural phase – a period lasting only 10,000 years – some genetic adaptations occurred in response to the new living circumstances, but the cultural shift was not drastic enough and the time period not long enough to induce fundamental genetic changes. The driver of modernity, science and technology – merely two centuries old – is introducing much more important cultural changes, but is so recent that major genetic adaptations have not occurred yet. Therefore the human species is facing a fundamental discrepancy between its biological heritage that is still largely adapted to the requirements of a hunter/gatherer culture, and the living conditions of modern culture.

Table 1.1. Sources of biosocial variation and maladaptive social practices in modernisation

Biosocial source of variation	**Maladaptive social practices in modern societies**	
	Relatively 'old' practices	*Relatively 'new' practices*
Individual variation		Individualism
Age variation		Ageism
Sexual variation	Sexism	
Family variation	Familism	
Reproductive variation	Pronatalism	Antinatalism
Social class variation	Nepotism Classism	
Between-population variation	Racism Ethnocentrism Xenophobia	
Intergenerational variation		Dysgenism

The human species will have to adapt to its self-created new cultural living conditions, either culturally or genetically, or both. Given the fundamental changes modern culture introduces and the speed with which these changes occur, the human species cannot rely on a spontaneous (and slow) genetic adaptation. Even a spontaneous cultural adaptation might be too slow to succeed in reconciling biological potentialities and socio-cultural demands. Consequently only goal-oriented and dynamic policies will speed up the necessary adaptations in order to avoid the dangers arising from present bio-cultural discrepancies.

Individual variation and individualism

General individual variation is in many respects adapted to pre-modern living circumstances. Modern culture has already succeeded in influencing and diminishing the significance of some of these characteristics, such as personal physical health characteristics. Other features, for instance particular cognitive and emotional personality characteristics, manifest a variation that may no longer be completely adapted to the requirements of modern life.

Thanks to its increased humanisation and socialisation, modern culture has considerably enhanced the opportunities for individual emancipation and self-actualisation. This has resulted not only in higher physical and mental performance, but also in increased individualism and, at the extreme, selfishness. Individual emancipation and societal progress evolve in some respects in opposite and conflicting directions. Individualism, which is in fact incompatible with the increased need in modern society for high levels of socialisation and cooperation, is often confused with individuality. Biosocial issues related to general individual variation and individualism are dealt with in Chapter 2.

Age variation and ageism

As far as human growth is concerned, modern culture has provoked a secular growth acceleration, resulting in earlier biological maturation. But at the same time, individual development requires a much longer socio-cultural maturation, thus increasing the gap between biological and socio-cultural maturity in both directions.

As far as concerns senescence, modern culture increases life expectancy. This increase, however, is partially, especially in the latest stage of life, accompanied by an increasing period of frailty. Modern culture also prolongs the dying process. In the future, modern culture may succeed in lengthening the species-specific life span, thus opening new challenges.

Due to fertility and mortality control, the demographic ratios between young and old have undergone substantial changes. Ageism on the one hand and gerontocracy on the other hand together challenge established patterns of inter-generational relations and transfers. Traditional values and norms with respect to senescence and death are, in different respects, no longer adapted to the possibilities and opportunities of modern interventionism. Biosocial topics pertaining to age variation and ageism are discussed in Chapter 3.

Sexual variation and sexism

Human sexual variation faces a discrepancy between the degree of sexual dimorphism for secondary sexual characteristics, especially those of the male, and the androgynic requirements of modern culture. Sexism is an attitude and form of behaviour that emerged from our evolutionary past and was strengthened in agrarian and early industrial culture. In modern culture sexism has become a maladaptive practice. The male-specific potentialities with respect to competitive and aggressive behaviour need to be strongly directed toward socially useful and ecologically sustainable goals. Old-fashioned masculine strategies will have to be replaced by a more moderate, a more socialised, a better balanced, and a more feminine-oriented strategy. Biosocial issues related to sexual variation and sexism are addressed in Chapter 4.

Family variation and familism

Family variation includes two major components: partnership and parenthood. Modern culture is changing quite considerably the biosocial functions of both of these factors. Partnership is evolving from a community controlled to a personally controlled choice, and becomes less dependent upon economic factors, but more on emotional satisfaction, hence, becomes more vulnerable. Parenthood evolves from quantity to quality, from chance to choice, from investing in a large number of children to promoting the ‘quality’ of children. In a growing number of cases, biological and social parenthood partly dissociate. On the whole, family structures and processes are becoming more changeable during the life course, resulting in a more complex and more variable family life course. Whilst most of the traditional socio-economic and socio-cultural functions of the family are being eroded, its original biosocial functions are strengthened. Modern culture faces several problems of adapting structurally to these changes and struggles with the controversy between the traditional values and norms favouring old time familism and the newly emerging family values based on shifts in family functions. Biosocial questions concerning family variation and familism are covered in Chapter 5.

Reproductive variation and pro/anti-natalism

Human reproduction is characterised by a high fecundity, the result of an adaptation to the high mortality rate that prevailed in pre-modern living conditions. In order to avoid demographic and ecological disequilibria, mortality control necessitates also fertility control. Pronatalism – high fecundity and its ethical/ideological prolongation – has become a maladaptive feature in modernisation. At the same time, modern living conditions and opportunities result more and more in a below-replacement fertility rate which, in the long run, is also not a sustainable behavioural pattern. Modern culture enhances access to birth control, but also simultaneously must reconcile individual and societal goals regarding intergenerational replacement. Biosocial problems of reproductive behaviour and fertility control are the subject of Chapter 6.

Social class variation and classism

Social class variation refers to within-population social differences of an economic, cultural or political nature. Thanks to democratisation, modern culture is characterised by a shift from static to mobile socio-economic-status (SES) positions of individuals. People increasingly are occupying SES-positions on the basis of their bio-psychic potentialities and drives, resulting in upward and downward social mobility. A meritocratic culture can only be perpetuated intergenerationally if democratisation efforts are pursued in each generation again and again in order to accommodate Mendelian segregation and recombination processes. The major biosocial challenge concerning the relationship between biological and social variation consists in the conflict between the shared need of individuals and society to maximise social mobility on the basis of individual potentialities and merits, and the familial and classist attempts to preserve social privileges and acquisitions intergenerationally. Chapter 7 deals with the biosocial issues related to social stratification and social mobility.

Racial variation and racism

Throughout human evolution and history, between-population variation has been characterised by the prevalence of xenophobia, ethnocentrism and racism, the biosocial basis of which is related to the principle of maximisation of inclusive fitness.

Modernisation, however, has been accompanied by the ever increasing internationalisation and globalisation of human relations, including increasing racial mixing and inter-group admixture in general. Modern culture, with its weapons of mass destruction and interdependence, has rendered the traditional biosocially based in-group/out-group polarisation maladaptive. Modern culture needs to effectively deal with the tensions between dynamics oriented toward the globalisation of human group relations and the biological drive to preserve and isolate one’s own group. Biosocial aspects of in-group/out-group relations are dealt with in Chapter 8.

Intergenerational variation and dysgenism

There are several important issues regarding intergenerational variation as a consequence of the fact that modern culture develops technologies changing man's phenotypic appearance and genetic make-up. Modern culture creates a protective environment for genes that wouldn't have survived or reproduced in pre-modern circumstances, leading to a possible future regressive evolution. At the same time, modern culture is developing knowledge and technology that will allow it to steer humankind's genetic future according to its own choice. This might result in the furthering of the hominisation process, or in other words lead to a progressive evolution.

Modern culture progresses at a fast pace. These changes require modern populations to adapt, phenotypically and genetically, to increasing levels of complexity and related higher requirements and demands. Modern value and norm systems are challenged to deal with possible regressive tendencies as well as the possibility of a future progressive evolution. Biosocial interactions related to generational succession are discussed in Chapter 9.

Ethical and policy considerations

Finally, Chapter 10 discusses ethical and policy considerations of biosocial interactions related to the key biological sources of individual, group and intergenerational variation in modern society, as well as the common features and challenges biosocial sources of variation raise in modern society and the adaptive requirements for sustaining further progress.

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CHAPTER 2

INDIVIDUAL VARIATION AND INDIVIDUALISM

INTRODUCTION

It is logical to start this book with a discussion about the simplest source of human biological variation – the differences which exist between individuals within populations. However, biological variation at the individual level is not only influenced by genetic and environmental factors of a general nature, but also by specific biological sources of variation such as sexual variation, age variation, social variation, and inter-population variation – specific sources which will be addressed in subsequent chapters.

Furthermore, dealing first with the individual sources of biological variation allows us to briefly dwell upon the role of basic determinants – both genetic and environmental – of biological variation in general, which are also necessary to understand the causation of specific sources of biological variation, such as sex, age, and race in later chapters. From the study of within-population variability it is conceptually easy to move to hierarchically more complex forms of variability, such as sexual variability, age variability, between-population variability and inter-generational variability.

The central question in this chapter is why people within a population, and apart from sex, age, and race, differ from each other and how this variation is linked to individualism in modern society. Why don't people of the same sex, age, or race resemble each other completely?

EVOLUTIONARY BACKGROUND

Some basic genetic concepts

In order to explain the evolutionary background of individual variation, it is necessary to remind the reader in a very simple and brief way of a few basic genetic concepts. Most readers will undoubtedly be familiar with these concepts, but it might be useful to specify their importance for the genetically unique identity of the individual and its relation to the population to which it belongs and its role in intergenerational transmissions, i.e. evolution.

The genetic identity of an individual is encapsulated in its *genome* (Winkler, 1920). This is the complete hereditary information that is encoded in the DNA of an individual. A *phenome* is the set of all phenotypic traits of an individual.

DNA, the acronym for *desoxyribonucleic acid*, is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms. DNA exists as a tightly-associated pair of molecules. These two long strands entwine in the shape of a double helix (Watson and Crick, 1953).

Nucleic acids are biomoleculair polymeres[1] that consist of monomere units called *nucleotides.* Groups of three nucleotides are responsible for the transmission of the genetic information in the DNA to cells for specifying the sequence of the amino acids within proteins. They are called *codons*. Since there are only four different types of nucleotides, $4^3 = 64$ codons can be formed. DNA segments, or combinations of segments, consisting of varying numbers and sequences of codons, that are responsible for the production of proteins and those that ultimately influence particular characteristics in an organism are called *genes* (Johannsen, 1909). In eukaryotic organisms[2] the organisation of many genes is discontinued, i.e. the genes are split in different parts, resulting in split genes (Sharp, 1977). The discovery of the DNA structure and the genetic code allowed for understanding, at the molecular level, of the duplication process of genes and the enormous genetic variability that exists in nature.

Within cell nuclei, DNA is organised into structures called *chromosomes* (from Greek: *chromos* = coloured; *soma* = body) (Strasburger, 1875). In the human there are 46 chromosomes (Tijo and Levan, 1956). In sexually reproducing organisms such as the human species, individuals in fact possess a double set of homologous chromosomes – a set coming from the female parent and another set coming from the male parent – on which most of the genes are located that determine or influence their hereditary features. With the exception of the features determined by the genes located on the two different sex chromosomes of the male (*X* and *Y*) – the female has two identical X chromosomes – every hereditary characteristic is genetically determined by at least two genes. In the case of *monogenes,* there is only one pair of genes, in the case of *polygenes* (Mather, 1941), there are several pairs of genes influencing a particular feature. The corresponding genes on the homologous chromosomes are called *alleles*. During the process of the production of sex cells (gametes) that occurs through a special form of cell division called *meiosis* (van Beneden, 1887*)*, the homologous chromosomes of the germ line cells are distributed over two daughter cells, so that the alleles segregate and the gametes include only one single set of genes. At fertilisation, male and female gametes unite, resulting in

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[1] Polymeres are large molecules composed of repeating structural units typically connected by covalent chemical bonds. Monomeres are small molecules that may become chemically bonded to other monomers to form a polymer.

[2] Eukaryotic organisms have cells with a variety organelles enclosed within internal membranes, the most important of which is the nucleus.

the reestablishment of a double set of chromosomes with their corresponding alleles for each genetically determined or influenced characteristic. Meiosis and fertilisation make possible the separating and reuniting of alleles in individuals. They form the cytological basis of the laws of Mendel (1865).

The discovery of those laws – the ‘uniformity law’, the ‘segregation law’ and the law of ‘independent inheritance of genetic traits’ – by the Augustinian monk Gregor Mendel (1822–1884) in his Brno abbey, and their rediscovery by Hugo De Vries in the Netherlands, Carl Correns in Germany and Erik von Tschermak in Austria in 1900, was of such fundamental importance that we now speak about Mendelian genetics, in contrast to pre-Mendelian genetics. Before Mendel it was generally believed that genetic traits were transmitted by means of blending of genetic material. Thanks to Mendel it was discovered that genes are particle structures that maintain their identity from generation to generation. Mendel also showed that genetic traits were transmitted by means of two elements, one from each parent, that joined at fertilisation and again segregated at gamete formation, and all this before anything was known about chromosomes and meiosis.

Since a gene for a particular characteristic can take slightly different forms, several allele combinations, named *genotypes* (Johannsen, 1909), can be formed. For a monogenetic feature, determined by two alleles – e.g. *A* and *a* – three genotypes – AA, Aa and aa – can be formed. The genotypes with two identical alleles (AA and aa) are called *homozygotes*, whereas the genotypes with different alleles (in this example: Aa) are called *heterozygotes*. Some alleles may be dominant (e.g. A), masking the phenotypic effect of recessive alleles (e.g. a). In that case, the heterozygote genotype (in this case Aa) can phenotypically not be distinguished from the dominant homozygote genotype (AA).

The concept of *phenotype* (Johannsen, 1909) concerns the manifestation of a biological characteristic. The relation between genotype and phenotype is not always straightforward. Two different genotypes, e.g. in case of total dominance, can produce the same phenotype. But also two identical genotypes not always produce the same phenotype: this can be due to incomplete genetic penetrance, to non-allelic compensation in polygenes (see below), or to the effects of environmental factors that influence phenotypic expression and hide or reinforce genetic effects.

The genetically unique identity of the individual

Due to the combination of the large number of genes in the genome, and the processes of meiosis and fertilisation, an endless number of genetically different individuals can be formed. This can be illustrated with the following example:

consider a diploid cell[3] with three pairs (= 6) chromosomes and on each pair of those chromosomes one allele pair: Aa, Bb, and Cc. On the basis of the segregation of the homologous chromosomes and the mutually independent transmission of the non-homologous chromosomes at meiosis, 2^n , with $n = 3$, eight different types of gametes can be produced: ABC, ABc, AbC, Abc, aBC, aBc, abC, and abc. Since the human has 23 pairs of chromosomes, considering one heterozygous allele pair per homologous chromosome pair, $2^{23} = 8,388,608$ different types of gametes can be produced. The potential variability of the gamete pool of an individual is, however, still larger. During meiosis, crossing-over between the chromatids[4] of the homologous chromosomes can occur, allowing the linked genes that are localised on the same chromosome to become dissociated if the alleles of one of them are exchanged between the homologous chromosomes. This process occurs so frequently – on average 50 to 60 crossings-over per meiosis – that genes that are located quite distantly from each other on a chromosome have as high probability of being transmitted in new combinations as in their original combinations. This means that the number of possible recombinations is immensely larger than 2^{23}. For instance, if the human had only 10 000 genes and 10 percent of them existed in heterozygous combination, then there are on average $1000/23 \approx 40$ allele pairs per chromosome pair. If only a single crossing-over occurred, then gametes with 80 different combinations could be formed for each chromosome. At the separation of the combinations between the chromosomes, 80^{23} possible types of gametes can be produced (Bennett, 1979).

Current estimates indicate that all humans are approximately 99.6 to 99.8 percent identical at the nucleotide sequence level. Within the remaining 0.2−0.4 percent genetic material, approximately 10 million DNA variants can potentially occur in different combinations. This represents a very small fraction of the total genome, but is vastly more than enough variation to ensure individual uniqueness at the DNA level (Tishkoff and Kidd, 2004). With the exception of monozygotic (identical) twins, where the segregation-recombination-mechanism is by-passed, no two individuals have the same genome. The individual has a unique genetic identity (Harris, 2006).

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[3] Diploid cell: somatic cell containing two complete sets of chromosomes, one set derived from each parent.

[4] A chromatid is one of the two identical copies of a duplicating chromosome during the process of cell division.

Evolutionary mechanisms and individual variation

Biological differences between individuals within populations are largely due to the various evolutionary mechanisms which today constitute the so-called modern synthetic evolutionary theory which took shape in the 1930's (Chetverikov, 1926; Fisher, 1930; Haldane, 1932; Wright, 1931): mutations, natural selection, genetic migration, genetic drift, and non-random partner choice. They allow for explaining not only intergenerational changes in the genetic composition and structure of populations – i.e. evolution – but also the within-generational variation between individuals.

The Hardy-Weinberg law

The genetic variation that exists between individuals within a population cannot always be directly deduced from the observation of phenotypic distribution, in other words, from the way biological features are manifested. As noted above, some alleles may be dominant, masking the phenotypic effect of recessive alleles. In the case of a dominant allele *A* and a recessive allele *a*, the genotypes *AA* and *Aa* cannot be distinguished phenotypically.

Furthermore, due to the processes of segregation and recombination of genes in genotypes during the intergenerational transmission of genetic material, the distribution of the genetic characteristics of individuals in a particular generation cannot be simply deduced from the distribution in the previous generation.

Also, due to the above-mentioned evolutionary mechanisms, genetic variation between individuals within a population can undergo changes from one generation to another.

A deeper insight into all of those phenomena can be obtained from the Hardy-Weinberg law (Hardy, 1908; Weinberg, 1908), which describes the relations between the individual gene and genotype frequencies from one generation to another and permits a better understanding of the complex genetic interrelations and interdependencies that exist between the individual and population levels of genetic organisation in reproductive communities.

The Hardy-Weinberg law describes accurately the individual genetic variation within a population (= the relative proportions of all of the possible combinations of the alleles in genotypes), and the exact genetic composition of a population (= the relative proportions of the alleles within a population for which gene exchange takes place). In the case of a monogenetic variable with two alleles (A and a) with frequencies p and q respectively, three possible allele combinations or genotypes (AA, Aa and aa) with the following frequencies can be obtained:

$$(p_A + q_a)^2 = p^2_{AA} + 2pq_{Aa} + q^2_{aa} = 1$$

From this equation, we can calculate the proportions of A and a alleles that will be produced at meiosis and will contribute to the formation of the next generation:

$$A = p^2 + pq = p^2 + p(1-p) = p^2 + p - p^2 = p$$

$$a = q^2 + pq = (1-p)^2 + p(1-p) = 1 - 2p + p^2 + p - p^2 = 1 - p = q$$

At fertilisation, the alleles A and a, with frequencies p and q respectively, produced by the parental generation, will again form the following frequencies of genotype combinations:

$$(p_A + q_a)^2 = p^2_{AA} + 2pq_{Aa} + q^2_{aa} = 1$$

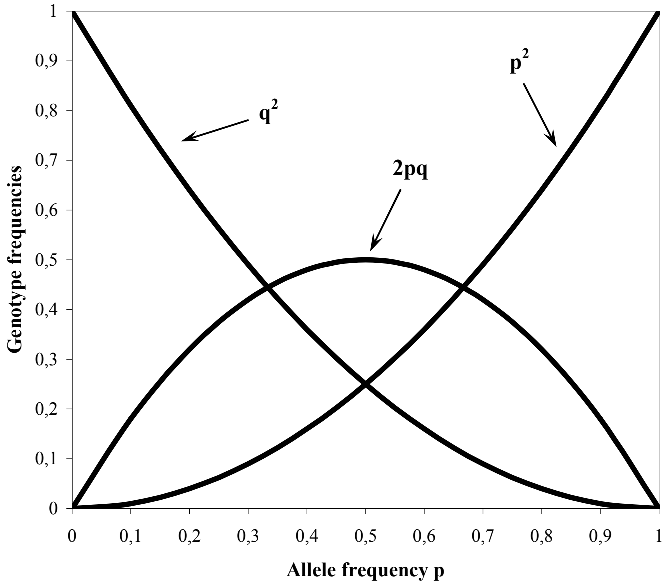

Figure 2.1: The genotype frequencies in a reproductive community (Mendelian population) in relation to the various possible allele frequencies.

Figure 2.1 represents the genetic variation of individuals in a population (= the genotype frequencies) for the different values of the allele frequencies. The Hardy-Weinberg law shows that the allele and genotype frequencies in a reproductive community remain constant from generation to generation, maintaining a genetic equilibrium expressed by the binomial formula

$$p^2 + 2pq + q^2 = 1$$

with the condition that no evolutionary mechanisms intervene. In other words, the Hardy-Weinberg law shows that, under such conditions, no evolution takes place. This is an excellent starting point for examining the effects evolutionary mechanisms may have on individual genetic variation within populations and on the possible changes in the genetic composition of reproductive communities.

The Hardy-Weinberg equilibrium can be influenced by all of the known evolutionary mechanisms: mutation, selection, genetic drift, genetic migration and partner choice. The first four of these factors affect allele frequencies, whilst the last factor affects genotype frequencies.

Mutation

Mutation is a change in the chemical structure – the DNA – of a gene or a group of genes.

Mutations are at the root of genetic variability and, consequently, form the basic condition for possible changes in the genetic composition of a population. Neutral mutations, which evolutionarily have neither an advantage nor a disadvantage, can take place in a population by chance and can be responsible for some genetic variation between individuals. Harmful mutations can also be present in a population, either because they have been newly introduced in the gene pool or because they haven't been completely eliminated by selection, and, hence, were transmitted from earlier generations. Even beneficial mutations can be responsible for a certain amount of genetic variation because the effect of selection which is responsible for their distribution is not yet completed. Genetic variants can spread in a gene pool because they had a relative selective advantage in former generations or due to environmental circumstances. In humans, less favourable mutations can thrive because they have sufficient survival value in society's sheltered cultural or economical conditions, or are even fostered by such conditions.

Selection

Selection, a theory originally and independently proposed by both Darwin and Wallace in 1859 as the major explanatory mechanism for biological evolution, is today usually defined in population genetics as the differential reproduction of carriers of different alleles. Positive selection results in genetic adaptation, whilst negative selection leads to a decrease, and eventually the elimination, of the targeted genes. At the population level, selection intensity can be measured by the selection coefficient *s*, which can vary between 0 and 1. The degree of genetic change in the population by means of selection can be calculated by introducing the selection values from the Hardy-Weinberg equation. Selection against a recessive allele, for instance, changes the Hardy-Weinberg equilibrium to

$$p^2_{AA} + 2pq_{Aa} + (1 - s)q^2_{aa} = 1 - sq^2_{aa}$$

The existence of genetic polymorphisms in a population can result from two different forms of selection: *directional selection* and *balanced selection*. A genetic polymorphism can be maintained when competitive forms of directional selection exert pressure in different directions on different alleles. A well-known example is the ABO blood group system, for which different alleles appear to be relatively better protected against particular infectious diseases. But many polymorphisms are the result of balanced selection. In these cases, a selective advantage exists in favour of the heterozygote genotypes, whereby the allelic variants of a gene in heterozygote combinations are favoured over their respective homozygote genotypes. Thus, both the alleles of a gene, in proportions dependent on the adaptive advantages of the heterozygotes compared to the homozygotes, are maintained in the gene pool. A well-known example is the sickle-cell polymorphism (e.g. O'Malley, 2006).

Genetic drift

Gene drift, also referred to as the *Sewall-Wright-effect* (Wright, 1931), can change allele frequencies as a result of the accumulation of random fluctuations in the intergenerational transmission of alleles in small populations. The formation of each new generation is, in fact, a sampling process of the gametes available in the gene pool of the population. The smaller the population, the greater is the risk that allele frequencies in the next generation will deviate from those of the preceding one. Therefore, this evolutionary mechanism has become less important in modern societies, which usually are composed of many millions of individuals.

Genetic migration

Genetic migration occurs when a genetically different population section leaves or joins a population. Genetic migration can occur on a small scale, at the level of individual (mate) exchange, or on a large scale, as a massive population invasion. It can occur as a single, non-recurring population move, or as a continuous gene flow between two or more populations. It can be of a uni- or a bi-directional nature. It can be merely of a deterministic nature, assuming an infinite population size, so that no random elements, resulting in drift, are included, or it can, in contrast, also be subject to stochastic forces resulting in complex interactions between migration and drift (e.g. Piazza, 1990). Genetic migration obviously changes the genetic make-up of either the sending or the receiving population. Genetic immigration leads to an increased heterozygosity and increased genetic variability within the invaded population, and to a decrease in between-population variance. It lowers the ratio of the variance between populations to the total (between and within) variance (Wright, 1965).

Genetic migration is a phenomenon that has expanded considerably since the big European exploratory expeditions in the 15th century, especially in the New World, and that, due to the increasing demographic and economic differences between more and less developed countries, manifests itself also more and more in Europe. Initially, genetic migration increases the genetic differences between individuals within a population due to the addition of homozygote genotypes, but after a few generations, at least in the case of random mating, individual differences decrease somewhat as a new genetic equilibrium with a higher percentage of intermediate genotypes (heterozygotes) is established.

Partner choice

Mating can occur at random or not. In case of non-random mating one can get either a positive or a negative *assortative mating*. In positive assortative mating, the homozygote genotypes (*AA* and *aa*) will be favoured at the expense of the heterozygotes (*Aa*) and population variance increases; with negative assortative mating, the opposite occurs. A special case of assortative mating concerns the positive or negative choice of blood relatives. A positive assortative mating for blood relatives leads to *inbreeding*, whereas a negative choice results in *outbreeding*. Inbreeding is a genetic consequence of biologically consanguineous mating, resulting in offspring with a higher than an at random risk of carrying a double dose of the genes that were present in a single dose in the common ancestor (Wright, 1922).

Assortative mating and inbreeding shift the Hardy-Weinberg equilibrium to Wright's equilibrium

$$[p^2 + Fpq]_{AA} + [2pq(1-F)]_{Aa} + [q^2 + Fpq]_{aa} = 1$$

whereby F represents the assortative mating or inbreeding coefficient which can take values from 0 to 1. The proportion of homozygous genotypes (*AA* and *aa*) increases and the proportion of heterozygote genotypes (*Aa*) decreases according to the size of the assortative mating or inbreeding coefficient F. The major difference between positive assortative mating and inbreeding is that the first is character-specific, whilst the second involves all of the genetically determined characteristics.

The level of selection: individual or group selection?

A salient question in the study of the role of evolutionary mechanisms, particularly of natural selection, in the establishment of individual variation is whether selection operates at the level of the individual or the group.

It is beyond doubt that Darwin's theory of natural selection concerned the individual level of organisation. Only for human morality Darwin hypothesised that selection operates at the population level. Probably partly in reaction to the abuse of the theory of individually oriented selection that was made in the so-called social-Darwinist discourse (see Chapter 7), the essence of Darwin's theory about the level at which selection operates faded away somewhat and the idea spread that selection operates 'for the good of the community'. However, as an explanatory mechanism, group selection raises a fundamental theoretical problem (e.g. Maynard Smith, 1964; Williams, 1966; Trivers, 1985).

Suppose that a mutation that limits the reproductive capacity of its bearer emerges in a population that over-exploits its environment. Obviously, this benefits the total population and allows the other members of the group to increase their reproductive fitness. Because the bearer(s) of this fertility-limiting mutation will produce a smaller number of offspring, this 'altruist' mutation will eventually be exterminated by means of individual selection. Group selection is, in other words, incompatible with individual selection.

The question of the level at which selection takes place – the individual or the group level – is closely connected to the question of the units at which selection operates. The discussion about individual selection versus group selection has inspired Williams (1966) to consider the gene as the 'fundamental unit of selection'. Dawkins (1976) nuanced the question further in his famous book 'The Selfish Gene' by distinguishing the survival of the *replicators* (= the genes) from the selection of the *vehicle*s (= the individuals).

However, some scientists continue to defend the principle of group selection and see natural selection as a hierarchical process in which groups as higher units of the biological hierarchy are the vehicles of selection for individuals, just as individuals are vehicles of selection for genes (see for example Wilson and Sober, 1994; Sober and Wilson, 1998; Field, 2008). In group selection theory, a population is subdivided into smaller groups, some of which increase more strongly than other groups thanks to the action of some of their individual members displaying behaviours beneficial to the group at the cost of their own relative fitness within their group (Price, 1970). The result is that in the total population the share of group beneficial traits can increase in frequency. Individual competition within groups and group competition between groups can have opposite effects: selection on the lower level (within groups) favours selfish individuals, whereas selection on the higher level (between groups) favours cooperating individuals.

At the end of the 20th century, consideration of group selection re-emerged as an important component of a multilevel theory of evolution (Borrello, 2005). New empirical research on eusocial insects (e.g. Wilson, 2008) and new mathematical models and computer simulations (e.g. Hales *et al.*, 2007) that targets traits emerging from the interaction of group members have breathed new life into the concept of group selection (e.g. Hölldobler and Wilson, 2008). However, the scientific discussion about the relations between and relative importance of individual, kin and group selection continues with great intensity (e.g. Dawkins, 2008; West *et al.*, 2008; Field, 2008).

In the discussions about individual versus group selection, sufficient distinction is not always made between within-group selection which Williams, Maynard Smith, Trivers and others were refuting, and between-group selection which can, indeed, be a powerful mechanism of selection between groups or populations and produce changes in gene pool compositions.

Especially in the human species where cultural traits, either in the form of values and norms or as structural features, play such an important role in survival and reproduction, individual selection may be weakened or eliminated, thereby increasing the likelihood of group-beneficial traits evolving. Consider a population in which an allele pair for high/low fecundity is present in equal proportions. Normally the subgroup with a predisposition for high fecundity would soon outnumber the group with lower fertility. However, when a cultural norm for limiting fertility is introduced – it doesn’t matter whether this is done by individuals with predispositions for either high or low fecundity – the fertility of the high fecundity group will decrease and so will the (relative) prevalence of its genetic predisposition for high fecundity. So, as Darwin himself suggested, cultural factors can operate at the group level because cultural transmission, through the Lamarckian horizontal transmission of acquired characteristics, bypasses the biological vertical transmission system which requires the individual to funnel genes from parents to offspring. As Henrich (2003) argues, the evolution of prosociality in the human is rooted in the interaction between cultural and genetic transmission.

A further development of this idea is found in the recent work of David Sloan Wilson (2002) and Boyd and Richerson (2005). These authors argue that the scale of organisation of the human species requires cultural selection theories as explanatory models for large human institutions such as religions.

Recognising that the moving power of human action is ultimately to be found at the individual level or even at the gene level of organisation, there can be no doubt that, in the evolution of the hominids, individuals transcending organisation levels, such as the family and population levels, have acquired an adaptive significance of such importance that the emergence not only of the biological specificity of the human but also of his ontogenetic development in each generation, and his future intergenerational, phylogenetic evolution depend on those higher levels of organisation.

The population level of human organisation is not only instrumentally significant with respect to individual survival and reproduction. As bearer of an intergenerationally emerged cultural heritage and transmitter of values and knowledge, the population level of organisation has acquired a secondary function that clearly transcends its role with respect to meeting the needs of the individual. As a product of the accumulated creativity of very large numbers of individuals, the members of both existing populations and many past generations, culture is not only an exosomatic structure, but has long been a phenomenon that exceeds the absorptive capacity of the individual. Despite culture's functional dependence on individuals (both in the present and for its future development), it has become an individual-transcending phenomenon.

GENETIC AND ENVIRONMENTAL CAUSES OF INDIVIDUAL VARIATION

The causes of variability between individuals are more complex than discussed thus far. In addition to genetic determinants of variation, a broad variety of environmental factors can also influence the phenome or particular phenotypic characteristics, and can even interact with the genetic predispositions.

From a global perspective, environmental influences manifest themselves differently, especially as a result of the profound socio-economic and socio-cultural differences that exist between more and less developed countries. Those living in developed countries are still confronted with environmental causes of phenotypic variation, despite the trend there of an upward levelling of environmental living conditions. Differences in the prenatal maternal environment, nutrition, contagious diseases, accidents, lifestyles, emotional and cognitive learning processes in and out of school, etc., strongly interact with the expression of the genetic endowment. Moreover, environmental factors can interfere with genetic factors, resulting in phenomena such as genetic-environmental interaction or covariance, and increases in within-population variance.

The obsolete nature-nurture discussion

Mentioning genetic and environmental factors will remind many readers of the obsolete discussion of nature versus nurture which amongst many social scientists, cultural scholars, and ideologically conservative thinkers was often interpreted as a pair of mutually exclusive alternatives. Whilst the scholars often fostered prejudices regarding the priority of environmental factors, the conservatives often believed in the supreme importance of hereditary factors. It should be made clear from the very beginning that there is no such thing as nature *or* nurture, especially with regard to socially important biological characteristics (Ridley, 2003). Such features, in particular those that show a continuous variation, such as intelligence, sociability and health, are always the result of both genetic and environmental influences.

The question of the relations between nature and nurture – according to the terminology of Galton (1822–1911) – is one of the themes in the human sciences that has produced the most vigorous disputes and differences of opinions. The nature versus nurture controversy has, moreover, not been limited to scientific discussion. It is also, if not mainly, an ideological question with important political implications. It has fundamentally to do with the way people conceive of human life, and with the (im)possibilities of influencing humankind and human society, and the maintenance or acquisition of power, territories and resources. Often the opposing views are expressed as extremes with hereditarian determinists on the one side and environmental determinists on the other. Politically, the first are mainly found among the right, the latter among the left, – not only in the formerly ill-fated Lysenko era in the Soviet-Union (cf. Huxley, 1949; Medvedev, 1969; Joravsky, 1970; Soyfer, 1994), but here and there also in the form of a kind of Neo-Lysenkoism as Weiss (1991) calls it in the West.

This polarisation actually is not surprising. Traditionally, the human has been indoctrinated to think in ideological terms about his nature, his origin and his future. It is only very recently that this is has been slowly changing. But the new, scientific insights into the human organism, including as relates to matters of nature-nurture relations, comprise a difficult subject that has not been made very accessible to non-specialists.

In the course of the 20th century, mainly thanks to the development of quantitative genetics and behavioural genetics, more nuanced insights about the nature-nurture question have been acquired. In spite of all that, overt or covert signs of biased environmental determinism are still widely dispersed in the social and behavioural sciences, whilst a lopsided hereditary determinism is virtually absent in bio-anthropology and human genetics. Signs of a biased environmental determinism can even be observed in important intergovermental political bodies such as the European Union, the Council of Europe and the United Nations where making reference to the influence of genetic factors in human social behaviour is virtually taboo. In the research programmes of some of those bodies there is simply no place for interdisciplinary projects that deal with sociobiological issues. Even biosocially oriented research projects that are strongly self-censured, avoiding any reference to sociobiological or genetic factors, have no chance of being funded within the social sciences. Consequently, many background and political documents issued by such bodies dealing with complex human social problems address the issues at stake in an incomplete way.

All this does not mean that there are no more problems or unknowns in human genetics and related sciences, or that biologists are completely immune to ideological influences. Nevertheless, it was geneticists, in particular behavioural geneticists, who succeeded in estimating quantitatively the relative effects of genetic *and* environmental factors on the variation of continuous variables. It can be expected that the fast developing field of molecular genetics will soon succeed in raising the nature-nurture discussion to a more fundamental level of analysis, as behavioural genetic studies start to be completed with findings at the bio-molecular level (e.g. Gottesman, 2002).

Measuring the relative impact of genetic and environmental factors

Essentially, the question is whether and to what degree the characteristics, properties and behavioural patterns of living organisms are influenced by genetic and/or environmental factors in the course of their ontogenetic development. Two, and in the human perhaps even three, types of characteristics can be distinguished:

- Some characteristics are exclusively determined by genetic factors in the realisation of their phenotype. Well-known examples are the different blood group systems;
- Other characteristics are influenced both by genetic and environmental factors in their phenotypic expression. Most of these characteristics are continuously variable characteristics;
- It is possible there are behavioural patterns that are not at all dependent on the presence of certain genes, and are consequently exclusively determined by environmental circumstances. Nevertheless, even here one should beware of too simplistic a view. For instance, fashion variation that is obviously strongly determined by cultural factors, might be differentiated in a population partly on the basis of genetically influenced personality differences.

So far, only genetic processes that show a qualitative or alternative variability have been considered: one may be rhesus positive or rhesus-negative, one may be A, B, AB, or O in the ABO blood group system, one may have the predisposition to develop Huntington's chorea or not, etc. This concerns characteristics that display clearly distinguishable alternative phenotypes resulting from the presence of different alleles of one gene.

However, most biological characteristics – in particular most socially important performance characteristics such as physical performance abilities, emotional and cognitive personality characteristics, sexual and reproductive features, maturation characteristics, and many health characteristics – show a quantitative variability which may be of a continuous or discontinuous nature. Many of those quantitative variables show a more or less normal Gauss distribution.

One shouldn't conclude, however, that genetically influenced characteristics are controlled either by monogenes or by polygenes. Many phenotypes can be influenced by both types of genes, and also by environmental factors.

Quantitative genetics (e.g. Hill, 1984), and more in particular behavioural genetics (e.g. Plomin *et al.*, 2008) have developed variance-analytic techniques that allow the estimation of the relative importance of the effects of genetic factors, environmental factors, and their covariance and interaction in the production of within-population biological variability. Some socially important biological characteristics appear to have a significant heritability component – i.e., the differences between individuals in a population are largely determined by genetic factors – whilst others are in their variability more prone to influences from environmental factors (Sesardic, 2005). As molecular genetics progresses with the 'Human Genome Project' (cf. Palladino, 2005) and the 'Human Genome Diversity Project' (cf. M'Charek, 2005), it will, probably in the coming decades, arrive at a more thorough and quantifiable understanding of the relative importance of nature versus nurture in the achievement of important human objectives (Gottesman, 2002).

The polygenic inheritance system

As early as 1906 the American mathematician George Yule hypothesised that quantitative variation could be caused by several genes having small effects. A few years later the Swede Nilsson-Ehle (1909) and the American East (1915) supported this experimentally. In 1918 R.A. Fisher provided a mathematical model of multifactorial inheritance in his classic 'The Correlation between Relatives on the Supposition of Mendelian Inheritance'. He observed that, whereas a single gene would yield only categorical traits, the actions of multiple genes in concert would yield a smooth and continuous trait distribution in which each gene has a relatively small effect on variation. Fisher argued that, if the allelic effects at a locus are additive, the genotypic values will correspond to the sum of the doses provided by its various alleles. As the number of loci becomes larger, the distribution of additive genotypic values more and more closely resembles the continuous distribution of a quantitative trait and their phenotypes typically vary along a continuous gradient that can be depicted by a bell curve. Although the phenotype is equated to the genotypic dose, there is no 'one-to-one' relationship between genotype and phenotype. Various polygenic genotypes can produce the same phenotype.

Initially the inheritance of quantitative characteristics was known as multifactorial inheritance (Yule, 1906), but later Mather (1941) coined the term *polygenes*, and in more recent times, with the development of molecular genetics, the term *quantitative trait loci* (QTL) appeared (Gelderman, 1975). Though not necessarily genes themselves, QTLs are stretches of DNA that are closely linked to the genes that underlie polygenes.

Polygenic traits and the inheritance pattern that characterises these traits show the following general features:

- They are affected by genes at several loci;
- The effect of alternative alleles at each of the segregating loci are relatively small and interchangeable; identical phenotypes may result from several different genotypes; the result of this is that polygenetic characteristics have a much higher 'hidden genetic variability';
- The phenotypic expression of most polygenic traits is subject to considerable influence from environmental factors during ontogenetic development;
- Polygenetic characteristics abide by the same Mendelian laws as monogenes. In addition, so far in the domain of molecular genetics nothing exceptional has been discovered about the genes controlling polygenic inheritance.

The operation of polygenic inheritance is best illustrated by the simplest genetic model for a quantitative trait, ignoring possible environmental effects and possible deviations due to non-random mating patterns. Consider two pairs of alleles, A-a and B-b. The effects of the alleles in both pairs are assumed to be identical: a value of 0 is assigned to genes a and b, and a value of 1 to genes A and B. The frequencies of a and b are also supposed to be identical and represented by p, whilst the frequencies of A and B are represented by q. The effects of the alleles are assumed to be additive. The relations between the genotypes and phenotypes and their frequencies in the population are given by the Hardy-Weinberg equation and summarised in Table 2.1:

$$(p + q)^4 = p^4 + 4p^3q + 6p^2q^2 + 4pq^3 + q^4$$

Table 2.1. The relations between genotypes and phenotypes and the frequency distribution for a polygenetic characteristic determined by two allele pairs

Genotypes	Aabb	Aabb aaBb	AaBb aaBB AAbb AaBb	AABb AaBB	AABB
Phenotypic values	0	1	2	3	4
Frequency	1	4	6	4	1

As this simple example shows, the genotypes with the most extreme phenotypic expression (0 and 4) are rare. They both occur only once. The more average the phenotypic expression is, the more different genotypes are present.

As has already been explained, reality is much more complex than the above mentioned example, which is based on very simplified assumptions. Usually, polygenetic inheritance is not only characterised by more than two allele pairs, but some experiments have shown that the different allele pairs can have unequal effects, that dominance can occur and that there can be interaction between the allele pairs (Mather, 1979).

The phenotypic frequency distribution of many quantitative characteristics includes, in addition to the normal distribution determined by the effect of polygenes, at (one of) the extremes of the variation some extra variability caused by monogenetically or chromosomally determined deviations. Examples are the low mental ability amongst people with Down's syndrome, determined by the presence of an extra chromosome in chromosome pair 21 (Lejeune *et al.*, 1959; Pritchard *et al.*, 2008), and the small body size amongst those with achondroplasia dwarfism, caused by a dominant monogen located on chromosome 4 (fibroblast growth factor receptor gene 3, *FGFR3*) (Shiang *et al.*, 1994). Many quantitative characteristics have a skewed distribution, as a result of the combination of polygenetic and monogenetic or chromosomal inheritance.

Very important also is the fact that the phenotypic variability of polygenetically influenced characteristics can be influenced by environmental factors. In all probability, the smooth frequency distribution of polygenetic characteristics can be ascribed to the combined effect of a relatively limited number of allele pairs and a large number of different environmental factors.

From the example given above, we can already deduce a fundamental feature of polygenetic characteristics, especially from a sociological point of view. Genetic variability in a population can, depending on the nature of partner choice, and the effects of environmental factors, be phenotypically visible (= 'free') or hidden.

Take the case of monogenes to start with. Here, genetic variability is visible or free when the alleles are combined in homozygous genotypes, whereas the variability is hidden in heterozygous genotypes. So, heterozygous genotypes contain genetically potential variability, since hidden genetic variation can be freed when, at meiosis, the gametes are formed, and during the formation of the next generation, at fertilisation, other genetic combinations can potentially be established. In the case of a monogene pair with two alleles (A, a) with identical frequencies ($p_A = q_a = 0.5$) and incomplete dominance (so that the heterozygote genotype Aa is phenotypically intermediary between the two homozygote genotypes, AA and aa), and with at-random mating, half of the potential genetic variability is hidden in the heterozygous combination.

Among polygenes, the hidden variability is much higher, first because of the occurrence of non-allelic combinations between the various homozygous genotypes of the different allele pairs, (e.g. AAbb and aaBB), and second because of the possible effects of environmental influences that can neutralise the effects of particular genotypic combinations. That is the reason why geneticists speak about the so-called 'iceberg effect' of polygenes, because the largest part of an iceberg's mass (90 percent) is hidden below the water line (Mather, 1964) (Figure 2.2).

Dissecting the variance of quantitative traits

What is the relative contribution of genetic and environmental factors in the realisation of a polygenetic determined phenotype of an individual? It is currently still impossible to answer this question for phenotypes that fall within the range of the normal variation of a polygenetic frequency distribution and cannot be traced back to a clearly identifiable chromosomal or monogenetic impairment. Not only is molecular genetics still in the early stages of identifying quantitative trait loci, but such characteristics can in the course of their ontogenetic development – starting at conception – be influenced by such a broad range of environmental factors that they cannot be methodologically registered.

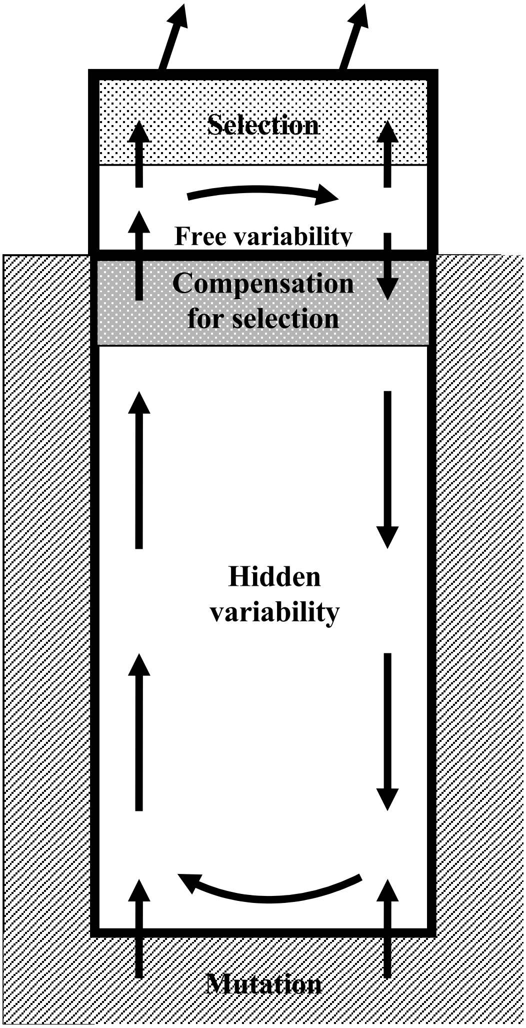

Figure 2.2. The 'iceberg' effect of polygenes. Source: Mather, 1964.

Does this mean that, at present, nothing can be quantified about the nature-nurture question? By no means! The question, however, must be phrased in a different way. In addition to the question of the relative impact of genetic and environmental factors on the realisation of the individual phenotype, there is the scientific and socially important question about the differences between individuals. And this question can be addressed scientifically. The question has to be set at another level, namely the population level: what fraction of the within-population variance is relatively due to genetic factors, and which fraction is due to environmental factors? Essentially, this question concerns the relative share of genetic endowment and the environment in the realisation of the differences between individuals in a population. In other words, we cannot currently approach the nature/nurture question in a molecular way but we can do so in a statistical manner.

The estimation of the relative quantitative effects of genetic and environmental factors on the realisation of differences between individuals starts with the definition of a statistical model. Experience has shown that an additive model best fits the empirical data:

$$\sigma_P^2 = \sigma_G^2 + \sigma_E^2$$

(P = phenotype, G = genetic factors, E = environmental factors, and σ^2 = variance)

However, reality is more complex than the general formula above might suggest. A somewhat more realistic formula can be developed as follows (Plomin *et al.*, 2008):

$$\sigma_P^2 = \sigma_A^2 + \sigma_D^2 + \sigma_{AM}^2 + \sigma_i^2 + \sigma_E^2 + \sigma_I^2 + 2\operatorname{cov}_{GE} + \sigma_e^2$$

σ_A^2 = additive genetic variance
σ_D^2 = variance caused by dominance deviation
σ_{AM}^2 = variance caused by assortative mating
σ_i^2 = epistasis variance
σ_E^2 = environmentally determined variance (to be subdivided in many subfractions)
σ_I^2 = gene-environment interaction variance
$2\ \mathrm{cov}_{GE}$ = covariance between genetic and environmental factors
σ_e^2 = variance due to measurement errors

The fraction of the phenotypic differences between individuals that can be attributed to genetic differences, σ_G^2 / σ_P^2, is called *heritability* (h_b^2) (Lush, 1940). The fraction attributed to environmental factors, σ_E^2 / σ_P^2, is called *modificability* (Cattell, 1971).

It is important to recognise that quantitative genetics not only demonstrates the existence of both genetic and environmental factors in the phenotypic variability of quantitative traits, but also that it succeeds in estimating quantitatively the relative impact of both genetic and environmental influences. Quantitative genetics offers a comprehensive theoretical framework for the study of individual differences (Plomin *et al.*, 2008).

It is also important to recognise that the concept of environment in quantitative genetics is used in a much broader sense than is traditionally understood in the social and behavioural sciences. Environment here means any non-genetic factor and includes not only socio-cultural and socio-economic factors, but also biological environmental factors such as the prenatal environment, delivery, nutrition, and illness.

The environmental contribution to phenotypic variance can, just like the genetic fraction, be subdivided into several subfractions. One of the most important subdivisions of environmental variance is the division between shared and non-shared environmental influences that can affect members of the same family. The notion 'shared environment' refers to between-family non-genetic differences that make siblings more similar than children reared in different families. Social class and parental differences in childrearing styles are examples of between-family variation. The concept of 'non-shared environment' refers to within-family non-genetic variance that makes siblings in the same family different from one another. Within-family non-genetic differences include prenatal and biological conditions as well as psycho-social events that affect one sibling in a different way from another.

In the general additive model that has been considered so far, it was assumed that all genetic and environmental factors that can be distinguished for explaining the phenotypic differences within populations are simply cumulative, and that the genetic factors involved are independent or that there are no specific interactions between genetic and environmental factors. But this model is too simple. Three sources of extra-variance that apply to such relations can be identified and added to the formula.

First, there is the possibility that the effect of the genes of different loci is not simply additive, but interactive. In such a case their combined effects can be larger or smaller than the sum of their single effects. Interaction between different allele pairs is called epistasis, and increases the population variance by a fraction, σ_i^2.

Second, interaction can also occur between genetic and environmental factors, meaning that a specific change in the environment has different effects on the various genotypes in the population[5]. The phenotypic effects depend, in other words, on the type of combination between the genetic and environmental variants. This fraction of interaction variance is represented by σ_I^2.

Third, covariance is another form of the combination of genetic and environmental variance. So far, it has been assumed that genetic and environmental factors operate independently of one another. In reality this is often not the case. Often genetic endowment and environmental conditions are partially correlated. This genetic-environmental covariance is responsible for an increase in phenotypic population variance.

Epistasis, interaction and covariance are examples of the complex ways genes and environment interact. In recent years, behaviour genetics is focusing increasingly on the several paths of gene/environment interaction.

Two sensitive matters: IQ and criminality

In order to illustrate the effects of genetic and environmental factors, let us briefly explore two controversial topics: IQ and criminality. These two topics are useful examples because they are socially important forms of behaviour and a subject to debate regarding the impact of genetic and environmental factors on individual variability. They also raise pertinent and sensitive questions regarding their role in and impact on modernisation.

The fractioning of IQ

Human cognitive (< Latin: *cognitio* = getting to know) abilities are amongst the most studied and best known characteristics in psychology and behavioural genetics. The interest in these characteristics is for good reason: the development of powerful cognitive abilities is one of the most distinctively human characteristics of the hominisation process, resulting in the relative freedom from and control of the natural environment that humans have been able to achieve (Waterhouse, 1984).

The effort to dissect human cognitive abilities into their genetic and environmental components is socially and politically sensitive. This is because the fractioning of IQ involves not just a scientific study of the biological, cultural and social importance of individual genetic and environmental characteristics. People commonly have ideological, and therefore prejudiced, views of this topic. Such controversy makes it all the more important to investigate the issue.

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[5] The concept of interaction is used here in the narrow statistical meaning of the word.

Defining and measuring dimensions of cognitive abilities

Cognitive abilities are often grouped under the comprehensive and multifactorial concept of ‘intelligence’. In psychology this concept has been defined in several ways that are not necessarily mutually exclusive, but in fact are rather complementary: the ability to reason and engage in abstract thinking, the ability to learn, the ability to adapt, and the ability to solve problems.

From the very beginning of the development of the first intelligence tests early in the 20th century by Binet and co-workers (Binet, 1905), it was endeavoured to measure general intelligence, in addition to identifying specific mental abilities such as reasoning, verbal ability, spatial ability, perceptual speed, and memory. Inventing a new statistical method called *factor analysis*, the British psychologist Charles Spearman (1904) tested empirically Galton’s hypothesis that the performance of any cognitive task depends on a general factor ‘g’ plus one or more specific factors that are unique to the particular task. Although some have expressed doubts about the existence of a single general talent (e.g. Gardner, 1999), the accumulation of cognitive testing data and improvements in analytical techniques have preserved the central role of ‘g’ (Carroll, 1993; Jensen, 1998). The positive correlation between all human cognitive skills constitutes one of the strongest empirical findings in psychology (Colom *et al.*, 2002).

In 1912, the German psychologist William Stern coined the abbreviation *I.Q.* (‘intelligence quotient’), the aim of which was to measure a child’s intelligence level as a quotient of its estimated mental age and its chronological age. In 1939 the Romanian-born, American psychologist David Wechsler published the first intelligence test designed for an adult population in which IQ is based on a comparison of a subject's measured score with the average score of the population of the same age which is taken as the norm. Usually IQ-test scores are transformed in such a way that they are expressed as standardised values with an average of 100, and a standard deviation of 15.

In addition to the distinction between general intelligence and specific human cognitive abilities, several other traditions have been established in the conceptualisation of intelligence as well as in the subdivision of currently used psychometric tests measuring verbal, mathematical, spatial, reasoning, and other abilities. For instance, Raymond B. Cattell (1971) subdivided ‘g’ into fluid ability (‘g_f’) and crystallised ability (‘g_c’). The former reflects the biological capacity of an individual to acquire knowledge, whilst the latter is supposed to measure the influence of culture and training.

Different types of intelligence tests differentially relate to crystallised and fluid intelligence: verbal tests are usually closer to crystallised intelligence, non-verbal or culture-fair tests such as Raven’s Progressive Matrices (Raven, 1938) are closer to fluid intelligence. Physiological measures of intelligence are closest to fluid intelligence.

Before wrapping up this section, attention must be drawn to the fact that, in recent decades, non-cognitive forms of intelligence increasingly appear in the literature, such as: social intelligence (Goleman, 2006), interpersonal intelligence (Gardner, 1983), emotional intelligence (Salovey and Mayer, 1990; Bar-On, 2006), and intrapersonal intelligence (Gardner, 1983).

Social intelligence is the capacity to understand the intentions, motivations and desires of other people. It is equivalent to 'interpersonal intelligence', one of the types of intelligences identified in Howard Gardner's (1983) 'Theory of Multiple Intelligences'. Emotional intelligence or intrapersonal intelligence is the capacity to understand oneself, to appreciate one's feelings, fears and motivations, and being able to use this information in social life.

Establishing to what degree these non-cognitive abilities relate to or are independent of the classical emotional personality characteristics, as well as cognitive abilities, requires further investigation (e.g. Cherniss *et al.*, 2006; Waterhouse, 2006).

Heritability of intelligence

Cognitive ability is a typical trait the normal variability of which is influenced by polygenes and environmental factors. At the lower extreme of the frequency distribution an additional source of genetically determined variability must be distinguished due to a number of monogenetic and chromosomal determined forms of mental retardation (Burt, 1958). The addition of the polygenic distribution and the monogenetic and chromosomal impairments results in a slightly skewed distribution of intelligence variation. However, some scholars (e.g. Weiss, 1992; 2000) have argued in favour of a major gene locus of general intelligence.

Correlation analyses of intelligence measures of people with different degrees of genetic relationship and raised in identical or different environments resulted in remarkable findings that have been summarised in the well-known publications of Erlenmeyer-Kimling and Jarvik (1963) and Bouchard and McGue (1981) (Table 2.2).

Table 2.2. Kinship correlations for IQ. Source: Bouchard and McGue, 1981.

Kinship relationship	NCS[1]	NP[2]	EC[3]	WAC[4]
Monozygotic twins (reared together)	34	4672	1.00	0.86
Monozygotic twins (reared apart)	3	65	1.00	0.72
Dizygotic twins (reared together)	41	5546	0.50	0.60
Brothers or sisters (reared together)	69	26473	0.50	0.47
Brothers or sisters (reared apart)	2	203	0.50	0.24
Half-brothers or half-sisters	2	200	0.25	0.31
Nephews or nieces	4	1176	0.125	0.15
Non-related children (adoption/own children)	5	345	0.00	0.29
Non-related children (adoption/adoption)	6	369	0.00	0.34
Average adoption parent/ adoption children	6	758	0.00	0.24
Adoption parent/adoption child	6	1397	0.00	0.19
Assortative mating	16	3817	0.00	0.33

[1] NCS = number of correlation studies
[2] NP = number of pairs
[3] EC = expected correlation on the basis of a purely genetic model
[4] WAC = weighted average correlation

Comparing the results of these empirical findings about actual kinship correlations with the correlations based on a model of strictly genetic transmission of intelligence allows for the estimation of the relative importance of genetic and environmental factors in determining the phenotypic differences between individuals within a population. Averaging the heritability estimates derived from the different kinship correlations shown in Table 2.2 reveals a broad heritability of ± 0.70 and ± 0.30 for environmental factors and errors of measurement, respectively. More advanced biometrical analyses in which all the data on people of various degrees of kinship reared together or apart are considered simultaneously – taking also into account the effects of dominance, assortative mating, gene-environment interaction and covariance – produce identical results, although with a somewhat broader range between about 0.40 and 0.80 due to differences in research methodology and sampling design (cf. Jensen, 1998; Plomin *et al.*, 2001). A recent analysis, which also includes the maternal effect, estimates the narrow-sense heritability at 34% and the broad-sense heritability at 48% (Daniels *et al.*, 1997).

Although quantitative genetics (cf. Mather and Jinks, 1982; Hill, 1984; Falconer and MacKay, 1996) and especially behavioural genetics (cf. Fuller and Thompson, 1978; Hay, 1985; Plomin *et al.*, 2008) are well-established disciplines, some of their concepts and fields of application such as heritability of cognitive ability, continue to raise scientific controversy, partly because of ideological interferences (Kamin, 1974; Herrnstein and Murray, 1994) and partly because of methodological issues, which are sometimes also mixed with ideological concerns (Capron *et al.*, 1999; Hay, 1999; Vogel, 1999; Vetta and Courgeau, 2003). Nevertheless, based on a broad variety of research methods and empirical findings, cognitive abilities are amongst the best documented polygenic characteristics so far known (Plomin, 1999, C26):

> *"... there is considerable consensus among scientists – even those who are not geneticists – that g is substantially heritable. Indeed, there are more studies addressing the genetics of g than of any other human characteristic, including studies of more than 8000 parent-offspring pairs, 25000 pairs of siblings, 10000 twin pairs and hundreds of adoptive families, all of which indicate that genetic factors contribute significantly to g."*

Even when one considers the lowest estimates, it is clear that genes are a major factor influencing the development of individual differences in intelligence. Advanced studies on the environmental-genetic fractioning of the population variance of measures of cognitive performance in childhood show that approximately half of the variance is due to genetic factors, including additive genetic variance, dominance deviation, epistasis and assortative mating. Half of the non-genetic variance is due to shared environmental factors (between-family non-genetic effects) and half to non-shared family environment (within family non-genetic factors) and measurement error. Genetic-environmental interaction appears not to be an important source of variation. (e.g. Loehlin *et al.*, 1997; Plomin *et al.*, 2001; 2008; Jensen, 1998).

An important finding of recent decades is that, contrary to what one would intuitively expect, the genetic variance of cognitive ability increases over the life course of individuals, largely at the expense of shared environmental variance the effect of which becomes negligible. This remarkable effect is explained by the fact that genotypes have the tendency to create their own environment (Plomin *et al.*, 2008).

In recent years, with the development of the Human Genome Project, molecular genetic studies have started to complement the behavioural genetic approach, leading to a domain of research that has been called 'behavioural genomics'. Many genes have already been identified that are associated with low intelligence. More than one hundred single-gene disorders include mental retardation among their symptoms, such as PKU, fragile X syndrome, Alzheimer's disease, muscular dystrophy, Lesch-Nyhan syndrome, neurofibromatosis, and Williams syndrome (Plomin *et al.*, 2002).

Molecular-genetic techniques are now also applied to identify the molecular basis of continuous variables, which are controlled by multiple-gene systems, called quantitative trait loci (QTL). They contribute interchangeably and additively to quantitatively variable traits. In 1990 an IQ-QTL project was launched to systematically search for QTLs associated with normal variation in general intelligence (Plomin *et al.*, 1994; Plomin, 2003). Several DNA markers have already been found to be associated with general cognitive ability (Plomin *et al.*, 1994; 1995; Chorney *et al.*, 1998; Plomin *et al.*, 2002; Harlaar *et al.*, 2005). However, progress toward identifying quantitative trait loci for intelligence has been slower than anticipated, probably because most QTL effects are much smaller than expected and can only be detected by more powerful analyses (Plomin *et al.*, 2006).

Cognitive ability has been shown to be substantially correlated to several morphological and physiological traits of the brain or the neurological system in general, thus proving that psychometric measures of intelligence are not simply the methodological artefacts of IQ tests or mathematical properties of factor analysis (e.g. Jensen, 1998; Posthuma *et al.*, 2002; Nyborg, 2003). Substantial correlations with IQ have been found for features such as head size ($r \approx 0.15$) and brain size ($r \approx 0.30$–0.40), measured using various methods such as endocranial volume from empty skulls, wet brain weight at autopsy, and external head size measures (e.g. Van Valen, 1974; Gignac *et al.*, 2003; McDaniel, 2005). These relations have been confirmed by means of more modern techniques such as magnetic resonance imaging (MRI) (e.g. Vernon *et al.*, 2000). Positron emission tomography (PET) studies of intelligence, measuring the glucose metabolism of the brain, have shown strong negative correlations between mental ability and glucose utilisation in the cerebral cortex ($r \approx -0.7$ to -0.8) (Haier, 2003). Reaction time (RT) – the elapsed time between the presentation of a sensory stimulus and the subsequent behavioural response – also correlates negatively with psychometric intelligence ($r \approx -0.3$ to -0.4) (Jensen and Munro, 1979;

Deary *et al.*, 2003; Jensen, 2006). Inspection time – a forced-choice, two-alternative visual backward-masking task – is also consistently, though weakly, negatively correlated (approximately $r \approx -0.30$) with psychometric measures of intelligence (e.g. Grudnik and Kranzler, 2001; Burns and Nettelbeck, 2003).

The average evoked potential (AEP) – an electroencephalographic average measure of the hundreds of brain wave samples generated in an individual in response to a specific stimulus – has correlations with IQ which range between 0.3 and 0.6 (Jensen and Sinha, 1993; Jensen, 1998). Some AEP indices such as the index of neural adaptability (NA) produce even higher correlations ($r \approx 0.5$ to 0.7) (cf. Schafer, 1985). Finally, all researches that investigated the relation between cognitive ability and aspects of general health or physical well-being found moderate positive associations for both ($r \approx 0.4$), even larger than the association between health and socio-economic status ($r \approx 0.2$) (cf. Lubinski and Humphreys, 1992; Gottfredson and Deary, 2004; Singh-Manoux *et al.*, 2005). A positive association between intelligence and beauty was also reported (Kanazawa and Kovar, 2004).

The role of environmental factors in the development of intelligence

Contrary to what is sometimes assumed, behavioural genetics provides information about the degree of environmental influence on intelligence, in addition to its insights into the role of genetic factors. The heritability estimates of cognitive abilities suggest that environmental factors do have a non-negligible effect on the within-population variation in modern societies.

However, because environmental factors influence phenotype expression and genotypes tend to influence their environment, most measurers of environmental influence on intelligence show genetic influence (Plomin, 1994). About half of the phenotypic correlation between the environment and children’s g appears to be genetically mediated (Rowe, 1994; Harris, 1998).

An important indication of environmental effects is the secular increase in measured intelligence. As early as 1951, a study by Cattell found that the average IQ had increased in the previous decade. In the 1980s Flynn (1987) and Lynn (Lynn and Paggliari, 1994) showed that, comparable to the secular increase in body height (see Chapter 3 on ‘Age Variation and Ageism’), measured intelligence levels were rising in economically prosperous countries such as the United States, England, Norway, and Germany in the period from 1920 to 1990. However, just as is the case for body height (Larnkjaer *et al.*, 2006), the ‘Flynn effect’ may have come to an end in the 1990s (Sundet *et al.*, 2004; Teasdale and Owen, 2008).

Three major types of explanations have been given for the secular rise in intelligence: (1) cognitive stimulation provided by modern culture, especially education, (2) improvements in the biological environment, and (3) changes in the composition of the population.

Although very tempting, the cultural factor – increased education, greater availability of cognitively stimulating books, toys and television, greater acquaintance with intelligence tests (cf. Blair *et al.*, 2005; Flynn, 2007), etc. – is quite improbable as the major explaining factor, because the full magnitude of the increase in intelligence has occurred among 4 to 6 year olds and is even reflected in the developmental quotients of 2 and 3 year olds (Hanson *et al.*, 1985; Lynn, 2009). The supposed cognitive stimulation in the family must also be considered as quite unlikely, given the low correlations found between the intelligence levels of pairs of unrelated adopted children reared in the same environment (cf. Scarr and Weinberg, 1978; Teasdale and Owen, 1984). The SES between-family differences have been found to have limited effects on the differing average intelligence levels among adolescents and adults (Loehlin *et al.*, 1997; Jensen, 1998). Apparently most of the non-genetic variance in IQ relates to variance within families, the so-called non-shared environmental factors, i.e. environmental factors that are specific for each child within a family (Plomin *et al.*, 2001; 2008). As the individual reaches adolescence and adulthood, its genotype tends to express itself more and more strongly in its phenotype, the heritability for IQ generally increasing from about 0.20 in infancy to about 0.80 in later maturity (Figure 2.3). Individuals increasingly select their own environment, influence it and adjust it to their genetically determined individual talents (Scarr and Weinberg, 1978; Loehlin *et al.*, 1989; Pedersen *et al.*, 1992; McGue *et al.*, 1993; Neisser *et al.*, 1996; Jensen, 1998; Posthuma *et al.*, 2002; Boomsma *et al.*, 2008).

A stronger explanation for the secular increase in IQ can be found in the changed biological environment of modern culture (Lynn, 1990; 1998; 2009). In 1969 Jensen (see also Mascie-Taylor, 1993; Jensen, 1998) drew attention to the broad variety of factors that constitute the within-family biological micro-environment, that have an effect on cognitive development: improved general health, suppression of diseases that have a detrimental effect on IQ levels, improved nutrition (cf. Eysenck and Schoenthaler, 1997; Colom *et al.*, 2005); moderately increasing but not too high maternal age, more healthy lifestyle during pregnancy (especially as regards maternal nutrition, smoking, drinking, and drug habits), high quality obstetrical care, avoidance of premature birth and low birth weight, (cf. Broman *et al.*, 1975), and the increased prevalence of breast feeding (Lucas *et al.*, 1992; Mortensen *et al.* 2002). However, multivariate research shows that some of these environmental effects might ultimately be the result of sample assortment, in other words, more intelligent mothers appear to have low birth weight babies less often (Storfer, 1990), or are more likely to breastfeed their children (Der *et al.*, 2006).

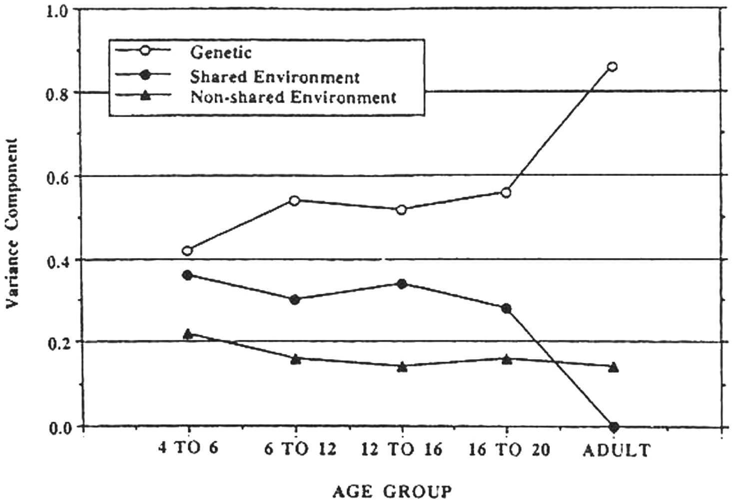

Figure 2.3. Estimated proportions of the total IQ variance attributable to genetic and environmental (shared and non-shared) effects during maturation. Source: McGue et al., 1993, in Jensen, 1998.

Legend: o *genetic;* • *shared environment;* ▲ *non-shared environment*

Relevant changes in the composition of the population include decreases in family size and birth order, and increased overall levels of education and welfare. Increased female labour participation may also partly be responsible for the secular increase in IQ (e.g. Boomsma *et al.*, 2008; Sundet *et al.*, 2008). Although most discussions today start from the assumption that the secular rise in IQ must be environmental in origin, Mingroni (2004) is of the opinion that several factors, among others the low shared environmental effects seen in IQ, and the numerous other highly heritable traits that have undergone large secular changes in tandem with IQ, warrant giving the genetic phenomenon of heterosis a closer look as a potential cause.

Given the (increasing) importance of mental abilities in modern societies and the non-negligible number of people with lower levels of abilities, the question of whether mental abilities can be enhanced by means of educational interventions has long occupied educational psychologists. The results of massive intervention programmes in the United States, such as Head Start (cf.

Neisser *et al.*, 1995), the Milwaukee Project (Garber, 1988), the Abecedarian Early Intervention Project (Campbell *et al.*, 2002), and the Infant Health and Development Program (IHDP), show that such programmes have positive effects on test learning, scholastic achievements, physical development and behavioural outcomes in general, but that they have only limited long lasting effects on cognitive ability which, indeed, is mainly a biologically phenomenon controlled by genes and other biological processes that affect the functioning of the nervous system (Spitz, 1986; Brody, 1992; Jensen, 1998; Baumeister and Bacharach, 2000).

Criminal behaviour

Another important and delicate theme in the social biology of individual variation is criminal behaviour. Important, because criminality is still a frequent phenomenon in modern culture, involving high social and human costs, all the causes of which should be effectively considered. Delicate, because many people are prejudiced that the discovery of (partial) biological or genetic influences on norm-violating behaviour implies that criminals are unchangeable or incurable, and consequently that social action is redundant, or that personal responsibility no longer needs to be the basis for a just judicial procedure. The mere idea that genetic factors, or even more generally, biological factors, could play a role in the aetiology of criminal behaviour, was for a long time taboo (Sagarin, 1980) and raised in the minds of many social and behavioural scientists the indignant question: ‘back to Lombroso?’

According to scholars who are well acquainted with Lombroso’s works (e.g. Buikhuisen, 1979; Gibson, 2002), the lopsided hereditarian interpretation of Lombroso’s theory is completely wrong, although his works must obviously be judged in light of the state of the discipline in his time. Lombroso’s (1876; 1897) oeuvre was, regarding the role of hereditary and environmental factors in the genesis of criminality, much more nuanced than Enrico Ferri’s (1884) concept of the ‘born criminal’.

In recent decades criminology can be described as shifting from the earlier, strongly ideologically influenced social-environmentalist theory of criminal behaviour toward a more interdisciplinary approach in which biosocial criminology takes a more prominent place (cf. Walsh, 2002; Thienpont, 2005). This shift is probably due to the remarkable recent progress of several biological disciplines, but also to the disappointing results of policies that are only based on social theory (cf. Walsh and Ellis, 2003).

In recent years more and more books about biosocial criminology have appeared (e.g. Mednick and Christiansen, 1977; Buikhuisen, 1979; Taylor, 1984; Wilson and Herrnstein, 1985; Mednick *et al.*, 1987; Eysenck and Gudjonsson, 1989; Denno, 1990; Ellis and Hoffman, 1991; Raine, 1993; Moir and Jessel, 1995; Rowe, 2002; Walsh, 2002; Walsh and Ellis, 2003; Thienpont, 2005), but a well-balanced approach to criminality is still far from being widespread.

Present-day biosocial criminology is based primarily on recent developments in three large biological fields of study: genetics, neurosciences and evolutionary biology. The first includes obviously molecular genetics (Rowe, 2002), but even more important is behavioural genetics (Mednick and Christiansen, 1964; Rhee and Waldman, 2002). The neurosciences include neurophysiology, psychophysiology, and neuro-chemistry (Raine, 1993). The third domain includes several fields of biological anthropology, in particular sociobiology and evolutionary psychology (e.g. Mealey, 1995; Pitchford, 2001; Walsh and Ellis, 2003; Thienpont, 2005).

Before illustrating with a few examples the involvement of biological factors in criminal behaviour, a preliminary remark should be made regarding the value dependency of criminal behaviour. We should, indeed, be aware that the definition of violent and deceptive behaviour, and in the end all criminal behaviour, depends partly upon society's value and norm systems, and those systems show considerable temporal and spatial variation. In most cases people are not born either as saints or as criminals; the same personal predisposition can, depending upon environmental conditions and value systems, result in heroic or criminal behaviour by the individual. Most current rule-based systems are not completely free from various forms of value bias that are of importance for the definition and substance of criminality: sexual bias, so prominently present in pre-modern value systems, but not completely absent in modern culture, which includes concerns issues such as virginity, extra-marital intercourse, divorce and inheritance rights; also, social class bias is well-known as the basis for discrimination between crude versus sophisticated forms of competition; and last but not least, in-group/out-group bias leads to an evaluation of violent behaviour towards others differently, especially in times of peace and war. The existence of these biases makes a complete and impartial treatment of the impact of biological (genetic) factors on criminal behaviour very difficult.

Genetics and criminality

Examples of genetic influences on criminal behaviour can be found in karyotypology[6], molecular genetics and behavioural genetics.

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[6] Karyotypology: a subdivision of cytogenetics aimed at identifying the structure of chromosomes.

In the domain of karyotypology, it has been observed that XYY men are relatively more present in penitentiaries and psychiatric institutions than can be expected on the basis of their prevalence in the population. XYY men are very tall (average body height = 1.90) and have above-average testosterone levels, but a somewhat lower average intelligence. They have a higher propensity towards aggressive behaviour and more often come into conflict with the law; however, only a minority of XYY men manifests criminal behaviour (Jacobs *et al.*, 1965). Multivariate research shows that the XYY karyotype is only indirectly – via a lower intelligence level – related to norm-violating behaviour (Witkin *et al.*, 1977).

An example in the field of molecular genetics concerns a point mutation of the MAO-A gene on the X-chromosome that is responsible for the failure to produce the enzyme monoamineoxydase A, which plays a role in the metabolism of neurotransmitters. This point mutation produces extremely violent behaviour (arson, rape, tantrum, aggression) in men. Since men have only one X chromosome, the mutated MAO-A gene directly manifests itself phenotypically, via the action of neurotransmitters (e.g. Brunner *et al.*, 1993).

Behavioural genetic studies, particularly those based on twin and adoption research, have taught us the most about the relative impact of genetic and environmental factors on criminal behaviour.

A first indication of the possible effects of genetic factors on criminal behaviour can be found in kinship studies. Familial factors, as a matter of fact, appear to be among the most important predictors of delinquency and criminality. Parental crime, child abuse, maternal deprivation, divorce/separation, poor parental supervision, marital conflict, and neglect have been found to show substantive relationships with offending. However, genetic and social effects are usually covarying or confounded in family environments and require analytical research procedures that enable fractioning the genetic and social components of the kinship relations with crime (Raine, 1993). Only a few studies have shown that the degree of genetic relatedness is positively correlated with crime (Daly and Wilson, 1988).

More pertinent findings in this respect come from twin studies. Virtually all twin research about criminal behaviour shows a significantly higher concordance among monozygotic than among dizygotic twins (Rhee and Waldman, 2002). In a recent meta-analysis of all available research, Raine (1993) found 52 percent concordance among monozygotic twins and 21 percent among dizygotic twins. Even after controlling for a number of mediating factors, the difference remained considerable (13–31 percent). These data do not prove that criminal behaviour is genetically determined, but they do indicate that the presence of particular genotypes in criminogenous circumstances can more easily lead to criminal behaviour.

Adoption studies have found that the influence of the biological father on the criminal behaviour of the adopted child is twice to three times as large as the effect of the adoption father. Chronic offenders – life course persistent delinquents – have a higher probability of having biological parents with several convictions (Hutchings and Mednick, 1977; Mednick *et al.*, 1987). The largest effect comes from the combination of 'bad' genes and 'bad' environment, not simply from a bad environment alone (Bohman *et al.*, 1982) (Table 2.3).

Table 2.3. Crime figures in cross-fostering adoption. Source: Mednick et al., 1984; Bohman et al., 1982.

			Criminality among biological parents	
			Yes	No
Criminality among adoptive parents	Yes	Data from Mednick *et al.* (1984)	25%	15%
		Data from Bohman et al. (1982)	*40%*	*7%*
	No	Data from Mednick *et al.* (1984)	20%	14%
		Data from Bohman et al. (1982)	*12%*	*3%*

The neurosciences and delinquency

A broad variety of scientific disciplines studying the human mind that apply diagnostic neurophysiological and biochemical tests, such as EEG (electroencephalogram), MRI (magnetic resonance imaging) and PET (positron emission tomography scanning) are making substantial progress in identifying the deep-lying causes of antisocial, delinquent and criminal behaviour.

A first indication of the effect of neurological factors in criminal behaviour comes from research on cognitive ability. Lower intelligence is a major feature related to criminal behaviour (ΔIQ ~ 17 between non-offenders and life-course persistent offenders) (Hirschi and Hindelang, 1977; Moffit, 1993; Walsh, 2003). Offenders also are overrepresented by a factor of about 2.2 on performance intellectual imbalance (P>V) (Walsh, 2003). The difference in IQ is not explained by the difference in detection (undetected delinquents are not brighter than the detected) (Moffit and Silva, 1988). Controlling for SES weakens the IQ difference between offenders and non-offenders only slightly (cf. Hirschi and Hindelang, 1977; Lynam *et al.*, 1993). Last but not least, the increase in crime rates in recent decades in some countries is not related to changes in IQ, but to factors such as family problems, a general breakdown in morality, and increased intellectual demands for job recruitment (Walsh, 2003).

Personality is also differentially related to delinquency. Delinquents are more likely to be extroverts, impatient, irritable, aggressive, asocial, unconventional, assertive, and emotionally unstable. They show less fear, weak self-control, and are less sensitive to reprimand and punishment. Delinquents often show psychopathic personality characteristics (e.g. Eysenck, 1977; Noziglia and Siegel, 2006).

Psycho-physiological research has identified, through measurements of skin conductance, heart rate, and blood pressure, statistically significant relations between low autonomic nervous system reactivity and an increased risk of antisocial or criminal behaviour (Mednick and Christiansen, 1977; Scarpa and Raine, 2003). EEG measurements show a high prevalence of abnormalities among violent criminals, especially in recidivistic offenders (Mednick *et al.*, 1982).

Neuro-physiological research established the existence of relations between defects in the prefrontal lobes of the brain and conduct disorder (CD), attention deficit hyperactivity disorder (ADHD), antisocial personality disorder (APD), and violent criminality such as homicide and aggressive impulsive behaviour (cf. Raine, 1993; Comings, 2003). Neurological disorders are also often associated with addiction and both are often present in delinquent behaviour. Drug abuse obviously reinforces the risk of criminality (cf. Moir and Jessel, 1995).

Neuro-chemistry established the existence of relations between some neurotransmitters and antisocial behaviour: low serotonin levels and high levels of norepinephrine are linked to impulsive and aggressive behaviour (cf. Raine, 1993; Quadagno, 2003). Concerning the influence of hormones, it is well known that delinquents show systematically higher androgen levels; the relation is most clear for violent criminals (cf. Dabbs *et al.*, 1987; Susman *et al.*, 1987). Among women there is an increased risk of criminal behaviour during the paramenstruum due to a sudden decrease in progesterone (Dalton, 1990).

So we see that the social biological study of criminal behavior transcends the behavioural genetic dimension, although this approach yielded considerable amounts of high quality data on the aetiology of criminality. Given the wideness of the biological study of criminal behavior, it is to be expected that synthesizing this information will be the scientific challenge of the future.

Evolutionary biology and antisocial behaviour

Various research fields in biological anthropology have revealed relevant clues concerning the influence of evolutionary biological processes on antisocial, delinquent and criminal behaviour.

From primatology came amazing findings about intergroup conflict amongst chimpanzees (cf. Goodall, 2000). From paleontology and archaeology there are multiple indications of homicide, cannibalism, and group conflicts amongst various hominids (cf. Thienpont, 2005), and ethnography has extensively documented in-group/out-group conflicts in prehistory, amongst hunter-gatherers, as well as agrarian populations (cf. Davie, 1929; Chagnon and Irons, 1979). Anthropometric studies of constitution types show that stronger body build predominates among delinquents (Sheldon *et al.*, 1949; Hartl *et al.*, 1982).

Perhaps the most relevant insights into the evolutionary background of contemporary antisocial behaviour come from sociobiological and evolutionary psychological theories. The partial revival in the second half of the 20th century of the extremely rich and extensive evolutionary study of social behaviour has contributed considerably to deepening the understanding of competition, violence and cheating and their implications for antisocial, delinquent and criminal behaviour (cf. MacMillan and Kofoed, 1984; Raine, 1993; Ellis, 1998; Walsh and Ellis, 2003; Thienpont, 2005).

A fundamental question is, how can evolutionary theory explain the widespread occurrence of genetically determined or influenced antisocial, delinquent and criminal behaviour which, in principle, must be seen as a maladaptation in such a highly socially developed species as *Homo sapiens sapiens*?

Maladaptive traits in general, not only those associated with antisocial behaviour, can be caused or influenced by various biological (genetic) factors: deleterious mutations which prevent a normal or healthy phenotypic or behavioural development; unfavourable environments that prevent favourable genes from manifesting themselves and produce phenotypes or forms of behaviour that cannot meet the challenges of the environment; changed environments, transforming earlier advantageous traits into disadvantageous characteristics or behaviour; and last but not least, and in particular to be found in modern culture, the conservation or even promotion of less favourable genetic mutations or behavioural patterns because they have sufficient survival value in the culturally or economically protected environment or are even fostered by such environments.

Sociobiology and evolutionary psychology have developed several specific evolutionary theories of criminal and antisocial behaviour with the goal of explaining their relatively high frequency. We can distinguish four major theories, which partially overlap in several respects (cf. Ellis, 1998). Indeed, all of these theories have in common the assumption that antisocial, delinquent and criminal forms of behaviour produce reproductive advantages for individuals who victimise others, allowing their own genetic predisposition to be transmitted to future generations, or prevent the reproduction of others. These four theories are the cheater (or 'cad vs. dad') theory of antisocial behaviour, the r/K theory of criminal and antisocial behaviour, the coincidental status-striving theory, and the cuckoldry-fear theory.

The 'cheater (or cad vs. dad) theory of antisocial behaviour' (MacMillan and Kofoed, 1984; Harpending and Draper, 1988) is the expression of genetic programmes for an evolved male strategy aimed at adopting a cad reproductive strategy rather than a dad strategy. In other words, this theory describes males who focus on obtaining numerous mating opportunities by means of highly deceptive and/or forceful strategies rather than assisting their partner in caring for the offspring they sire. Several forms of sexual harassment and assault, forced copulation, and of course especially rape (Thornhill and Thornhill, 1983; Thornhill and Palmer, 2000) are explained by this theory.

The 'r/K theory of criminal and antisocial behaviour' (Ellis, 1987) assumes that people who have the tendency to harm others may be manifesting a more r-oriented reproductive strategy than law-abiding citizens by producing more offspring.

The 'coincidental status-striving theory' (Alexander, 1979; Ellis, 1990) states that competition for status and resources favours males who attract mates and sire a disproportionate share of offspring. Males who are the most extreme in their overtly competitive and status-striving activities are more likely to violate the within-group order. Many cases of homicide, as forms of elimination of male competitors, can be explained in this respect (cf. Daly and Wilson, 1988; Duntley and Buss, 2005).

The 'cuckoldry-fear theory' (cf. Hiatt, 1989; Geary, 2006) explains some forms of antisocial and criminal behaviour based on the idea that males, due to the uncertainty of their paternity, are more susceptible to the risk of being cuckolded in cases of their partner's infidelity. Thus, males would be under additional natural selection pressure to use violent tactics to curtail sexual infidelity. Various forms of male partnership tactics – mate guarding, partner sequestration, female genital mutilation, spouse abuse, assault and murder (cf. Buss, 1994; 2002) – as well as some forms of child neglect and abuse and infanticide, particularly in cases of non-relatedness, come under this heading (cf. Lightcap *et al.*, 1982; Burgess and Garbarino, 1983; Ellis, 1998; Daly and Wilson, 2008).

The two major components of antisocial (criminal) behaviour – violence and cheating – have a clear evolutionary basis: they formed as an adaptation to the Environment of Evolutionary Adaptedness (EEA), be it as occasional or secondary strategies. But it is important to keep in mind that behaviours and emotions that evolved as reactions against antisocial violence and cheating are also part of out evolutionary heritage (cf. Raine, 1993).

A pertinent illustration of the evolutionary background of part of delinquent/criminal behaviour can be seen in the sociobiological explanation of the differentials in the sex-age-crime curve (Kanazawa and Still, 2000; Kanazawa, 2003). Sex produces the most significant difference in criminal behaviour. The very large majority of all crimes are committed by men. Male criminality is strongly linked to aggressive and other drives that begin to appear early in the life course, even before learning and socialisation processes have a chance to influence sexually differential behaviour (cf. Maccoby and Jacklin, 1974; Smith and Visher, 1980; Steffensmeier, 1980). Age is the second most important differential factor in criminal behaviour. Violent criminality peaks in (male) adolescent and young-adult age (Hirschi and Gottfredson, 1983). Proximally, these sex-age differentials in life-course crime are explained by differences in sexual dimorphism in morphology and physiology – larger male body build, stronger musculature, masculinised brain physiology, higher levels of androgen production, ejaculation physiology, etc. Ultimately they are due to evolutionarily embedded sexual differences between men and women in mating and parenting efforts and their changes over the life course. From a life course perspective, the evolutionary causes are manifested as follows:

- The overall reproductive investment, consisting of mating and parenting efforts, is smaller in males than females;
- In the life course mating efforts precede parenting efforts;
- Reproductive efforts shift over the life course from mating to parenting efforts;
- The reproductive benefits of competition correlate with the degree of mating efforts;

- The reproductive costs of competition increase with degree of parental efforts;
- The propensity towards competition = benefits – costs of reproductive investment.

These processes result in lower crime rates among women than men, higher male crime rates at adolescence and in young adulthood, and decreasing crime rates in later life course stages (Figure 2.4).

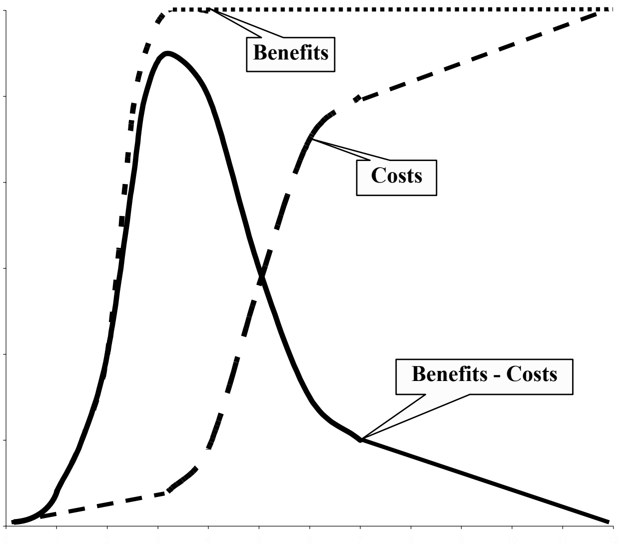

Figure 2.4. The benefits and costs of mating competition and the age-crime curve. Source: Kanazawa and Still, 2000.

Obviously, the sex-age life course crime curve does not explain all of the criminal behaviour observed in human beings (Comings, 2003). More generally, not all criminal behaviour is ultimately related, consciously or unconsciously, to reproductive drives as proposed by the above-mentioned evolutionary theories. A substantial part of antisocial and criminal behaviour appears to be life-course persistent, influenced by variations in cognitive and emotional personality, and neurological and hormonal functioning that are caused by genetic or developmental factors, or to the combination of the presence of a specific biological endowment and the perceived or experienced social inequalities in the accessibility or availability of desired goods and services in the modern affluent society.

Concluding considerations concerning biology and crime

One of the most important findings of recent decades is that the risk of criminal behaviour at an adolescent or adult age can to an increasing degree be predicted on the basis of the combination of familial, physiological and behavioural indicators at young age. Neural defects, low arousal levels, low verbal intelligence, hormonal abnormalities, low serotonin levels, lack of concentration ability, irritability, impulsivity and aggressivity at a young age, and especially the combination of several of these indicators form risk predictors for criminality at an adult age. Progress in the aetiology of criminal behaviour and expanding possibilities for physiological and medical interventions offer new opportunities for early, preventive treatments for children with multiple risks of criminal behaviour and will allow a shift from a juridical punitive approach toward a controlled psychotherapeutic and medical approach (Moir and Jessel, 1995).

Criminal behaviour is often the result of the combined, interacting or covarying effects of biological and social factors. Biological and social factors often co-vary, either because genotypes tend to create their own social environment, or because social circumstances exert a sortment effect on biological variability.

The differential relation between biological factors and criminal behaviour often depends on the individual's socio-economic status, just as the effect of genes depends on the type of social environment. The relation between biological factors and criminal behaviour is more manifest in higher and middle social classes because the favourable social environment allows the various genotypes to become visible. This relation is not manifested or is less evident in deprived social environments where unfavourable living conditions mask the effects of genetic variation (Raine and Venables, 1981; Cloninger *et al.*, 1987; Raine *et al.*, 1997).

Prosocial behaviour requires a subtle bio-cultural interaction: internally, a sufficient neuro-physiological and endocrinological basis for social 'arousal' needs to be present, but externally, the culture must be sufficiently stimulating in order to satisfy the exploratory and danger-defying neuro-hormonal constitution of the human, particularly the potentially aggressive drives of the male adolescent and young adult. Moir and Jessel (1995) rightly argue that modern culture, with its protective environment in which basic needs for security, nutrition, housing, education, labour opportunities, health care, and leisure are largely ensured and which frees the individual from the need to respond to the challenges, exigencies and dangers of living in natural circumstances – such as the stresses of hunting and gathering, natural disaster, and war – attracts young people to sensational and adventurous, and occasionally antisocial, actions.

In modern society, violent and cheating behaviour has become maladaptive: socially, because the harsh living conditions (including intergroup conflict) of the original Environment of Evolutionary Adaptedness no longer exist, at least in peacetime, and evolutionarily biologically because women can now protect themselves efficiently against involuntary conceptions by means of modern birth control practices by which the reproduction of genes of sexual offenders and abusers can be avoided (see Chapter 6).

BIOLOGICAL SOURCES OF INDIVIDUAL VARIATION

The phenotypic differences between individuals in a population are due to a combination of various sources of variability: a non-specific source of variability (general variability), and several specific sources of variability, including ontogenetic variability, sexual variability, and interpopulation variability.

Each one of these components can be influenced by genetic and environmental factors and by their interrelations. No general pronouncement can be made about the relative impact of genetic and environmental factors on each of the components. It is, however, quite likely that in specific cultural or economic circumstances, the impact of both groups of factors may be component-specific. Thus, one can image that in modern societies the relative impact of genetic factors on general variability increases to the extent that the traditional negative effects of environmental constraints can be mastered more efficiently and, consequently, decreased. The variability coming from interpopulation differences is, by definition, largely of genetic origin, but to the degree that genetically different immigrants fail to integrate fully in their host society and form socio-cultural isolates, environmental factors can also play an important role in their phenotypic differentiation.

General variation

The phenotypic differences between individuals are primarily influenced by a non-specific source of biological variability, known as general variability. The term describes differences between individuals within a reproductive community that result from the occurrence of mutations in the present or a previous generation, and the action of selective processes on those mutations, as explained above. In addition, environmental factors can produce general differences between individuals.

A special case of general variability is pathological variability. Health and disease is a category of variability that sometimes manifests itself in alternative phenotypic forms, but in most cases appears in continuous gradients. In an ontogenetic or time perspective health turns to illness and death (Hudson, 1993).

In many cases temporary recovery after an acute period of illness is possible, but in the end the human genetic programme leads inevitably to conditions in which life processes cannot continue regularly or undisturbed. The difference between health and disease is in many cases partly environmentally or culturally determined, and is especially dependent on progress in the bio-medical sciences.

‘Normality’ versus ‘abnormality’

This consideration of the concepts of health and disease raises the question of how to understand the variability between ‘normality’ and ‘abnormality’. In everyday language the concepts of normal and abnormal can have two meanings: corresponding to or deviating from what is prevalent in majority, and corresponding to or deviating from a social norm according to which one should behave.

The attempt to reduce a quantitative variable into two parts is a scientifically hopeless task. Nevertheless, several approaches or practices can be observed in this domain:

- Statisticians often use the norm of ± 1.96s of a normal distribution to distinguish the normal probability area of 95 percent from the two eccentric areas of each 2.5 percent each, for a total of five percent. This statistical definition of normality and eccentricity forms a quantitative expression – obviously arbitrary – of the above mentioned majority/minority distinction (Bauer, 1945);
- In an attempt to distinguish between health and disease, the medical sciences often define ‘normal’ (= healthy) variation in the population on the basis of samples of people who are in good health (Simonson, 1966);
- In evolutionary biology, normality is defined on the basis of genetic fitness, i.e. on the basis of survival probabilities and differential reproduction (Garn, 1966).

These three delineations of normality do not necessarily coincide. The statistical average of a characteristic is not always to be considered the ideal phenotype. A well-known contemporary example is the average relative body weight of North Americans, which correlates to a higher risk of hypertension and cardio-vascular complications (Simonson, 1966). Also, variation in genetic fitness doesn’t necessarily completely coincide with what is statistically or medically normal, probably because genetic fitness varies over the entire life course (Garn, 1966).

The usefulness of the concepts of normal and abnormal in an ethical-normative perspective is less difficult to identify, since making this distinction has only to do with the description of observable facts, but it is, much more than with the scientific approaches, subject to cultural variation – and in modern culture, both between societies and within societies, norms can change rapidly, as the recent history of changing attitudes towards issues such as contraception, abortion, homosexuality, and euthanasia so clearly shows.

General variation within the 'normality' range

How to explain the general biological variation within the 'normality' range of the Gauss distribution (i.e. within the 95% probability range, leaving both of the eccentric areas of 2 × 2.5% on the side)?

From an evolutionary point of view, the answer is relatively simple: mutational variation or developmental variation under the influence of internal or external environmental factors that are not harmful either for the ontogenetic development of the individual or for his reproduction. Obviously, such 'normal' variation can have, particularly in large, complex societies, relatively important social effects, because they may interfere in the competition for status, mates, and resources in general. All socially important biological performance characteristics – including body height, muscular strength, speed, reaction time, cognitive ability, emotional personality characteristics, social and emotional intelligence, superior health – may be more or less involved in such social processes. In the end, such 'normal' variation may also result in differential reproductive outcomes, producing small generational shifts in directional selection. But as long as such variation does not drastically impair reproductive performance, it can remain in the population.

Age variation

Ontogenetic variability is an important specific source of phenotypic variation between individuals. This source of variability can express itself in two distinct forms of variability: age-related variability and age-independent variability.

Age-related differences between individuals are due to the changes individuals undergo in the course of their ontogenetic development. A distinction should be made between the maturation period and the senescence period in the life course, phenomena that will be dealt with more extensively in Chapter 3 on 'Age Variation and Ageism'. Here, attention is focused on the effects of ontogenetic development on the between-individual variation that occurs within each age.

Ontogenetic development can manifest itself in different ways. For the maturation period, Loevinger (1966) distinguished the following types:

- Differences in the growth or developmental rhythm, leading to the same end result: this leads to variation within each age stage of the maturation period, but not at the end of the maturation period. Maturing individuals of the same chronological age can differ in degree of maturation. For instance, skeletal age can vary according to this model;
- Differences in the growth- or developmental rhythm, leading to a different end result: this leads not only to differences in maturation degree within some stages of the maturation period, but also to differences in the adult life phase. Measured intelligence can vary according to this growth type;
- An identical growth or developmental rhythm leads to a different end result: this also results in differences at ages during and after the maturation period. Differences in attained educational level vary according to this model.

Following Loevinger's (1966) typology, one could also distinguish various developmental models for the senescence period. However, here the situation is much more complex, because senescent processes can vary not only according to a different ageing rhythm, but they can also start at different ages.

Sexual variation

Sexual variability is another important source of phenotypic variability between individuals in a population. This source of variability will be discussed separately in Chapter 4 on 'Sexual Variation and Sexism'.

Nevertheless, there is one facet of the sexual variability that is important for understanding the biological differences that exists within each sex, namely intra-sexual variation. Within each sex there is, indeed, a variation along a masculinity-femininity gradient, particularly with regard to secondary sex characteristics (cf. Bayley and Bayer, 1946).

The masculinity-femininity gradient for secondary sex characteristics manifests itself within each of the two sexes, for instance through morphological differences in general body build, skeleton structure, distribution of fat and muscle tissue, and hair distribution, through physiological differences in hormonal activity, and through psychological differences in social relations, fields of interest, activity drive, etc.

Sexual differentiation can be influenced at every level of the determination of ontogenetic development – genetic, hormonal, neuro-organisational, morphological, and psychological. This apparently not only impacts the differentiation between the sexes, but also within-sexual variation.

Racial variation

The phenotypic variability amongst individuals within a population can also be partly be influenced by biological differences that originate from inter-population variability, a topic that is discussed extensively in Chapter 8 on ‘Racial Variation and Racism’.

Fusions of genetically different populations result in new ‘gene pools’ with a genetic composition that is the product of the original parental populations. Even a limited, but intergenerationally sustained immigration of genetically different allochthones can, in the end, quite substantially change the intra-population variability.

Depending on the nature of the partner choice – at random or not – the mixed new populations can form one or more reproductive communities, with all of the known consequences for the distribution of the combined alleles and for their possible combinations in genotypes.

Because of a long and complex migration history, many populations contain a significant component of biological variability resulting from between-population genetic variability.

INDIVIDUAL-SOCIETAL INTERDEPENDENCY

One of the most important areas of tension in human societies can be found in the relations between the individual and population levels of organisation. To better understand this tension, and possibly alleviate it, a broad range of philosophical, ethical, and political theories have been developed, on one extreme giving absolute priority to individual interests, and giving strong preferential treatment to the population on the other extreme.

Usually such extreme theories rely on opinions that are not always supported in a balanced way by well-grounded knowledge of the facts of life. Thanks to its specificity, social biological knowledge – based on the study of the interrelations between biological and social phenomena – can contribute in several respects to refining and deepening of insights into that relationship.

There are at least three major domains in which social biology can make a positive contribution to this question: (1) the ontogenetic interdependency between individuals, (2) the genetic relationship between the individual and the societal level of organisation, and (3) the controversy between individual competition and social cooperation.

The ontogenetic interdependency between individuals

This is the easiest and most obvious issue to deal with. Due to two interconnected specific biological features of *Homo sapiens sapiens* – namely the shift from automatically programmed instinctual behaviour toward a conscious control of behaviour through the development of the large brain hemispheres (Jerison, 1973), and the relatively short duration of pregnancy resulting in the premature birth of the newborn (Portmann, 1944; Leutenegger, 1982) – human postnatal growth and development became strongly dependent upon biological drives and socio-cultural values, norms and structures for childcare. Moreover, the socio-biological dependency of the human child and adolescent, as well as the interdependency of adults, increased and prolonged as human culture and society became more complex.

Because human infants are born so helpless, it takes many years of intensive learning and socialisation for the individual to survive, grow, and become a functional part of a group. Even the motivation to learn and socialise must be stimulated by means of value and norm systems. In many domains important for survival, the individual no longer knows instinctively what and how to teach his offspring.

In modern culture, with its extensive educational requirements and rising standards for social and cultural performance, the care and oversight of infants, adolescents and young adults transcends by far the role of parents and other kin – the family – and involves many more non-related adults.

Due to modern societal developments, inter-individual dependencies have also grown during adulthood. The increasing value placed on individual emancipation and equality of opportunities, coupled with the rising standard of quality of life and its associated social protection systems in the fields of health care, welfare provisions and social security in general, greatly enhance the mutual interdependencies between individuals and groups in society. In particular, due to growing longevity, caretaking functions are increasingly needed for elderly people, and in this instance close family and kin ties no longer suffice to fulfil every need.

Thus, sociobiology reveals that there are powerful biological drives as well as culturally fixed and transmitted values, norms, and structures that steer the ontogenetic development of the individual during the various phases of the life course. Especially in more complex societies such as those made possible by the development of modern science and technology, the level of social interdependency between individuals has reached unprecedented heights.

The genetic interrelationship between individual and population

Amongst sexually reproducing organisms an individual can be characterised as being genetically constituted of two sets of chromosomes, each originating from one of the two parents. Hence, in the parental generation the genes of an individual were distributed across two individuals. Because of the opportunities for the combination of genes during meiosis – between as well as within chromosomes – the genome of any given individual was, two generations ago, maximally divided between four grandparents, with an average gene contribution of 1/4 per grandparent. For every further removed generation, this average probability is further halved. Ten generations ago, in absence of inbreeding, the genes of an individual were distributed across maximum 1024 individuals, with an average gene contribution probability of 1/1024 per ancestor. Twenty generations ago, i.e. approximately in medieval times, the genes of an individual alive today theoretically could have been distributed over more than one million individuals. In reality, this obviously cannot be so because the reproductive communities in pre-industrial populations were very small and, moreover, inbreeding was common, to varying degrees.

The genetic future of an individual is characterised by an identical multiplicative dilution. In the absence of inbreeding, and with an average fertility of two children, the genes of an individual will successively be distributed over 2, 4, 8, etc., descendants. Consequently, the past and future genealogy of an individual can be represented by the shape of an hourglass (Figure 2.5).

It follows, then, that genetically the individual is a temporary condensation of genetic material that was, only a few generations before, spread over nearly the entire reproductive community from which it emerged, and will, within a few generations, again be spread over the total population within which the genes are recombined.

However, in previous generations the genes of an individual were present not only amongst its direct ancestors. Within each generation, the ancestors had close relatives with whom they had a probability of 1/2 for brothers and sisters, 1/4 for cousins, 1/8 for second cousins, etc., to carry the same genes on the basis of close kinship. There is also the ordinary population probability that the same genes are carried by others in the population.

Intuitively one can see that, contrary to the temporary and unique genetic character of the individual, the population – understood in the sense of the reproductive community – is, intergenerationally, the enduring entity in matters of genetic composition. This is exactly what the Hardy-Weinberg-law shows.

Hereditary phenomena and their ultimate outcomes – the evolution and adaptation of a species – cannot be completely understood when considered only at the level of genes, or individuals. Genes – the replicators – are the basic elements through which life can differentiate and evolve. Individuals are the organic units – the vehicles – in which life characteristics develop and manifest themselves. But, genetic adaptations to changing living conditions – i.e., evolution – can only occur at an organisational level that transcends in a double way the individual and the intra-generational level: namely at the population and the inter-generational levels.

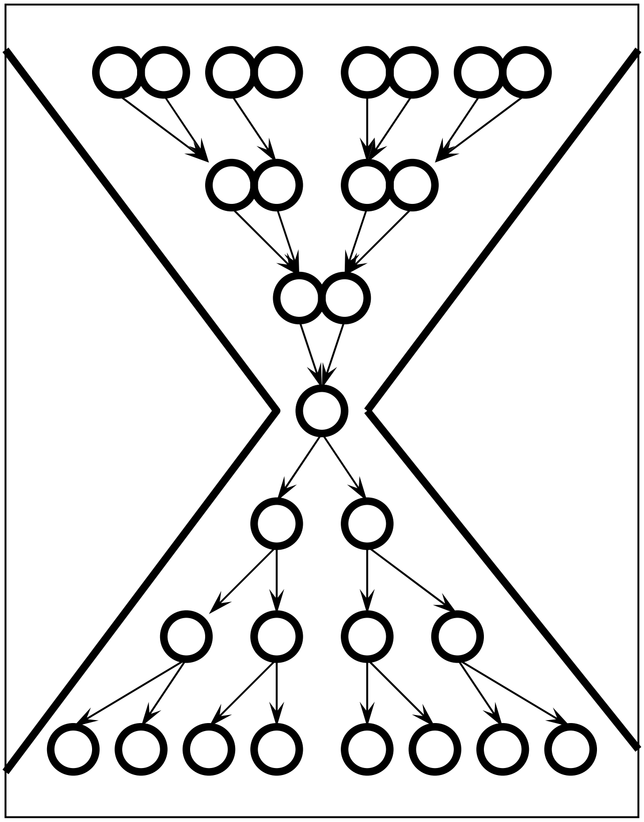

Figure 2.5. The genetic relationship between the individual and population

Whereas individuals are genetically, and more precisely genotypically, unalterable and limited in life span (mortal), populations are in their genetic and genotypic composition changeable. Moreover, theoretically they are immortal! Li (1955, 251) argued rightly:

> *"Adaptability is a response of populations rather than of the individual, who cannot react to the needs of the changing environment."*

Spiess (1977, 2) formulated it a bit more harshly:

> *"The individual is powerless to evolve."*

Consequently, it is important to put claims about the priority of the individual level of organisation, compared to the societal level, into perspective. Individuals are, like a dewdrop on a window, only the temporary and largely accidental combination of genetic material of a reproductive community.

However, those who advocate the priority of the population shouldn't be too jubilant. They shouldn't lose sight of what has earlier been argued about the importance of the basic unit at which mutation and selection, and hence evolution, operates and the role of the vehicles – the individuals – in that process. Intergenerational replacement at the population level must pass through the constriction of the individual hourglass, the ontogenetic development of individuals. If individuals are not adequately cared for, the hierarchically higher levels of groups, populations, societies, species can be forgotten. The genetic interrelationship between individual and population, in other words, clearly refutes both the ideological extreme positions which are commonly taken, and are, unfortunately, in some quarters still being argued.

Individual competition versus social cooperation

The ontogenetic development and the intergenerational reproduction of complex organisms such as the human together imply that the individual must be equipped with genes that produce strong drives for self-oriented behaviour. Survival and reproduction would otherwise be impossible. The selfish drives of the individual must inevitably lead to competitive behaviour, particularly in circumstances of scarce resources of whatever nature.

However, the human species emerged and evolved as a social species and also needed to be equipped with strong drives toward social behaviour – resulting at first sight, in a paradoxical twist in the Darwinian theory of evolution.

Life in groups must lead to the selection of genes through which behavioural patterns are realised that, at a minimum result in tolerance of the presence of others, but that usually also favour cooperation with others, especially in species that are characterised by the development of more complex forms of social life. Group life that transcends the elementary level of living next to each other requires the presence of altruistic behaviour, i.e. behaviour that provides assistance to others at the expense of pure self-interest.

As argued in the introductory chapter, in the second half of the 20th century sociobiology discovered evolutionary mechanisms, such as kin selection and various forms of reciprocal altruism, that explain the transmission of altruistic behaviour, and hence the evolutionary basis of social co-operation. Nowak (2006) considers the generation of cooperation in a world of competition to be perhaps the most remarkable aspect of evolution and even suggests that 'natural cooperation' might be considered a third fundamental principle of evolution beside mutation and natural selection.

This explosive development of sociobiology, and its offshoot evolutionary psychology (cf. Palmer and Palmer, 2002; Buss, 2007) has occasionally evoked among some outsiders the scornful question whether there exists something like a gene for altruistic behaviour? Apart from its salient maliciousness, this question is a sign of flagrant ignorance of the state of present-day genetics, particularly of behavioural genetics and evolutionary psychology. Obviously, there is no gene for altruistic behaviour. Complex behavioural characteristics are seldom controlled by a single gene pair, but furthermore genes do not 'code for' behaviours, but only for behaviour control mechanisms (Dawkins, 1979; 1995; Buller, 1997). When biologists speak about genetic determinants of altruistic behaviour, they mean that the action of one or usually several allele pairs produces behaviour control mechanisms that, in interaction with environmental influences and socialising learning processes, result in emotional personality characteristics that, in particular circumstances, can result in altruistic behaviour.

How is group co-operation to be reconciled with the competitive self-interest of individuals? Paradoxically, in particular conditions of in-group or out-group threats, the development of social life appears to favour individual survival, and, hence, the transmission of genes. In other words, social co-operation, without excluding moderate forms of individual competition, fulfils the same functions as competition. In present-day sociobiological terminology, this is referred to as the maximisation of the inclusive fitness of the individual.

Hence, the biological-evolutionary study of altruistic behaviour offers the opportunity to redefine and refine the concepts of egoism and altruism in several respects. The concept of altruism can be considered in an ethical or in a behaviouristic sense. The ethical meaning of the word concerns behaviour that is normatively aimed at providing helping behaviour at the cost of the individual's own welfare. In its behaviouristic meaning, only the behavioural expression is considered, whatever its aim may be.

The preceding discussion also shows that, from a biological-evolutionary point of view, the effects of behavioural patterns such as egoism and altruism have to be evaluated in reproductive terms. Indeed, evolution is more about the reproduction of the fittest than the survival of the fittest (Ridley, 1993).

Bertram (1982, 252) defines altruism as follows:

> *"Altruism in biology is defined as behaviour which is likely to increase the reproductive output of another member of the same species who is not a descendant of the actor, and which at least in the short term is likely also to reduce the number of the actor's own descendants."*

The most important insight into altruistic behaviour introduced by the biological-evolutionary approach concerns the fact that evolutionarily selected altruistic behaviour is, in its ultimate effects (i.e. the differential transmission of alleles) in fact to be equated with genetically selfish behaviour. Alexander (1979, 46) formulated this as follows:

> *"Such altruism ... may be described as phenotypically*
> *(or self-) sacrificing but genotypically selfish."*

In biological-evolutionary terms genuine altruism – or 'ascetic altruism', as Lopreato (1981, 117) calls it – can only be defined as helping behaviour that decreases the inclusive fitness of the altruist and increases that of the beneficiary:

> *"Ascetic altruism is behavior, conscious or unconscious which, guided by innate predispositions, potentially reduces the inclusive fitness of the dispensers and potentially increases the fitness of the recipients."*

The altruistic drives of the human must have been a very early hominid adaptation. Human grouping tendencies developed as early as the Pleistocene, in the 'Environment of Evolutionary Adaptedness' (EEA). It was an adaptation for living in small groups in which people were genetically closely related and where people also had the opportunity to get acquainted with all of the group members (Wilson and Sober, 1994).

In the course of their history, human populations evolved from very small numbers in the hunter-gatherer phase of cultural development to many millions in modern societies, a novelty to which *Homo sapiens sapiens* in fact has not yet adapted genetically. Therefore, modern million-member societies face many biosocial constraints and conflicts resulting from the fact that the human mind, with its specific evolved psychological mechanisms and design as an adaptation to Pleistocene living circumstances, is not yet adapted to the novel environment we created. Humans are programmed not to maximise biological fitness *per se* but only to achieve goals that led to high fitness in ancestral environments (Symons, 1992). Modern societies consequently struggle with many problems related to the necessity to induce co-operative behaviour amongst huge numbers of people with whom individuals have no close genetic relatedness, and whom they mostly don't know very well. It doesn't come as a complete surprise, then, that finding the right balance between co-operation and competition is one of the main endeavours of modern societies (Ridley, 1993). Human nature is partly stalled, and therefore, partly maladapted, in its evolutionary transition from individual to group (Stearns, 2007).

Let us take the example of nepotism. Although the complex and fast-evolving modern culture can remain innovative only by filling responsible positions on the basis of individual qualifications and not on the basis of descent, favouritism toward relatives based upon that relationship, rather than on an objective evaluation of ability or suitability, is a phenomenon that is so widespread that it requires strong rules in all kinds of job assignment procedures to avoid or limit it (Bellow, 2003). The nepotistic drive is so strong that it has transcended even the genetically based groupism, and manifests itself as well in culturally defined group formation, in particular religious organisations and political parties (Van den Berghe, 1981).

INDIVIDUALISM IN MODERN SOCIETY

The concept of individualism arose in France after the French Revolution and originally had a pejorative connotation, being largely equated with egoism and selfishness. In Germany the term *individualismus* soon became synonymous with individuality (*individualität*), the notion of individual uniqueness, originality, and self-realisation. In the United States, the concept of individualism itself became, partly under the influence of the social-Darwinist evolutionary theories of Spencer and Sumner, associated with very positive moral qualities such as self-determination, self-reliance and the full development of the individual, and pride in personal freedom (Lukes, 1971).

A contemporary and more universalistic definition, taken from *http://en.wikipedia.org*, summarises very well the essence of the phenomenon of individualism and its opposition to all kinds or forms of groupism:

> *"Individualism is a term used to describe a moral, political, or social outlook that stresses human independence and the importance of individual self-reliance and liberty. Individualists promote the exercise of individual goals and desires. They oppose most external interference with an individual's choices – whether by society, the state, or any other group or institution. Individualism is therefore opposed to holism, collectivism, fascism, communalism, statism, totalitarianism, and communitarianism, which stress that*

> *communal, group, societal, racial, or national goals should take priority over individual goals."*

Nevertheless, there are cultural and historical differences in the interpretation of the meaning of the term individualism that continue to evoke, within many cultures, diverse ethical evaluations and appreciations. According to some people, ideologies, and political orientations, individualism continues to be associated with negatively valued attitudes and behavioural patterns, such as selfishness and egoism. But for others, it is valued in a very positive way and stands for highly esteemed moral values such as individual self-development and self-fulfilment. This is reflected in the strikingly sizeable sociological, political and philosophical literature on individualism that is continually added to in the major languages in the West (cf. Etzioni, 1997; Hastedt, 1998; Beauvois, 2005; Elliot and Lemert, 2005; Molénat, 2006; Bellah *et al.*, 2007).

In present-day sociology the view seems to predominate that modern culture is characterised by a gradual increase in individualistic attitudes and behaviour (e.g. Schmid, 1984). Countless survey investigations, such as the World Values Survey and the European Values Study (Halman, Inglehart, and Basanez, 2007) appear, indeed, to confirm that, in recent decades, attitudinal and behavioural changes in different domains of life show an increasing tendency for individuals to concentrate on themselves, to withdraw from social groups, institutions, and anything outside themselves (Glenn, 1987). This is revealed in a particularly striking way in the research about changes in family values, family relations and structures (Lesthaeghe, 2002; Hofferth, 2003; Karraker and Grochowski, 2005).

Undoubtedly, there are many factors in the development of modern societies that allow for or even encourage an increase of individualism: technological innovation, mobility, affluence, social security, independent jobs, exposure to media, small family size, rapid social change, open borders, and last but not least, the collapse of the communist regimes, which has increased economic competition and globalisation (Elliot and Lemert, 2005).

The current jubilant mood in some quarters about the benefits of the expanding economic competition in the post-communist, neo-liberal era may, from a somewhat longer-term perspective, prove to be very premature, as has been shown by the recent world wide banking crisis. The rising stress levels experienced by individuals in all societal domains associated with growing requirements for competitive performance might, in the long run, prove to be unsustainable because of negative side-effects. For example, in the domains of mental health or reproductive behaviour, there have been deleterious effects that could have been foreseen but were not seriously taken into consideration (e.g. Karasek *et al.*, 1990). But there may be many more negative and unsustainable side-effects that are for the moment underestimated or ignored, such as tighter social control and resulting conflicts, increasing social exclusion of the less intelligent, less energetic, less healthy, and less educated people, further environmental degradation, subreplacement fertility rates, and dysgenic developments.

Thanks to its increased socialisation and technological innovation, modern culture has considerably enhanced the opportunities for individual emancipation and self-actualisation. This has resulted not only in improved physical and mental performance, but may also have induced amongst many individuals the subjective feeling of heightened independence and boundlessness, and hence lay the grounds for an amplified individualism. The growing opportunities for individual emancipation in modern culture are only possible thanks to higher levels of socialisation and co-operation, and particularly thanks to the actions or influences of ever larger numbers of anonymous and unrelated people, far transgressing the boundaries of one's own kinship group, community or even nation. However, some aspects of individual emancipation and basic features of societal progress associated with the interdependence of individuals have evolved in opposite and conflicting directions: the pursuit of more individuality with the growth of human potential made possible by co-operation, contrasts with the quest for individualism that is associated with lower levels of co-operation.

The importance assigned to the person and increase in opportunities for individual development and emancipation in modernisation are fully justified, because in Western culture these are considered necessary conditions for wellbeing and happiness, and also because historically they have proven to enhance cultural creativity and social progress.

However, giving an absolutistic priority to individualistic endeavours, without taking into account the various between-individual and individual-societal interdependencies, is increasingly a maladaptive practice. The social protection systems based on mutual solidarity, that gradually developed and matured in the course of the twentieth century in Europe, Canada, and Australia also make possible some individualistic excesses. Free-riding, in any social domain – whether it be social welfare abuse, financial speculation, delinquency, environmental pollution, machismo, military aggression, to name only a few – is incompatible with the subtle interrelationships and interdependence between the needs of the individual and society at the national, international and even global level. Modern society requires a vision of humankind that, as Wielemans (1993) formulates it, goes '*voorbij het individu*' ('beyond the individual'), and also needs to promote structures that foster cooperation rather than competition and that attempt to channel competition to socially desirable ends (Singer, 1999).

Because we no longer live in the small communities of the Environment of Evolutionary Adaptedness (EEA) in which the human genomes and the current gene pool emerged, but in hugely populous and highly complex societies with many maladaptive characteristics, with respect to individual-societal interdependency we must humbly agree with Leigh (1990):

> *"Human intelligence has yet to design a society where free competition among the members works for the good of the whole."*

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CHAPTER 3

AGE VARIATION AND AGEISM

INTRODUCTION

The term age variation refers to the biological changes the individual undergoes from birth to death. Although this is a continuous process, characterised by several accelerations and decelerations in the individual life course, two major processes can be distinguished: (1) growth and developmental processes, and (2) ageing and senescent processes, which includes the dying process.

Growth and development consist of early processes that enhance the functional capacities of the individual, whilst senescence consists of later processes that diminish or have no effects on the ability to function (Kohn, 1978).

The biosocial interest in age variation resides in the fact that ontogenetic processes – growth/development as well as ageing/senescence – are both characterised by changes in appearance and performance over the individual's life course, as well as by inter-individual variation since individuals do not grow and age in the same way. Individual growth and ageing variation is not limited to the dichotomic normal vs. pathological development, but is a much broader phenomenon that, especially during the adolescent growth spurt and during senescence, has important social implications.

Moreover, the variation in inter-individual growth- and ageing in society displays additional group-related variations, according, for instance, to sex, race, and socio-economic status. Ageing processes are subject to substantial modifications by socio-cultural processes, and modern culture presents two major biosocial challenges. The first is in the domain of growth/development, namely the increasing discrepancy between biological and social maturation. The second can be found in the domain of ageing/senescence, namely the increasing discrepancy between biological ageing and social roles and organisation of elderly and the ageing process.

There are numerous philosophical and pragmatic definitions of the turning points that mark the end of the growth phase and start of the ageing process. There is some agreement that changes usually begin to manifest at reproductive maturity (cf. Arking, 1998) and that fundamental age-related changes in adulthood are deleterious, progressive, intrinsic, and, regardless of individual variation, universal (Strehler, 1982), and they eventually result in death.

In this chapter we will only briefly deal with the biosocial challenges of growth/development variation, and will instead focus more extensively upon ageing/senescence in modern culture.

GROWTH AND DEVELOPMENT

Growth is usually understood as the quantitative and qualitative biological changes experienced from the beginning of an individual's existence until reaching maturity or adulthood.

Some authors distinguish the concept of growth from the notion development – the first being limited to physical and physiological processes whilst the second also includes psychological processes (cf. Cameron, 2002). Others (e.g. Bogin, 2008) distinguish growth and development on the basis of the nature of the processes.

There are quite important between-individual differences in growth tempo. These differences are present at all ages, but their effects are most striking during puberty. For instance, the age range of the beginning of penis maturation among boys lies between ages 10.5 and 14.5 and the end of that maturation varies between ages 12.5 and 16.5. Some individuals finish their adolescent growth spurt at an age at which others still have yet to start it (Eveleth and Tanner, 1990; Preece, 1997; Malina *et al.*, 2004).

Since children and adolescents are usually grouped on the basis of their chronological age in school or after-school activities, this can give rise to problems for early and late maturing individuals, especially in puberty. Which normally or late-maturing boy does not remember frustrations because of his school grouping with early-maturing peers who were, physically, almost adults? The same applies, moreover, for the differences in maturation between the sexes: normally or late-maturing boys are surrounded by somewhat earlier maturing girls.

Between-individual differences in growth tempo are manifested physically, sexually, and mentally. Mental performances are statistically significantly correlated with physical maturing and development. Physically early maturing children perform somewhat better on intelligence tests than their less mature peers ($r = 0.25$), though differences in maturation tempo do not always cause differences in adult performance capacities (cf. Tanner, 1962; Waber *et al.*, 1985).

Emotionally, as well, early or late maturation can have quite important consequences. Early-maturing individuals often assume leadership roles, thanks to their stronger muscular development. Later, they often appear to be socially more stable and successful, although in the beginning of their early maturation many feel frustrated by their advanced morphological and physiological development. Late-maturing individuals are often troubled by doubts about their prospects for normal physical and sexual performance (cf. Tanner, 1989).

Consequently, in dealing with a heterogeneous school population educators need to be guided by insights into the individual and sexual differences in growth tempo, both inside and outside the school system. This is vital in order to avoid or prevent social conflicts or the emergence of individual psychological problems, especially among early- and late-maturing children (cf. Tanner, 1973).

Evolutionary background

The comparative study of the growth of primates has given us much insight into the specificity and explanation of the human growth pattern.

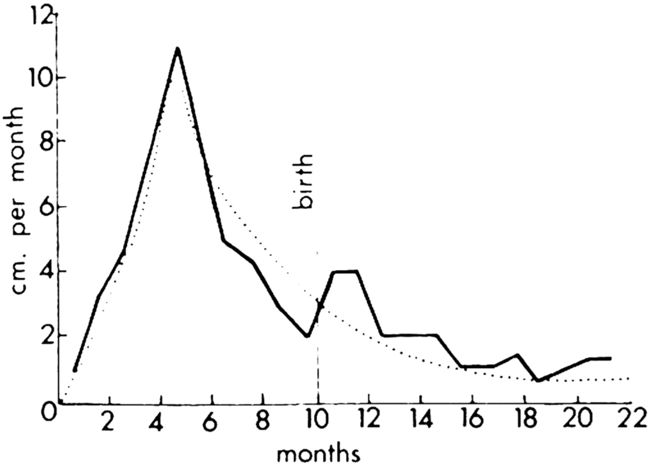

Figure 3.1. The growth velocity curve for height during the prenatal and early postnatal period. Source: D'Arcy Thompson, 1942, reproduced in Sinclair and Dangerfield, 1998.

Within the human foetus, tissues, organs and body parts grow differently. For body height, the prenatal growth distance curve[1] shows a slight sigmoid flexure;

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[1] Growth distance curve: represents the distance that is covered on the way to maturity (Tanner, 1978; Sinclair and Dangerfield, 1998).

the growth velocity curve[2] shows a sharp peak approximately in the middle of the prenatal period (Figure 3.1). The prominent decrease in growth velocity during the second half of pregnancy continues into the postnatal period, approximately until after the second year of life, and then stabilizes during infancy. In puberty, body growth accelerates again and subsequently gradually slows down until a standstill is reached.

During postnatal growth, the growth velocity curve for body height shows, *grosso modo*, four stages (Figure 3.2): (1) an initial pronounced decrease in growth velocity – the continuation of the prenatal growth deceleration; (2) a slightly decreasing growth velocity plateau until puberty, which is a period of virtually constant growth; (3) the pubertal growth acceleration; and (4) the final growth deceleration resulting in zero growth during adulthood.

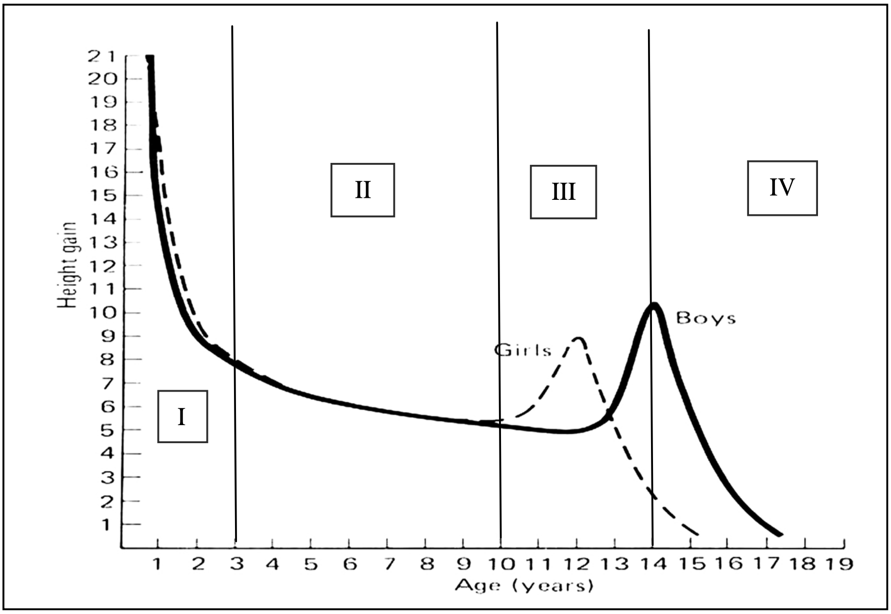

Figure 3.2. The four major stages in the human growth velocity curve for body height. Source: Tanner and Whitehouse, 1976,

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[2] Growth velocity curve: represents information on the degree to which a trait increases or decreases per unit of time (Tanner, 1978; Sinclair and Dangerfield, 1998).

From an evolutionary point of view the growth velocity plateau – that period between the steep growth reduction immediately after birth and the puberty growth spurt – is particularly interesting. This stage is called the primate plateau in postnatal growth because the maturation process in primates, particularly in humans, is characterised by an interruption of the growth acceleration in the time before adulthood. This postponement of maturation until puberty, controlled by the hypothalamus, relates to the long period the primate brain needs to become fully functional. During this period of pre-puberty maturation and socialisation the growing individual is still quite docile before it comes, from puberty onwards, into sexual competition with other adults. Ascending the primate phylogeny, this pre-pubertal primate plateau becomes ever longer; in the human it is the longest (Tanner, 1962).

Secular growth acceleration

Growth patterns can change over time. They can decelerate or accelerate and lead to a smaller or larger end result. Such changes over time are called secular growth changes, as they relate to a long-enduring process.

The contemporary industrial cultural phase is characterised by secular growth acceleration. This phenomenon occurs in all countries or regions where modern culture develops: this has been true for some 150 years in western countries, but recently also in modernising developing countries (cf. Meredith, 1974; Bodzsar and Susanne, 1998; Krawczynski *et al.*, 2003; Zhen-Wang and Cheng-Ye, 2005).

Secular growth acceleration is a socially important phenomenon. Growth patterns are related to morbidity and mortality trends. Secular growth patterns can serve as indicators of public health. Furthermore, secular growth acceleration can have important implications for economic conditions, for example for the manufacture of clothing and all sorts of appliances. Finally, it can also require legal and educational adaptations (Van Wieringen, 1978).

Secular growth acceleration includes a moving forward of the beginning and the end of the maturation and growth processes, and the achievement of a larger end result. Secular growth acceleration has been observed for body height, body weight, skeletal age, dental eruption, menarche/first ejaculation and other sexual maturation characteristics, several serological characteristics, and measured intelligence (the so-called Flynn-effect) (Tanner, 1962; Flynn, 1987).

The experience of secular growth acceleration in modern culture is quite spectacular. In some countries an increase in final stature of 13 centimetres has been observed, a rate of more than one centimetre per decade (Tanner, 1978; Van

Wieringen, 1978; Sinclair, 1991). Final body size is also reached at an earlier age: whereas in the nineteenth century young adults continued to grow until age 25, in the twentieth century adult body height was reached by age 20 (Sinclair and Dangerfield, 1998).

With regard to menacheal age, Berenberg (1975) has suggested a decrease from 17 years in the early nineteenth century to 12 years of age today – a decrease of five years. Probably this is an overestimation because the menarcheal age at the beginning of the industrialisation was in all probability retarded due to the bad living conditions in early capitalism. Nevertheless, it may be estimated that modernisation has decreased menarcheal age by some three years (cf. Hoshi and Kouchi, 1981; Herzog-Gutsch, 2002; Nichols *et al.*, 2006).

Whereas secular growth acceleration is taking off in many modernising developing countries, it seems to have weakened or even stopped in the upper social strata of the most advanced industrial countries (cf. Sinclair and Dangerfield, 1998; Tanner, 1978; Vercauteren and Susanne, 1985; Hauspie *et al.*, 1996; Krawczynski *et al.*, 2003; Zellner *et al.*, 2004). For instance, in Northern Europe, adult height has largely stabilised, and the age of menarche has settled at around 13 years, while weight continues to increase due to obesity (Cole, 2003). The problem of obesity is a quite generalised recent phenomenon in affluent countries, especially amongst members of the lower socio-economic strata, and is to be distinguished from modern secular growth acceleration (Wang and Lobstein, 2006; Marques-Vidal *et al.*, 2008).

The increasing gap between biological maturation and social maturity

In modern culture the prepubertal primate plateau has become insufficiently long. An adequate socialisation and learning period requires much more time than the biologically programmed period which corresponds *grosso modo* to the primary school age. The modal citizen in complex modern society needs a much longer learning period than the duration of primary school in order to be able to function well in modern culture. The needed social maturation time transcends by many years the biological (sexual) maturation period. Moreover, the time gap between biological and societal maturity is constantly increasing. On the one hand, biological maturity now comes earlier in the life course due to secular growth acceleration; on the other hand societal maturity takes more time due to increasing needs for schooling and training. This expanding gap between biological maturation and societal maturity is a typical example of the asynchronic biosocial development in modern culture, as biological-evolutionary adaptation is not fast enough to respond appropriately to cultural development. This asynchrony is a major cause of the generational conflicts between parents and their adolescent children in affluent modern societies, where various cultural, economic and technological innovations have vastly empowered and raised the awareness of adolescents but at the same time prolong their dependency (cf. Noom, 1999; Arnett, 2001; Cobb, 2006).

AGEING AND SENESCENCE

In everyday language, the term ‘individual ageing’ is generally used in two different senses: ‘ageing’ *sensu stricto* and ‘senescence’ (Rose, 1991). The first meaning merely relates to the chronological changes over the life course. Many age-related changes in adults have no unfavourable consequences for the vitality of the person. For example, hair graying is one of the more obvious and reliable signs of human ageing, but gray hair is by itself not deleterious (Arking, 1998). Wrinkles are a manifestation of ageing but their appearance is not necessarily associated with generalised regression. More often, the term ‘ageing’ is more often employed in the sense of ‘senescence’, describing the age-related changes that lead to the gradual and generalised regression of mental and physical functions which end in death (cf. Comfort, 1956; Finch, 1990). This is the meaning usually used in gerontology – the study of senescence and the elderly.

In evolutionary biology, ageing is studied in a somewhat broader way, namely in light of the Darwinian concept of fitness as it encapsulates a decrease of both age-specific chances of survival and age-specific fertility. A typical sociobiological definition of ageing is given by Rose (1991, 20):

> *“a persistent decline in the age-specific fitness components of an organism due to internal physiological deterioration”.*

Individual ageing associated with chronological changes over the life course and gradual and generalised regression of mental and physical functions and reproductive fitness is an inherent human feature which acquires new manifest forms in modern culture, since most members of the population can expect to live to an old age.

Senescent changes related to age are amongst the most important concerns reported in attitudinal surveys in which people are asked to report their subjective perception of their general health condition (Figure 3.3).

In adults, many morphological, physiological and psychological features gradually deteriorate with increasing age, albeit with individual differences in intensity and tempo. In addition, almost every major morphological structure or physiological function shows age-related pathologies, such as osteoporosis and arthritis in the skeletal system, atherosclerosis in the cardiovascular system, emphysema in the respiratory system, and Alzheimer's disease in the nervous system. Human ageing is, indeed, not the result of a single cause, but is instead an expression of numerous macroscopic and microscopic traits, many of which are deleterious (Cortopassi, 2002). Moreover, the multiple processes of ageing are, in the individual, not completely correlated (cf. Borkan and Norris, 1980).

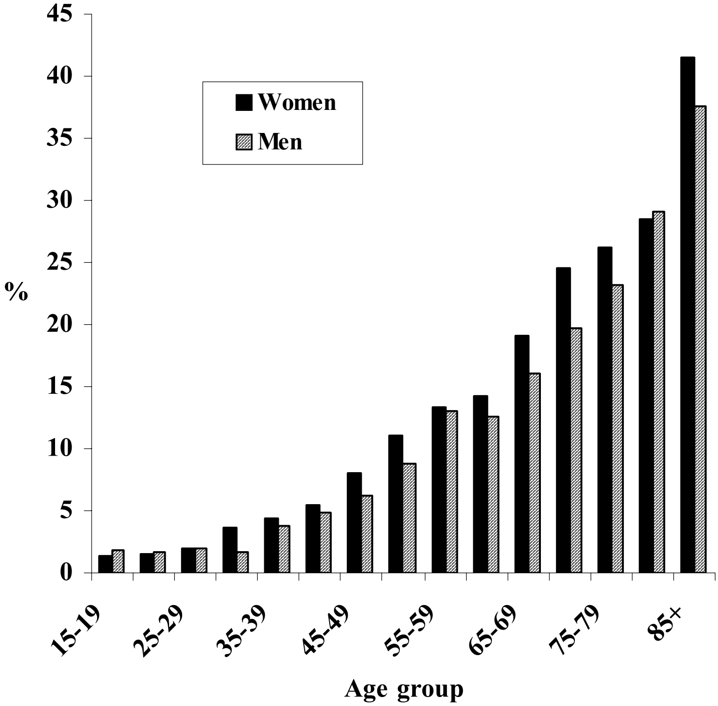

Figure 3.3. Women and men reporting bad or very bad health by age group, EU15 pooled data (ECHP, 1996–1998). Source: Avramov, 2003.

Ageing is partly independent of time. In other words, physiological ageing does not completely correlate with chronological ageing. In everyday life we see that people with the same chronological age often have very different levels of vim and vigour. Senescent processes show substantial within-population heterogeneity as individuals age at different rates. Multivariate statistical analyses of many physiological functions confirm the individual variation between chronological and biological ageing, but they are, on average, nevertheless very closely related (cf. Nakamura, 1991).

Notwithstanding the gradual decrease in physical and mental performance at advanced ages, in modern culture health conditions for the large majority of the elderly are satisfactory and do not impede professional or household activities or independent living. Health status is generally more favourable among the better educated (Schoeni *et al.*, 2001). Obviously, in terms of functionality a distinction needs to be made between the 'younger' old (say 60–70), the old-old (say 70–80) and the oldest old (say 80+) (cf. Garfein and Herzog, 1995). The oldest old are considered to be at the limits of their functional capacity (Baltes and Smith, 2003). They are the survivors of a life-long selection process (Perls *et al.*, 1993; Christensen *et al.*, 2008).

Cognitive abilities in older persons appear to be largely sufficient for performing everyday tasks and even jobs. The slightly lower abilities and the challenges induced by the introduction of new technologies are compensated by higher levels of experience, crystallised and social intelligence, and in many cases even by higher levels of work motivation. The capabilities of the aged are not only determined by their genetic endowment and familial predisposition for longevity (cf. Perls *et al.*, 2007), but also by their social environment (cf. Breeze *et al.*, 2004; Schoeni *et al.*, 2005), by environmental factors acting in early life (cf. Gluckman and Hanson, 2004), and by individual choices related to activity or passivity in shaping life in old age (Birren, 1985). Health, education and motivation are often more important determinants of physical and mental abilities over the lifespan than age as such. The main problem lies with the 'oldest old' where degenerative conditions related to senescence strike substantial proportions of that population (cf. Baltes and Smith, 2003; Schoenmaeckers, 2004; Guilley *et al.*, 2008).

In view of the complex interplay between chronological age and the regression of an individual's physical and mental functionality determining a universal threshold when one is to be considered 'elderly' is tricky. In modern culture the social division of labour and activities has become inextricably connected to legal definitions of the age at which work-related transitions must be made. Indeed, many think of being 'elderly' as a state of being based on the legal age of retirement. Many people today, however, stop working before the statutory retirement age, and some continue to be active many years into old age. Furthermore, thanks to the protective environment of modern culture both biological ageing and death are greatly postponed. There is an obvious and widening gap between biological ageing and the social perception and organisation of ageing and care for the elderly.

Evolutionary background

For a long time the deterioration associated with senescence was an unresolved question in gerontology. Numerous proximate ageing/senescence theories were produced and competed with each other, but didn't arrive at a satisfactory fundamental explanation of the ageing/senescence phenomenon because they failed to interpret the observed phenomena within the framework of evolution (Dobzhansky, 1973).

The beginnings of the present evolutionary insights into the origins of senescence have their roots in the work of Weismann (1885) who made a distinction between somatic and germ cells and explicitly identified senescence as a property of only somatic cells. Originally, among unicellular organisms life existed without mortality determined by senescence. Unicellular organisms reproduce through simple cell division, and are in principle immortal. This does not mean eternal survival but the capacity for unlimited cell division. Death was only the result of exogenous factors such as accidents, starvation, or predation. With the emergence of sexual reproduction more complex organisms emerged and life diversified, becoming strongly associated with a new cause of death: senescence. Hence, senescent mortality is the product of an evolutionary process that led to sex and complexity, and yes, to enhanced opportunities for adaptation and faster evolution.

In the course of the twentieth century Bidder (1932), Medawar (1952) and Williams (1957) contributed independently to develop the present evolutionary theory of senescence. Based on the earlier work of population geneticists and evolutionary theorists such as Norton (1928), Fisher (1930), and Haldane (1941), the evolutionary theory of senescence has in recent decades been mathematically formalised by Hamilton (1966) and Charlesworth (1980; 1994). An overview can be found in Rose (1991). Motivated by Hamilton's untimely death in 2000, Charlesworth (2000) traced in an enlightening paper the history of the modern evolutionary theory of senescence.

The evolutionary theory of senescence

The basic idea of the evolutionary theory of ageing is that ageing is caused by a decrease in the force of natural selection with increasing age (Medawar, 1952):

> *"...the force of natural selection weakens with increasing age – even in a theoretically immortal population, provided only that it is exposed to real hazards of mortality. If a genetic disaster ... happens late enough in individual life, its conse-*

> *quences may be completely unimportant. Even in such a crude and unqualified form, this dispensation may have a real bearing on the origin of innate deterioration with increasing age."*

The reason for this is the high risk of mortality that prevails in natural living conditions (Finch, 1990). Most species have very little chance of reaching the normal end of their existence through ageing. They are much more likely to be killed by an accident, an infection or a predator than to die by natural death (Klarsfeld *et al.*, 2000):

> *"Natural selection will tend to effectively eliminate mutations that cause defects early in life. In contrast, it may easily allow a mutation whose negative effects appear later in life, when an individual has already had most of its descendants. Such mutations will be able to spread in the population, through the generations, producing the appearance of ageing in the species."*

Therefore, selection against genes that manifest themselves early in the life course affect a larger number of individuals than selection against genes that reveal themselves at advanced age when the number of survivors and their reproductive capacity are smaller. Genes with late detrimental consequences can accumulate and result in senescence among individuals who live sufficiently long enough. Senescence is the inevitable result of the fact that selection has a greater impact on genes that affect survival or fertility only early in life than genes whose effects are manifest only late in life. Consequently, senescence is in most cases an artifact of domestication, or civilisation, much more than it is a product of nature.

Population genetic mechanisms of the evolution of senescence

Two kinds of theories that explain the evolution of ageing/senescence can be distinguished, namely adaptive and non-adaptive theories.

Adaptive theories see ageing/senescence as a favourable characteristic per se which is genetically programmed (cf. Mitteldorf, 2004; Goldschmith, 2006). The advantages preconceived by adaptive theories, hence, relate to the species, not the individual. As argued before, theories based on group selection are no longer considered valid. Genetic traits can spread in the gene pool only because they have advantages for the individual. Ageing/senescence is a phenomenon that diminishes the reproductive opportunities of an individual and cannot, consequently, be considered as a favourable characteristic in itself. Moreover, death due to senescence is such a rare phenomenon under natural living conditions that the chance of the occurrence of an adaptive ageing process is minimal (Kirkwood and Holliday, 1986).

Non-adaptive theories consider senescence as unfavourable, or at least as neutral. Consequently, the evolution of senescence must be explained in an indirect way (Rose, 1991).

Two evolutionary genetic models have been proposed to explain the origin and maintenance of senescence, mutation accumulation theory suggested by Medawar (1952), and antagonistic pleiotropy theory originally also suggested by Medawar but later more fully developed by Williams (1957). Both theories are based on the premise that populations pile up alleles that have harmful effects for older people but not for younger people. These theories are not mutually exclusive, and may become part of a future unified theory of ageing (Charlesworth, 2000).

Mutation accumulation theory suggests that the weakening of natural selection with increasing age *in se* suffices to explain the evolution of senescence (Medawar, 1952). If the force of natural selection declines with age, mutation-accumulation of age-specific deleterious genes occurs, leading to a gradual deterioration.

The antagonistic pleiotropy theory states that senescence is a side effect of the selection of other, favourable characteristics (Williams, 1957). Genes that confer a reproductive advantage early in life may have harmful effects in the post-reproductive period.

The essential difference between both theories is that the first presumes that genes with negative effects at higher age accumulate passively from one generation to another, whereas in the second theory favourable genes are maintained actively because of their positive effects at younger age.[3]

A special corollary of the antagonistic pleiotropy theory, the disposable soma theory developed by Kirkwood (1977; 2002), proposes that senescence is the result of the relative allocation of energy over time for physical maintenance and repair, and for reproduction. With a finite supply of resources, the body must compromise, and it is this compromise in allocating less energy to the repair function that causes the body gradually to deteriorate with age.

Recently Baudisch (2008) developed and mathematically formalised the view that tradeoffs must be made between spending energy on growth, repair

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[3] For examples of genes that are subject to antagonistic pleiotropy and mutation accumulation, see Crews (2003).

and maintenance on the one hand, and reproduction on the other, showing that senescence results from the cumulative impact of an imbalance between damage and repair.

In conclusion, earlier theories on the advantages of ageing and death for 'the good of the species' must be considered obsolete. Senescence is in no way a favourable characteristic resulting from a positive natural selection, neither for the individual nor for the species. Senescence and death, just as sex (see Chapter 4), may have as a consequence, but not as a cause, a favourable effect on the evolution of the species because it facilitates intergenerational succession and change (Kirkwood, 2002). The ultimate cause of ageing derives from the evolutionary imperative to pass on copies of our genes to the next generation. Klarsfeld and Rehav (2000, 75) pertinently pinpointed the relationship between ageing and natural selection:

> "*Ageing is an inescapable side effect of natural selection*."

Brain development and the evolution of the lifespan

The human lifespan[4] has substantially increased over the last few million years of evolution. Evolutionary theory explains this increase as based on the increase in brain size.

Sacher's (1959; 1978) comparative research on the lifespan of mammals has shown that maximal lifespan is allometrically[5] related to the adult brain weight. Judge and Carey (2000) have shown the same for a large number of primate species (Figure 3.4). This allometric relationship between brain development and lifespan can be explained as follows: larger brains allow a better control of the environment and result in a reduction of mortality; larger brains require a longer maturation time; a longer maturation requires in turn a larger birth interval, as well as a shift from a multiparous towards a monoparous gestation, both of which lead to a lower age-specific fertility. All of these features require a longer lifespan, on the one hand for the more intensive parental care of long-term needy youngsters, and on the other hand to allow for an overall fertility rate sufficient for generational replacement. A longer lifespan requires a larger investment in somatic maintenance and repair, in the end resulting in a postponement of senescent processes. In this respect, Baudisch (2008) introduced the concept of 'sustenance' as opposed to senescence.

In this context Carey and Judge (2001) have recently stressed the importance

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[4] Lifespan: refers to the typical length of time that an organism can be expected to live.

[5] Allometric growth: relative growth of a part of an organism in relation to the entire organism.

of intergenerational transfers of resources from old to young. Successful reproduction, indeed, often involves intergenerational transfers as well as fertility itself. Intergenerational transfers increase the fitness of the young (for instance, through improved health, skill, and competitive ability) and thus favour the presence of older individuals in a population. Lee (2003) even goes so far as to argue that the evolutionary theory of ageing has to be rethought because, in his view, it is transfers rather than births that shape senescence in social species.

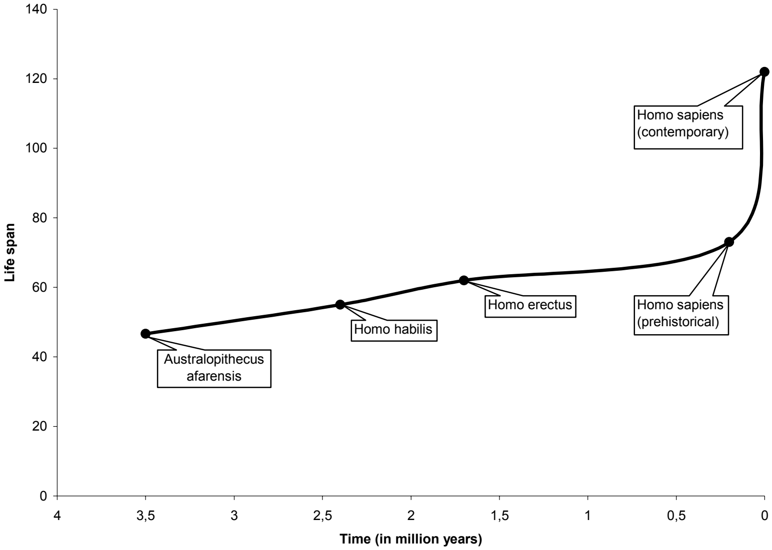

Figure 3.4. Predicted lifespan of different hominid species on the basis of body and brain size of various primate species. Source: Judge and Carey, 2000; Hammer and Foley, 1996.

Over the last few hundred thousand years, the increase in brain size and its co-evolving cultural development in the course of hominid evolution contributed significantly to the increase in human longevity (Carey, 2003; Baltes *et al.*, 2006). These two distinctive features of humans may be considered products of a co-evolutionary selection (Kaplan and Robson, 2002).

Longevity and ageing/senescence

Most biologists are of the view that the species-specific longevity of the human is genetically limited, but neither the population average, nor the individual maximum lifespan in the human are well known. Population scientists have developed ingenious mathematical methods to model the hypothetical potential lifetable for the human. For instance, assuming that the maximal potential lifespan of the human is 115 years and the modal potential lifespan 95 years, Duchêne and Wunsch (1986) calculated, on the basis of the equations of Gompertz and Weibull, a hypothetical potential life table with an average lifespan of 90.8 years for the Gompertz distribution and 91.6 years for the Weibull distribution. In a more recent publication, Manton and Stallard (1996) claim that the maximum individual longevity potential is more than 130 years and the average potential life expectancy 95 years. Based on the evolutionary theory of senescence, Carnes and Olshansky (1993; 2007) take a more ‘realist’ position that life expectancy is unlikely to exceed an average of 85 years (for men and women combined) unless it becomes possible to slow down the rate of ageing in a significant fraction of the population. When discussing three different theoretical approaches – the limited lifespan hypothesis, the compression-rectangularisation hypothesis and the limit distribution hypothesis – Wilmoth (1997; 2000) does not deny the existence of an ultimate limit, but concludes that the present available demographic data do not allow us to observe it. In his view, it is more important to examine how close we are now to approaching a biological limit to longevity than to inquire whether such a limit exists.

From a concave to a convex survival curve

In the course of the cultural evolution of human beings, going from the gathering/hunting stage to the industrial stage, the life table functions changed considerably. The most spectacular change concerns the survival curve that evolved during modernisation from a concave to a convex form (Figure 3.5), also called the rectangularisation of the survival curve (Comfort, 1956; 1964). Meanwhile, the complexity of this transition has resulted in the elaboration of three distinctive features of this rectangularisation: horizontalisation, verticalisation, and longevity extension. ‘Horizontalisation’ corresponds to how long a cohort can live; ‘verticalisation’ corresponds to how strongly ageing-related deaths are concentrated around the modal age at death; and ‘longevity extension’ corresponds to how far the survival curve exceeds the modal age at death (Cheung *et al.*, 2005).

Modernisation has been characterised by a revolutionary extension of life expectancy, whereby the causes of death have largely shifted from external (e.g. infectious diseases) to internal factors (e.g. senescent deterioration). More and more people are protected against or successfully treated for infectious diseases in old age and thus are exposed to senescence as a gradual and generalised regression that results in death.

In modern culture the average life expectancy at birth[6] has more than doubled over the past two centuries and it has roughly tripled over the course of human history (Wilmoth, 2000). Currently it continues to increase by approximately three months every year. In the most advanced regions of the world it amounts nowadays to 78 for men and 84 for women (Council of Europe, 2006). Also the maximum reported age at death has systematically been increasing (Wilmoth and Lundström, 1996). To date, the highest certified age reached so far is 122 years for Jeanne Calment, a woman in France, and Christian Mortensen, an American man of Danish origin, has been verified as 115 years old (Wikipedia, 2009).

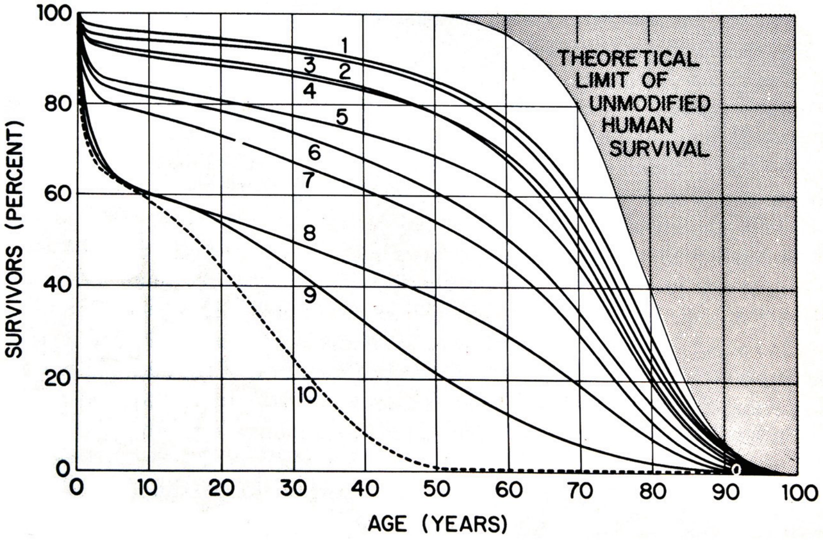

Figure 3.5. The transition from a concave to a convex survivor curve during modernization. Source: Comfort, 1956; 1979.
Legend: (1) New Zealand, 1934–1938; (2) US Whites 1939–1941; (3) US Whites 1929–1931; (4) England and Wales 1930–1932; (5) Italy 1930–1932; (6) US Whites 1900–1902; (7) Japan 1926–1930; (8) Mexico 1930; (9) British India 1921–1930; (10): Stone Man.

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[6] Life expectancy is the average number of years of life remaining at a given age, i.e. the averageexpected lifespan of an individual.

The question whether the increase in life expectancy to date has been accompanied by a similar increase in years of good health, or perhaps to the contrary is associated with an increase in health impairments and disease, is a matter of debate within the scientific community. Some are of the opinion that the increase in life expectancy has been accompanied by an increase in frailty, comorbility, or even disability for people at higher ages (e.g. Fried *et al.*, 2004; Westendorp, 2006), and that the years have been gained at the expense of quality of life (e.g. Kramer, 1980; Olshansky *et al.*, 1991). Others are of the opposite view and maintain that senescent morbidity has been compressed into the last years of life (e.g. Dupâquier, 1997; Fries, 1989; 2003; Robine *et al.*, 2008). Up-to-date research provides arguments for both views, but the social reality appears to be less dichotomous and reflects a combination of processes that are affecting the heterogeneous population of elderly people in a variety of ways (e.g. Cai and Lubitz, 2007; Lutz and Scherbov, 2003). Robine and Michel (2004) distinguish four elements:

- An increase in the survival rates of sick persons, resulting in an expansion of morbidity;
- Control of the progression of chronic diseases, resulting in a decrease in mortality but an increase in disability;
- Improvement in the health of new cohorts of elderly people, resulting in a compression of morbidity;
- The emergence of very old and frail elderly, resulting in a new expansion of morbidity.

Indeed, the increase in life expectancy in the course of the twentieth century was accompanied by a compression of morbidity to higher ages, resulting in a double trend: better health and increasing capabilities of the younger aged and an increasing frailty of the oldest old who are no longer suffering or dying from infectious diseases but are confronted with the degenerative processes of senescence at very high age. At the same time large proportions of the new generations of elderly people have benefited from higher levels of education acquired in youth, enjoyed the advantages of the modern culture of affluence, and experienced less demanding or debilitating living conditions during their life course. Whereas the protective effects of modern culture produced a selective relaxation, allowing people with weaker genetic resistance to environmental hazards to survive, they also allowed them to experience a healthy life and to be active in society.

Although the spectacular increase in life expectancy has shown a tendency to slow down or even stagnate in very advanced countries (cf. Janssen *et al.*, 2003; Nusselder and Mackenbach, 2000), it can be expected that life expectancy will continue to increase until the species-specific lifespan has been reached. While there is general consensus in the literature that the future holds further gains in longevity for the human species, it is less clear at what pace the trend will evolve and how closely we have approached the ultimate human longevity limit (Wilmoth, 1997; Arking *et al.*, 2004). On the one hand, it may be argued that due to unhealthy behavioural practices (such as smoking, exposure to environmental pollution, inactivity, risk-taking behaviour and bad nutrition), the 'natural' boundary probably will not be reached in the near future (cf. Olshansky *et al.*, 2005). There is, nevertheless, still room for a substantial rise in life expectancy by promoting healthier living and working environments and healthier lifestyles. On the other hand, it may be assumed that if new scientific discoveries occur, either via direct genetic manipulation or indirect (physiological) interventions that could slow down the senescence process and decrease mortality, life expectancy could be considerably boosted.

Strategies that aim at increasing life expectancy up to the species-specific potential lifespan are called 'curve-squaring strategies' (Gordon *et al.*, 1979). However, such a goal requires some specification. The species-specific lifespan is, as a matter of fact, a population characteristic with a maximum and an average, and consequently shows substantial between-individual variation. Moreover, as argued before, the maximum and average species-specific lifespan of humans are not well known.

The further increase of life expectancy ('curve-squaring') is to be evaluated as a positive strategy as long as the results do not decrease quality of life. The rectangularisation or 'curve-squaring'-strategy, as a matter of fact, not only enhances the opportunity of valorising the genetic potentials present in the gene pool of a population; it also promotes the emancipation and happiness of individuals, allowing them to complete every stage of their ontogenetic development. This strategy forms the basis for people to make an optimal contribution to society.

Several methods have been proposed or are being explored to further increase human life expectancy. First of all, life expectancy may be enhanced through a continued gradual progress in the fight against the most important contemporary causes of mortality, namely heart and vascular diseases and cancer (cf. Hayflick, 1996).

If the causes of mortality and morbidity associated with modern lifestyles – such as traffic accidents, drug and alcohol abuse, smoking, excessive calory intake, and inactivity – could be controlled by means of adequate behavioural changes, both life expectancy and quality of life would be improved in many respects. Though a technically relatively easy strategy, such behavioural changes are probably difficult to achieve. It will in any case require enormous efforts in the domains of education and ethics to change our present value patterns that are so strongly focussed on the satisfaction of short-term needs.

A means that was strongly proposed by Walford (1984) and that is based on the research of McCay *et al.* (1935) and many others on rodents, and recently also on some primates (Roth *et al.*, 2002), concerns the life-prolonging effects of limited caloric intake. The explanation for this remarkable phenomenon is that adaptation to food shortage leads to a postponement of all ontogenetic life phases whereby senescence begins later and the total lifespan is increased. But it is likely this method will not enjoy great popularity, given the importance most people assign to consumption in their quality of life (Hayflick, 1996).

More success may be expected from the use of pharmacological substances such as anti-oxidant vitamins and free-radical scavengers that slow down the onset of some age-associated diseases and/or retard normal physiological deterioration, as well as several types of biological interventions such as hormone therapy, proteins to control body weight, and the targeted application of various cell-signaling molecules which might allow for the modulation of specific functions in particular cells, such as immunological functions (Arking, 1998).

From curve squaring to life extension?

Whilst modernisation has succeeded mainly in rectangularising or curve-squaring the survival curve (i.e. more people reach the biological potential lifespan), so far not much progress has been made in the field of life-extending technologies, which could move the current species-specific lifespan to a higher age. It is, however, possible that in this or the next century bio-medical inventions will enable the extension of longevity beyond the present species-specific lifespan, in addition to further increasing the number of people who survive up to the maximum lifespan. In Figure 3.6 we see illustrated the possible effects of curve-squaring and of life extension. In both cases the aged population would increase far above the numbers that are now expected. However, in the latter scenario a considerable proportion of people would survive to a much higher age than is possible today.

The desire to extend human longevity beyond its current natural boundary will have to be carefully matched, first, against risks of poor quality of life at very high ages or worse, the prolongation of the dying process in pain and discomfort, and, second, against its meaningfulness with respect to the length of the other stages of the ontogenetic process, in particular the maturation phase.

Due to the individual drive to selfrealisation and self-preservation, it is understandable that people would want to live eternally. The belief in a hereafter in many religions is an eloquent expression of this desire. However, it can be expected in the modern world that life-extending aspirations are no longer concentrated on the hereafter; today modern science is advancing toward this goal through gene manipulation whilst at the same time advances in scientific knowledge render smaller and smaller the probability of the existence of life after death.

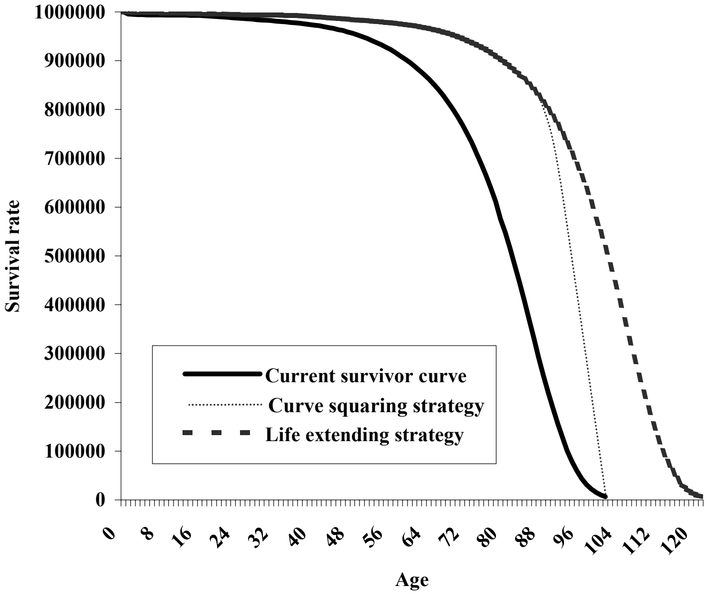

Figure 3.6. The effects of curve-squaring and life-extending strategies on the lifespan

At present, from an individual-transcending (= population) or evolutionary point of view, the goals of extending life beyond the maximal or modal species-specific lifespan appears to be quite problematic.

The potential lifespan of human beings is a biological feature that has been selected on the basis of the long maturation time of offspring and relatively low human fecundity. As long as the duration of human biological maturation does not increase or other reproductive traits require a longer reproductive life phase, an additional prolongation of the potential lifespan is redundant, a useless investment (cf. Hayflick, 2000; Perls and Fretts, 2001).

In the present ethical climate, individual values largely predominate over social or population values. If in the future biomedical science discovers effective means to lengthen the species-specific human lifespan, there can be little doubt that many individuals would be eager to take advantage of technological innovations to prolong their lifespan, unless social norms and rules are developed to limit or prohibit such practices, as is now the case for human cloning.

What are the probabilities and possibilities of extending the species-specific lifespan? Most experts are quite sceptical about this matter. To be succesful, one would need to be able either to act directly on the DNA – genetic engineering – in order to enhance the repair capacity, or to prevent or compensate cellular or physiological degradation through replacement therapies – euphenic engineering. A third way could consist of intensifying natural selection for longer lifespan – evolutionary eugenic engineering – but as is well known this is a long-term strategy requiring differential reproduction, two elements that don't fit very well with the current spirit of time. One could also try to apply the principle of the lifespan lengthening effect of postponement of reproduction. Whether this mechanism is applicable in the human is not known, but theoretically it can be expected that the postponement of giving birth to higher ages might favour selection for better soma maintenance mechanisms over the generations, and in the long term, might favour genes for further lifespan expansion (Klarsfeld and Behav, 2000).

However, it is very probable that humans will – in the long run – succeed in prolonging the lifespan. Strategies for extending the lifespan will have to focus on the genetic mechanisms underlying the senescence processes. Rose and Mueller (1998) conclude:

> *"The immediate future of human evolution is unlikely to see extensive genetic increases in lifespan, given the experimental data on rates of change in lifespan with experimental populations. But, evolutionary research suggests that there are few fundamental biological barriers to the extension of human lifespan, only practical barriers."*

Demographic implications of ageing

Population ageing relates to changes in the age composition of the population, particularly the relative increase of the older age groups in the population age pyramid. Population ageing can be the result of population 'dejuvenation' and/or population 'greying'. The first is caused by a decrease in the proportion of younger age groups in the population, for instance as a consequence of decreasing fertility, which shrinks the age groups at the bottom of the age pyramid. The second is caused by an increase in the proportion of the older age groups – a swelling of the age groups at the top of the age pyramid (Figure 3.7). Population greying is not necessarily the result of a longer individual lifespan although it is usually associated with it. Population ageing can be reinforced when larger birth cohorts reach the age categories that are conventionally considered to be elderly or seniors, as will soon be the case with the post-World War Two 'baby boom' generation.

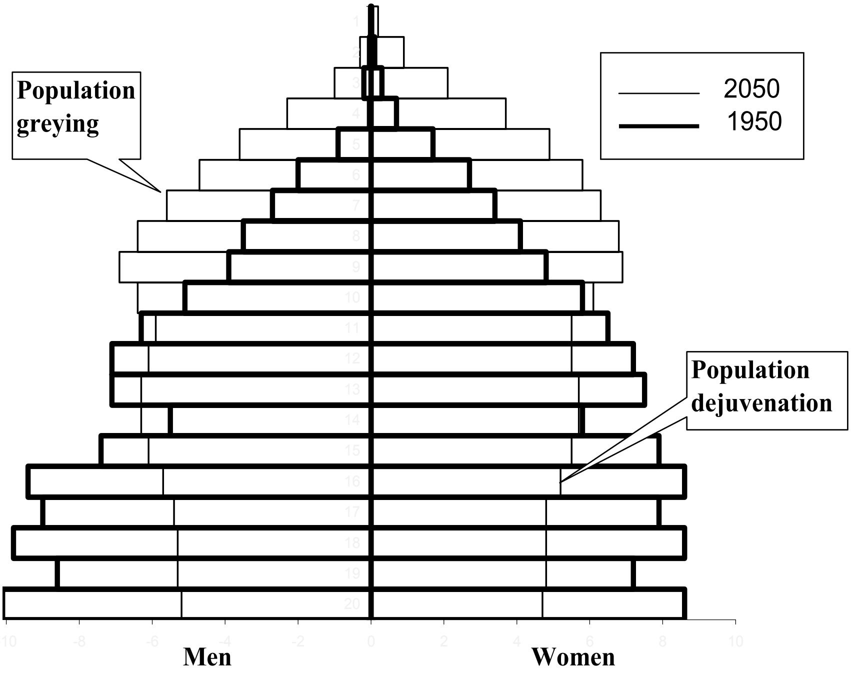

Figure 3.7. The European age pyramid in 1950 and the United Nations medium scenario projection for 2050. Source: Population Division (2008).

Although, up to the present day, most population ageing has arisen from low fertility, this issue is addressed here because conceptually it is an important dimension of the phenomena of age variation and ageism.

Population greying

The process of the modern demographic transition with its gradual changes from high to relatively low levels of fertility and mortality is at the root of the substantial changes of the age structure in the direction of population ageing.

Since the completion of the modern demographic transition in the first part of the twentieth century, life expectancy in the old industrial world has risen above 70 years. This increase is conditioned mainly by mortality improvements in higher age groups. According to stable population models, when fertility remains around the replacement level (2.1 born children per woman) for a long period of time and life expectancy continues to grow due to adult and old age mortality gains, the development of mortality becomes the driving force of the ageing process. The new phase of population ageing – ageing at the top of the age pyramid – leads to a pronounced increase in the numbers and proportions of the elderly (Myers, 1983).

Today all modernising societies are greying at an accelerating pace. Populations aged 65 and over are growing both numerically and as a share of the total population. The increase of the oldest old is most remarkable.

The future of ageing in each industrial country depends on its demographic past, and on the future trends in fertility, mortality and migration. According to the United Nations medium variant population prospects (United Nations, 2008), by 2050 the population of those 60 years of age and over will reach 28 percent in North America, 30 percent in Northern Europe, 35 percent in Western Europe, 38 percent in Southern Europe, and 44 percent in Japan (Figure 3.8). These figures may be underestimated, because life expectancy could advance more rapidly and fertility might remain below the replacement level. The decrease in mortality at higher ages might go on until the species-specific lifespan has been reached.

By 2050, the oldest old (those aged 80 years or over) are, according to the United Nations medium variant scenario, estimated to account for 7 percent in Eastern Europe, 9 percent in Northern Europe, some 12 percent in Southern and Western Europe, 8 percent in North America and 16 percent in Japan, but again these figures may be underestimated (Figure 3.9).

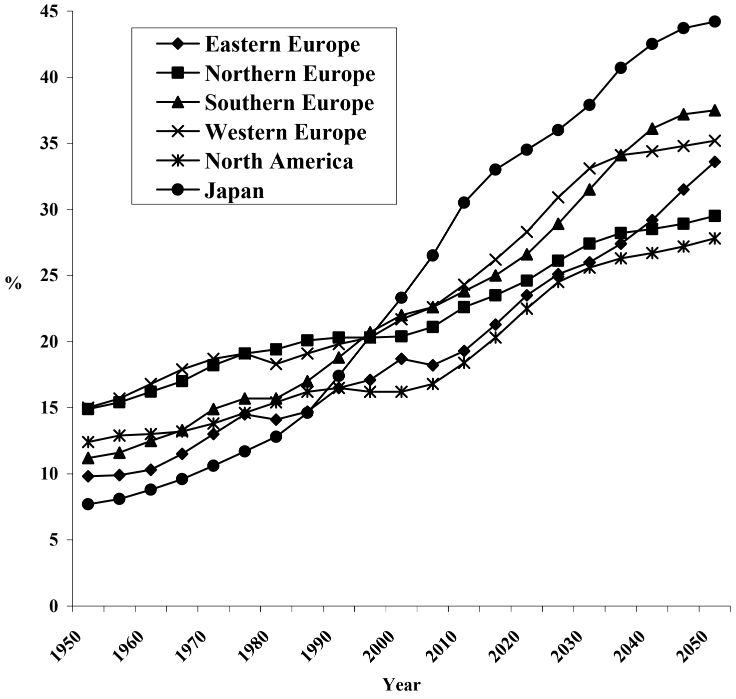

Figure 3.8. Population aged 60+, United Nations medium variant scenario, 1950–2050. Source: Population Division (2008).

Population dejuvenation

In the coming decades Europe and North America will experience a temporary acceleration of population greying. The big ageing wave will start around 2010 when the post-war 'baby boom' cohorts will begin reaching the age of retirement and the 'baby bust' cohorts of the 1970s and following years will reach middle age. The current 'curve squaring' efforts are generally expected to modestly contribute to further greying in the course of this century (Olshansky *et al.*, 2001).

Current trends in the population ageing process are the result not only of population greying, but also of population dejuvenation. Recent trends in fertility – its stabilisation at a below replacement level in almost all developed countries – will accentuate the population ageing process, giving the age pyramid a bulb-shape form, and leading to a gradual and systematic population decline. If in the future fertility could be redressed up to the intergenerational replacement level, it would, in the short run, increase the total dependency load, but in the long term, it would undoubtedly somewhat relieve the ageing load. However, the stationary post-transitional demographic regime inevitably will include a much larger proportion of elderly people – a demographic reality to which modern societies will have to adapt.

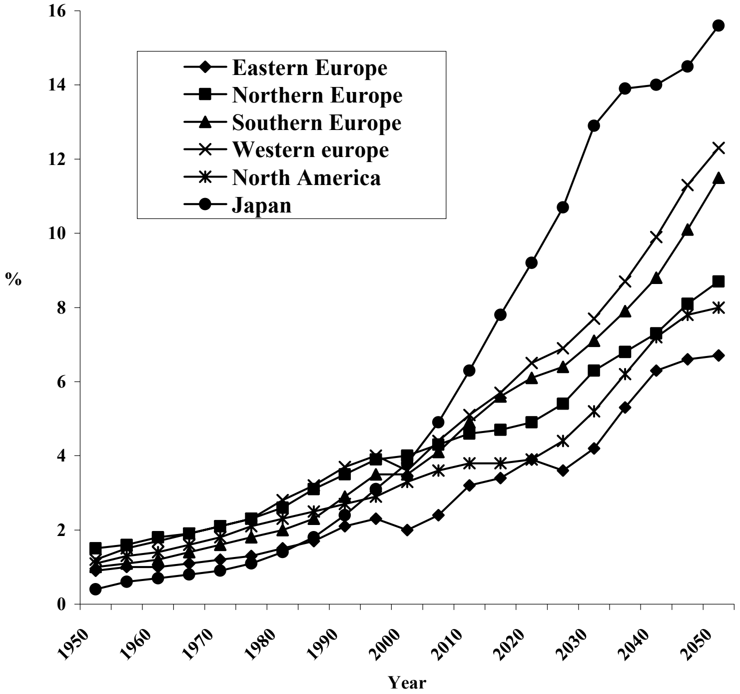

Figure 3.9. Population aged 80+, United Nations medium variant scenario, 1950–2050. Source: Population Division (2008).

Societal implications of individual and population ageing

The likelihood of substantial increases in average lifespan and the potential for extreme longevity raise a host of societal issues: huge increases in the number of old and very old persons, massive growth in health expenditures for the elderly, depletion of social security and pension resources, decreasing quality of life, and intensifying intergenerational tensions (Louria, 2005).

Attitudinal ambiguities

The current stage of the demographic transition with its changes in the age composition of the population, elicits a variety of philosophical and political views.

Many observers are or were of the opinion that the current stage of the demographic transition will lead to a societal catastrophe – the ‘doomsday scenario’. Some decades ago, when the population growth ideology was still prevailing in various quarters, renowned authors were warning against the devastating social and psychological consequences of an ageing society. The French pronatalist demographer Alfred Sauvy formulated it eloquently, albeit controversially, in this way:

> *“de vieilles gens qui ruminent de vieilles idées dans de vieilles chaumières”*[7]

However, as early as 1954, the renowned American demographer F.W. Notestein stated:

> *“Viewed as a whole the problem of ageing is no problem at all. It is only the pessimistic way of looking at a great triumph of civilisation.”*

He was obviously reacting against the doomsday scenarios about the unfavourable societal consequences of population ageing which had become so widespread but which contain, in several respects, fundamental ambiguities. It is, indeed, remarkable that this achievement, for which people have strived for so long and so hard, provokes so many negative responses.

The idea has not disappeared completely that societies with an older age structure will be less dynamic and creative, will be at a disadvantage in international competition, and will eventually perish as a consequence of the burden of a languid and conservative gerontocracy. But in the most recent literature such views are contradicted by more positive appreciations of the potential abilities and performances of people in the later stages of their life course (e.g. Schoenmaeckers *et al.*, 2006). Improved knowledge about the biological, psychological and social capacities of older people and the changing profile of the members of the newer old generations – who are better educated, healthier and wealthier than their predecessors – undoubtedly are factors which contribute to this changing perspective. Probably, the inevitability of the ageing

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[7] “*old people who ruminate old ideas in old dwellings*” (author’s translation)

process in modern culture is also inciting more and more people to think about ageing in terms of a challenge rather than in terms of a problem.

However, the current views on ageing – whether it is considered at the individual, the family or the societal level – are not without fundamental ambiguities.

For individuals a long life is an ideal which is highly desired and aimed for. However, few wish for longevity regardless of the quality of life at high age.

At the family level, most people want to see their parents and close kin live long and are prepared to provide care for them when needed (cf. Grundy, 2008; De Jong Gierveld and Dykstra, 2008; Tomassini *et al.*, 2008). However, modern living circumstances, typically characterised by fewer siblings, female participation in the paid labour market and geographical mobility and migration, have eroded many extended families or family care networks, especially making multigenerational co-residence uncommon. Also, in an increasing number of cases, care thresholds are being reached. When degenerative diseases and ailments last for years, the burden of dependency becomes disruptive for the entire family.

At the societal level, population ageing is a very important concern for many policy makers. This is not surprising since ageing costs. It costs in terms of public pension schemes, satisfying the new care needs of older people, and improving health services so that they can meet the growing demand arising from the ageing of the population.

However, the concern about the cost of ageing must be qualified. Surveys shows that in the domain of care many elderly are rather care providers than care receivers. They give instrumental, financial and emotional support to their children and they have an important share in childcare. Moreover, many older persons provide care to other elderly (cf. Jacobs *et al.*, 2004).

Nevertheless, the progress made in improving the living conditions of older people has required a major public involvement. There can be no doubt that modern societies will have to further adapt the current system of redistribution of resources, social institutions and services to the changing age structure of their populations with considerable innovation. Population ageing is not the only demographic change modern societies are experiencing. It occurs concomitantly with changes in relational and reproductive behaviour, family structures, women's participation in paid labour, and an increase in the number of simultaneously living generations, etc. And all this occurs parallel to and in interaction with rapid cultural, socio-economic and technological changes. The demographic dynamics related to ageing, consequently, has to be considered and dealt with in a broad societal context, taking into account individual, familial, social, economic, cultural and bio-medical changes.

The expected increasing elderly dependency burden

Retirement and survival pensions constitute one of the most important sources of expenditures in the social security systems of modern societies. In most European countries and other highly developed regions of the world these expenditures absorb a considerable part of the total social security budget.

Since the pension systems in most countries are still largely based on the direct transfer of resources from social security contributors to pension receivers, many scholars and policy makers expect social security to become under significant pressure as a consequence of the imminent population ageing wave (cf. Gonnot *et al.*, 1995; Harding and Gupta, 2007; Kemp *et al.*, 2008). Others, however, hold the view that future economic growth will, thanks to improved technologies and/or the discovery of new cheap sources of energy, be able to generate sufficient resources to finance the social security needs of the growing numbers and proportions of the elderly (cf. Schulz, 1999).

Many demographic-economic simulation studies, applying a multi-scenario approach (e.g. Wardenier *et al.*, 1990; Harding and Gupta, 2007; Alho *et al.*, 2008; Rausch, 2009), show that the increasing social security expenses to be expected as a consequence of the forthcoming ageing wave could be absorbed by a reasonable rate of economic growth, combined with some other favourable socio-economic developments.

This effect mainly appears to be the result of the counterbalancing action of compensatory and interacting social processes resulting from the projected demographic changes, such as a decrease in unemployment, an increase in female labour market participation, and decreasing expenses for child subsidies and education. However, this precarious balance can easily be disrupted by factors such as a more pronounced increase in longevity, the attainment of particularly costly lifestyles, a less successful employment policy, a less well-managed public debts policy, and increasing economic competition under pressure from globalisation and international capitalism.

Low fertility/high longevity scenarios show that, in the absence of significant economic growth or adapted policies, either factor will have to be increased up to unbearable levels or pensions will have to lowered to unacceptable levels (Busch, 1988), thus creating considerable intergenerational inequities.

The expected growing need for health and welfare care

Although one should beware of the 'ontogenetic fallacy' that old equals sick, it is a fact that old people show, on average, much higher levels of morbidity and lower levels of functional capacity. These facts, however, have to be qualified. The health profile of the elderly shows a considerable heterogeneity over time, including between individuals, between younger old and older old, and between income and educational groups. Moreover, the health conditions of the elderly are strongly subject to plasticity in the sense that living conditions and health strategies experienced throughout the life course can influence quite considerably the ageing process, particularly health and functional capacity in the advanced stages of life.

Most elderly, more particularly those between 60 and 80, are fit, able to live independently, and manage the tasks of daily living (cf. Guilley *et al.*, 2008). Illness is not a universal characteristic of later life, not even in the oldest age group (Dooghe, 1991; Victor, 2005). International surveys estimate the proportion of people aged 65 and over who are severely incapacitated to lie between 10 and 20 percent, depending on the classification criteria used. Those figures, however, vary considerably within the group of the elderly, particularly with age. Whereas the prevalence of disability-provoking illness or handicaps amongst the younger old (60–80) is often less than the above-mentioned figures it increases substantially at very high age (80+) (Baltes and Smith, 2003). The oldest old, moreover, are characterised by high frequencies of a number of chronic degenerative conditions, such as dementia, which require permanent intensive care (cf. Suthers *et al.*, 2003). Due to progress in medical technology, both longevity and the terminal phase of life are prolonged, resulting in increasing numbers of very dependent 'marginal survivors' – very ill disabled people who are shielded from death (Verbrugge, 1984).

Another perspective on the problem of the aged can be found in the consideration of the development of absolute numbers. Medium variant population projections (e.g. Prinz and Lutz, 1993; Giannakouris, 2008; United Nations, 2008) show that by 2050 the population of those 60 and over will almost double and the number of very old (80+) will more than quadruple. These figures can vary a great deal, obviously according to more extreme scenario variants.

The implications for health and welfare care are obvious. Given the link between age, morbidity and disability distribution, particularly during the terminal period of life, the health and welfare care system might come under considerably increased pressure (OECD, 2000).

The health and welfare care budget will not only have to increase owing to the larger absolute numbers of dependent elderly, particularly oldest old, but also because health and welfare care probably will be performed less and less by close family members. In recent decades, the health and welfare care system has already grown as a result of its own intrinsic development and maturation, involving not only expensive technological innovations, but also the emergence of health and welfare care professionals and services. All this has to be set against shrinking human resources as a consequence of population dejuvenation and greying.

Labour shortage

It is generally believed that strong population ageing, due either to low fertility or high longevity or both, affects many spheres of economic life: productivity, savings, investments, consumer expenditures, income level and distribution, wealth, etc. (cf. Chaloupek *et al.*, 1988; McDonald and Kippen, 2004).

An essential underlying factor in this respect is the supply of labour. Since labour availability is so strongly dependent on the phases of the life cycle each individual goes through, it is self-evident that the labour supply can be strongly influenced by changes in population age composition (Figure 3.10). It is tempting to derive the conclusion from this fact that ageing societies will be confronted with shortages of labour, with varying consequences for different sectors of the economy, such as decreasing productivity and other negative economic impacts (cf. McMillan and Baesel, 1990). Demographic projections or scenario exercises (e.g. Prinz and Lutz, 1993; Giannakouris, 2008; United Nations, 2008) show that the proportion of the population of working age will indeed decrease in the coming decades. However, the conclusion that this would lead inevitably to a labour shortage has to be qualified, among other things taking into account the currently unused labour supply of the unemployed, the early retired, non-working women, and the labour reserve of the healthy and well-educated younger elderly.

Intergenerational relations

Family members who, in the past, provided care for relatives, are increasingly employed outside the home, and there is a thinning down of the number of people per household due to a variety of social and demographic changes. Lower fertility results not only in fewer children per family, but also in a smaller number of relatives (siblings, cousins, etc.) in each household. Higher frequencies of separation and divorce in combination with existing sex differentials in longevity, also contribute to a higher prevalence of smaller, often single person, households (Hagestad, 1991). The increasing instance of female employment at higher ages makes women less available for caring functions in the later stages of their life course. Furthermore, geographic and social mobility, leading to lower degrees of co-residence or neighbourhood community spirit, also contributes to a smaller chance of modern people being in daily contact with close relatives.

The size of personal support networks that include both relatives and friends is more likely to decrease than increase with time and age. Very old people, especially those with disabilities that prevent them from leaving their house freely, form a group who may lack friends or close ties. Those separated from close relatives by migration are particularly vulnerable to isolation or lack of support. Those who need help and live alone are more likely to receive this help from formal services than are those with a co-resident. There is some evidence that living alone may be associated with various health-related disadvantages, functional decline, and higher risk of anxiety and depression. But there is also a selection effect: those with serious health problems are no longer able to live alone (Grundy, 2006).

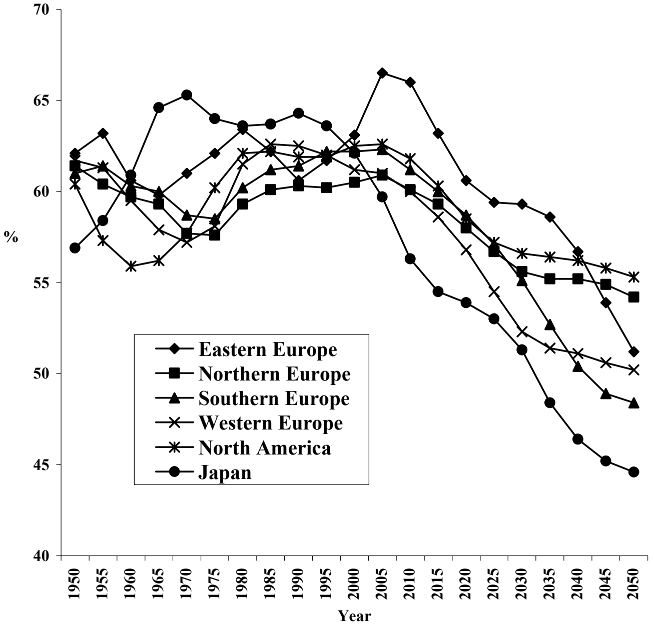

Figure 3.10. Population aged 15–59, United Nations medium variant scenario, 1950–2050. Source: Population Division (2008).

It is also important to note that socio-cultural changes such as postmaterialism, and individualisation, secularisation, and socialisation processes tend to make people less inclined to accept long-term caring responsibilities for the elderly.

As a consequence of the demographic, socio-economic and socio-cultural changes, the decline in family-provided assistance – traditionally the most important form of solidarity – is likely to be the main future change in intergenerational relations. The solution to intergenerational problems related to ageing will probably have to derive from a combination of three possibilities: reducing the needs of the elderly, exploiting the increased free time of mature adults and the young elderly, and augmenting (or improving the efficiency of) public intervention (De Santis, 2007).

Social differentials in longevity

The first source of differential mortality still can be found in individual differences. Human populations show a substantial heterogeneity in individual variation in senescent processes and mortality. Notwithstanding the increasing uniformity in living conditions and opportunities, important between-individual differences in mortality continue to exist. Despite its transition from a concave to a convex form, the survivor curve hasn't reached a strict rectangular form, which would imply that all individuals in a population should pass away at the same age.

In addition to the individual and age-related mortality differences, modern societies are still confronted with substantial group differences in morbidity and mortality. Apart from sex, ethnic and race differences which will be discussed respectively in Chapters 4 and 8, relatively important socio-economic differentials in morbidity and mortality continue to be observed, despite the reduction of historic socially related environmental differences. The social differentials in morbidity and mortality are correlated not only to causes that can be presumed to be related to occupational specificities, but also to other factors which point to a complex aetiology. In all probability, in addition to several environmental factors, social sortment processes are involved in the persistence of social differentials in mortality. These matters will be dealt with in Chapter 7.

DEATH

Although it might, at first sight, be surprising – some readers might even consider it out of place – this chapter not only deals with senescence but also with mortality. After all, most elderly are not in a terminal life stage at all. Nevertheless, senescence and mortality are closely connected, and from a methodological point of view it is appropriate to discuss them together. Senescence is often measured by means of mortality rates.

Death marks the end of the autonomous and integrated function of a living being. Death is nowadays medically defined as brain death. In earlier days, breathing one’s last, and later the stopping of the heartbeat was considered to be the sign of death. However, both respiration and heart functions can be artificially revived and maintained, even after termination of the main brain functions. In fact, the cessation of brain functions seldom forms the direct cause of death. Usually, another organ or organ system fails without which the brain cannot continue to function.

The biological meaning of death

From an individual point of view, death can hardly be considered an advantage. It is, consequently, not surprising that the overwhelming majority of humans are endowed with a strong drive toward survival and try to prolong their life as long as possible. Probably the ancient belief in or hope for eternal life in a hypothetical hereafter – still strong for many today – originate in the same drive for perpetuity. In the minds of most people, realisation of the limits to individual existence is unbearable. Death is experienced as an absurdity, “probably the most intolerable of all absurdities” (Klarsfeld *et al.*, 2000).

In pre-Darwinian biological views, death was thought to have been selected ‘for the good of the species’ (cf. Ruffié, 1986; Chabanis, 1982). However, on the basis of the present evolutionary theory of senescence, we now know that Weismann (1885) was right in stating that death becomes possible amongst multicellular organisms in which the somatic and reproductive cells are distinct. In multicellular organisms only germ cells are immortal, whereas somatic cells are dispensable. The loss of immortality is a price multicellular organisms pay for the evolutionary advantages they have acquired. Organisms are programmed for survival, not death.

The prolongation of the dying process

Today it may be observed that the use of medical technologies are increasing longevity, but are also, in a growing number of cases, merely prolonging the dying process. This issue is getting prominent attention in the scientific and ethical literature (e.g. Logue, 1993; Gorsuch, 2006; Yount, 2007; Griffiths *et al.*, 2008). Death control, either in the form of palliative care or as euthanasia, includes practices that deal with the unintended and undesired effects of partial medical successes whereby people are kept alive in conditions of severe terminal suffering or degrading regression. Death control practices – end-of-life decision-making and care for dying patients – obviously relate to delicate and difficult issues on which fundamentally differing philosophical and religious views exist in all societies (e.g. Brock and MacLean, 1993; Dowbiggin, 2005; Paterson, 2008; Wilcockson, 2008).

The battle against mortality has important implications for quality of life. Undoubtedly modern medicine in general has an extremely favourable effect on quality of life for most people. Nevertheless, more and more voices are heard warning against an unconditional application of advanced medical technologies in situations or at ages where the dying process has started or the human qualities of the artificially sustained organism have dwindled away. Hence, the increasing attractiveness for euthanasia as a guarantee against a technologically prolonged deteriorating and humiliating process during this stage of modern culture in which values and norms have not yet completely adapted to some of the undesirable consequences of the new technological possibilities. In this sense, it is quite meaningful that the *American Gerontological Society* has the motto:

"To add life to years not years to life."

Death control

Just as is the case with birth control practices, death control includes a variety of practices which differ in their ideological background and justification as well as in their technical approach and effectiveness. Usually two major groups of death control practices are distinguished: palliative care and euthanasia. But a more sophisticated classification would probably be appropriate. Bishop (2006), for example, classified them into five categories: standard pain management, forgoing life sustaining therapy, voluntary stopping of eating and drinking (VSED), terminal sedation (TS), physician assisted suicide (PAS)[8], and voluntary active euthanasia (VAE).

Death control practices have to be considered at three levels: individual, family and society.

For individuals a long life is an ideal that is highly desired and aimed for. However, the wish for longevity at all costs regardless of the quality of life at old age, may show some variation. Some people may want to have control over

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[8] In order to distinguish the act of writing a prescription from the administration of drugs by a physician, with the intention of ending the suffering of an incurably ill patient at his or her explicit request, the concept 'physician assisted suicide' (PAS) is used to mean the more passive action of writing a prescription that the patient can use to take his own life (cf. Bishop, 2006). We consider it very unfortunate that the term suicide has been introduced into the death control discussion. In many languages, suicide is termed as self-murder (e.g., German: '*Selbstmord*', Dutch: '*zelfmoord*'), implying that the patient commits a serious crime.

the management of their own dying process and decide about the initiation or the continuation of excessive technological intervention in end-of-life scenarios. They want to have the right to die with dignity when they suffer from unbearable pain and incurable illnesses, and/or to prevent their family from having to witness and live through such a painful experience or, in some cases, be confronted with the financial burden of prolonged but useless medical treatments.

Indeed, at the family level two elements have to be considered, as well: the emotional pain of losing a loved one in a long process of pain and degradation and the financial consequences of end-of-life medical overtreatment. In the United States, with its socially weak medical insurance system, estimates show that about one third of all families with a terminally ill family member will end up in poverty as a consequence of care costs (Bilchik, 1996). Of course, there may be a conflict of interest between the terminal patient who is not prepared to go and his or her family that cannot deal with the emotional pain of enduring a degradation process or that wants to avoid spending limited resources on a terminal family member (Kapp, 2001).

This brings us to the societal level where, at which two more aspects of dealing with the terminally ill have to be distinguished: cultural and economic factors.

The first has to do with fundamental values of life, quality of life and death. In many cultures values pertaining to death were traditionally focused on maintaining life at all costs. Religions such as Judaism, Christianity and Islam teach that decisions about life and death are the prerogative of God alone (cf. Larue, 1985; Kramer, 1988; Melton, 1991; Brockopp, 2003). However, those religions emerged and flourished in cultural and technological circumstances in which humans were relatively powerless to intervene in life and death issues. Now, in modern culture, things have fundamentally changed with respect to the management of the dying process. Modern science, complemented by newly emerging non-religious ideologies, such as humanism, atheism, socialism, liberalism, and ecologism, has made possible a totally different perspective on quality of life, including its terminal phase. The new attendant value orientation insists that individuals (and families?) should themselves have the right to make end-of-life decisions (cf. Kohl, 1992; Kurtz, 1992).

Economic considerations may also, and apparently increasingly do, influence the decision-making process and practices of end-of-life situations in the real world of limited resources (Heyland *et al.*, 1999). In death, health care costs are expensive (Bramstedt, 2001). Care for the terminally ill accounts for a substantial part of society's health care expenses. For the United States, Bilchik

(1996) estimated this to amount to ten percent of the total national healthcare costs. He further calculated that 27 percent of all Medicare spending occurs during the last year of a person's life and 40 percent of that figure is for the last month alone. Some authors even fear that the increased emphasis on cost savings and managed care will become the primary basis for decision making for the terminally ill, whereas in the past decisions were primarily made based on clinical judgements (Steinberg and Younger, 1998).

Given the various interests involved in end-of-life decisions – the patient's wellbeing in the ultimate phase of his life, the emotional involvement and economic concerns of close family members, the ethics and economics at the societal level – the application of sophisticated medical technology prolonging the dying process has to be carefully matched against modern standards of quality of life of the patient, the emotional and economic costs for his family, and the ethical standards and economics of society as a whole.

Hence, it doesn't come as a surprise that the shift in causes of mortality from external (e.g. infectious diseases) to internal factors (e.g. senescent deterioration), which currently are subject to less than perfect medical control, has contributed to new ideas and practices in the domain of death control: palliative care and euthanasia.

Palliative care

Although often considered a form of compassionate medical care for the terminal ill, palliative care (from Latin *palliare,* to cloak) is a much broader medical specialisation aimed at reducing the severity of disease symptoms, rather than providing a cure, in order to prevent and relieve suffering and to improve quality of life for people facing serious, complex illness. Ventafridda (2006) defines it as a multidisciplinary approach towards patients and their families during the progression of incurable illness, the advanced stages of disease and the last hours of life. As a matter of fact, a recent survey of the European Association for Palliative Care (EAPC) on 3.013 patients from 143 palliative care centres in 22 different European countries showed that very few patients had less than one week of expected survival (six percent) and that a substantial number of patients had an anticipated life expectancy of more than six months (Kaasa *et al.*, 2007).

Palliative sedation at the end of life aims at mitigating unmanageable disease symptoms in order to alleviate the patient's suffering. Engström *et al.* (2007) define it as "the monitored use of medications to relieve refractory and unendurable symptoms by inducing varying degrees of unconsciousness but not death, in patients who, given their disease state, progression, and symptom constellation, are expected to die within hours or days". Although palliative care "intends neither to hasten nor postpone death" (World Health Organisation, 2008), it may also have a life-shortening effect (Hartogh, 2004). As a matter of fact, in many cases it considerably reduces the duration of the dying process.

Euthanasia

Definition

Sir Francis Bacon, an English philosopher and statesman, devised the concept of 'euthanasia' early in the seventeenth century (Yount, 2000). Derived from the Greek words 'eu' (good) and 'thanatos' (death), euthanasia means a good or easy death. Today euthanasia has come to mean an act or practice of painlessly putting to death persons suffering from incurable conditions or diseases.

In currently existing legislation as well as in most attitudinal surveys about euthanasia, the concept is defined in a more restricted sense, namely as the prescription or administration of drugs by a physician with the intention of ending the suffering of an incurably ill patient at his/her explicit request. We will think of this as euthanasia *sensu stricto*.

The above-mentioned broader definition – terminating the life of patients suffering from incurable conditions or diseases irrespective of their own will (euthanasia *sensu largo*) – raises a major ethical issue in the euthanasia debate, as it includes patients both with and without informed consent or an explicit request. This definition can, moreover, apply both to mentally competent as well as to mentally incompetent terminally ill patients. The intentional administration of medication or other interventions to cause a competent person's death, without informed consent or an explicit request is sometimes called 'involuntary euthanasia', whereas ending the life of an unwilling individual or mentally incompetent person who is unaware of what is happening (such as a child or a senile elderly) is defined as 'non-voluntary euthanasia' (Csikai, 1999).

Legislation

Based on the ideologies of the great religious traditions, euthanasia is still illegal in most countries of the world. Muslims believe that only Allah has the right to end life; both Hindus and Buddhists teach respect for life and the belief that euthanasia is an interruption of karma; Jews and Christians base their objections on the Biblical commandment, "Thou shalt not kill" (Allen *et al.*, 2006). So far, only a few political jurisdictions have legalised euthanasia *sensu stricto* and have set up a number of rigorous requirements so that both patients and the medical profession are protected (Deliens and Van der Wal, 2003; Nys, 2003; Griffiths *et al.*, 2008). These include three European countries – Belgium (in 2002), the Netherlands (in 2001), and Luxemburg (in 2008) – as well as the state of Oregon in the United States (in 1995) and the Northern Territory of Australia (from 1996 to 1997). In Switzerland, euthanasia *sensu stricto* is not prosecuted when it is done without 'self-interest' (Giroud *et al.*, 1999; Bosshard *et al.*, 2002).

In many countries, however, euthanasia is being applied tacitly more and more because the legislation is lagging behind societal and technological developments (Gastmans *et al.*, 2006). Legalisation would bring existing practices of euthanasia out of the grey area, and make them more open for control of legal liability and protection of legal rights and obligations of both patients and medical care personnel.

Attitudes

The obsolete character of the legislation in most countries is demonstrated not only by the widespread practice of euthanasia, but also by the predominantly positive attitudes towards euthanasia where opinion surveys concerned euthanasia *sensu stricto* have been conducted. These data mainly concern European countries and North America. Three major findings have to be mentioned here: the large proportion of people approving of euthanasia, the considerable increase in positive attitudes towards euthanasia in recent decades, and the continued existence of within-population diversity of opinions.

Several surveys or opinion polls in the United States have shown that a large majority of the population favours the freedom to end one's life when the perceived quality of life has significantly diminished (Moore, 2005; Allen *et al.*, 2006; National Opinion Research Center, 2006).

European studies of public attitudes towards euthanasia *sensu stricto* also show that a majority of citizens think that it is acceptable or should be legalized. These sentiments have been expressed at levels of 80–93 percent in

Germany (Helou *et al.*, 2000), 84 percent in Great Britain (O'Neill *et al.*, 2003); 82 percent in Switzerland (Hurst & Mauron, 2003); 61 percent in France (Teisseyre *et al.*, 2005); and 50 percent in Finland (Ryynanen *et al.*, 2002).

The results of the European Values Study (EVS) data from 1999–2000, comparing acceptance of euthanasia *sensu largo* (i.e. omitting the qualification 'at the explicit request of the patient') with a total of 41.125 respondents in 33 European countries revealed, in general, lower proportions of acceptance. This may be due to the phrasing of the question. The EVS asked: "Please tell me whether you think 'euthanasia (terminating the life of the incurably sick)' can always be justified, never be justified, or something in between" (Cohen *et al.*, 2006a).

Regularly repeated opinion surveys, both in the United States and Europe, show that there has been a pronounced increase in favour of euthanasia in recent decades. The General Social Survey (GSS), a long running survey of social, cultural, and political indicators conducted in the United States shows that Americans' approval of euthanasia rose after 1978 to a peak in 1990–1991 and then dropped somewhat (National Opinion Research Center, 2006). The European Values Surveys of 1981, 1990, and 1999–2000, conducted in twenty one countries for which data on attitudes toward euthanasia are available, also show a growing support for personal autonomy regarding medical end-of-life decisions (Inglehart *et al.*, 2003; 2004; Cohen *et al.*, 2006b).

Notwithstanding this growing societal acceptance of euthanasia, a substantial diversity of opinion continues to exist, between as well as within countries. The EVS in Europe are most illustrative of this: the acceptance of euthanasia tends to be high in most North-Western countries (e.g. Belgium, the Netherlands, Luxembourg, Denmark, France, and Sweden), while a markedly low acceptance was found in others (e.g. Romania, Malta, Turkey, Portugal, Poland, and Ireland).

Multivariate analyses of the EVS and other survey data show that younger cohorts, people from non-manual social classes, and people with a higher educational level tend to have a higher acceptance of euthanasia. Weaker religious belief is the most important factor associated with a higher acceptance. However, Protestants and Orthodox Christians are generally not much less favourable towards euthanasia than non-religious persons. Roman Catholics are less accepting, although also here there is some differentiation: Roman Catholics in a liberal-secular environment are more accepting than Roman Catholics in a conservative-religious environment (De Moor, 1995; Suarez-Almazor *et al.*, 1997; Moulton *et al.*, 2006).

Palliative care versus euthanasia

Palliative care in the sense of palliative sedation at the end of life (Engström *et al.*, 2007) is often, mainly for ideological reasons, seen as an alternative to voluntary euthanasia. However, this opposition is is many respects quite artificial, and is not completely free from some considerable, although often unconscious, hypocrisy. Despite the fact that both approaches seem to be rooted in different ideological values, as a matter of fact, the outcome of both procedures is quite similar in the sense that both relate to the ending life, only with some difference in timing. Moreover, as Hurst and Mauron (2006) rightly argue, both approaches are very similar in various values arguments put forward: the importance of reducing human suffering, adversion to the technical medicalisation of the end of life, the importance of control by the patient at the end of life, and the recognition that death is not always the worst thing that can happen.

AGEISM

On the model of the concepts ‘sexism’ and ‘racism’, Butler (1969) coined the term ‘ageism’, meaning marginalisation or discrimination based on age, and especially prejudice against the elderly. Ageism differs in one important aspect from other forms of discrimination such as racism and sexism: all people grow old and those who discriminate against older people when they are young may themselves suffer from ageism in a later phase of their lives (Van der Geest and Niekamp, 2003).

Whereas there is a great deal of scientific and political attention to racism and sexism, there has been much less research on or political concern about ageism. Nelson (2002) sees as major reason for this neglect that age prejudice is still considered socially acceptable.

But times are changing. Probably due to the in-depth maturation of modern democracies in which all forms of social inequity or inequality are becoming ideologically unacceptable, stigmatisation or discrimination of persons of higher age groups is also considered unacceptable, just as discourteous attitudes or behaviour on the basis of ideology, sex, gender, ethnic group or race is no longer accepted. It is striking that many charters or conventions dealing with human or social rights, such as those agreed under the auspices of international bodies such as the United Nations and the Council of Europe, now include age in their principles or recommendations right next to ideology, political conviction, sex, gender, and race. Another reason for the increasing attention to ‘ageism’ may be that the new generations of elderly are becoming more numerous and consequently have greater impact on the economy and policy making, and also are becoming, due to their better health and higher education, much more able to stand up for their own rights.

Ageist attitudes and behaviour towards seniors

Surveys amongst the elderly on attitudes or behaviour towards people of higher ages systematically found that the experience of ageism is widespread, frequent and multiple. Often seniors experience disrespect, or are considered to be less able or productive. Older people as a group experience negative treatment in terms of poor access to transport and housing, low incomes, and inadequate nursing home care. There is evidence of extensive de facto health care rationing or overtreatment by providers on the basis of age (Kapp, 2001). While few have experienced overt or brutal ageism, interaction in everyday life involves some negative treatment, and only occasional positive 'sageism' (cf. Minichiello, 2000; Palmore, 2001). Surveys also found evidence of gendered ageism: across all ages, women were more likely than men to experience ageist attitudes concerning appearance or sexuality (cf. Duncan and Loretto, 2004).

According to some investigations, ageism seems to be a widespread phenomenon. In his survey of the treatment of older people (now and in the past) in 41 nonindustrialised societies, Glascock (1983; 1990) found in half of these societies 'deathhastening behaviour' that included withholding care, refusing them food, leaving them behind to die, or by actively killing them.

Social exclusion of seniors

In industrial societies, older people of working age, say 40 to 60, often experience discrimination in the labour market, have fewer opportunities at job solicitations, and are more often fired or forced into retirement because of the higher costs of their salaries, despite their experience and capabilities. There is also higher than average unemployment among older workers. Employers invest less in elderly workers to enhance their competitiveness in the regular labour market. In the present era of economic globalisation, elderly workers are often being made redundant, given casual jobs or being pushed into retirement (Andrews, 1999).

Although the creation of retirement schemes was originally intended as a protective measure for older workers, most countries also adopted compulsory age limits for retirement. For people who are willing and able to continue working beyond the 'normal' age of retirement, these limits are experienced as a salient ageist practice, especially since the obligatory retirement age often prohibits them from engaging in any paid activity at the risk of losing their pension rights. The ongoing and accelerating population ageing wave with its implications for a sustainable social protection system will perhaps incite policy makers to reconsider the rigidity of existing retirement rules.

Ageist attitudes and discrimination have negative effects on the living conditions of older people because they unfavourably influence their socio-economic situation, and some investigations show that they have negative psychological effects as well, and may even shorten their lives (Levy *et al.*, 2002).

Arguing that 'old age is nothing more than a social construct', and that until it is eliminated as a conceptual category ageism will continue to flourish, some researchers are advocating the concept of 'agelessness' (cf. Andrews, 1999). This reminds us of well-intended efforts to deny the reality of sexual and racial differences. Age, sex, and race, are, obviously, not simply social constructs, but also biological realities one has to live with and adapt to, in order to avoid discrimination and social exclusion.

Increasing gap between social and biological ageing in modern culture

In pre-modern society retirement, as a social condition which entails transfers of public resources, did not exist. People worked until they were incapacitated or died. Intergenerational solidarity was limited to the family environment. The first statutory retirement age was established in Germany with the Bismarckian old-age and disability pension scheme of 1891, which set the age limit for receiving an old-age pension set at 70 years – an age to which most people did not survive in those days. In 1913 this was decreased to 65 years of age, a limit which was later adopted by most other industrialised nations (Jacobs *et al.*, 1991). It is only in the most recent years that, in some European countries (e.g., Denmark, Germany, Iceland, Netherlands and Norway), the statutory age for retirement has been slightly increased above the age of 65 for both sexes.

From the beginning of the twentieth century until about 1970, age at retirement among men clustered around the age of 65 in most European countries. Since the 1970s the average age at retirement has been decreasing continuously. For women, the picture is more heterogeneous due to their increasing labour force participation.

The proportion of people aged 60 or more who are still in the work force is extremely low. Data for the European Union countries show that in the northern countries 15 percent of men and four percent of women at this age are working; in the southern countries the proportions are 12 percent and three percent respectively. In western European countries the share of economically active people slumped to as low as seven percent among men and two percent among women.

Although life expectancy has increased considerably in recent decades, and health conditions, educational levels, and technological support mechanisms are being continuously improved and allow most older people to work up to a much higher age than in the past, many countries in the second half of the twentieth century developed policies fostering early rather than later retirement, resulting in ever decreasing labour force participation and occupational exclusion of older adults (e.g. Kohli *et al.*, 1991; Worsley, 1996; Ebbinghaus, 2006). Figures for Germany and Sweden clearly illustrate the general trend observed in industrialised countries, namely a marked increase in life expectancy and a marked decrease in age at retirement (Figure 3.11). In the twentieth century the biology of ageing and the societal perception of ageing clearly evolved in opposite directions. Only in recent years some countries have started reforming their legislation to limit early retirement and have even increased the statutory age of retirement (cf. Fornero and Sestito, 2005).

AGEING AND AGEISM IN EVOLUTIONARY PERSPECTIVE

The human-specific lifespan has been selected for as a function of the fitness optimisation of a large-brained, long-maturing and relatively low-reproducing species. As a sexual species, with immortal germ cells but mortal soma (= the old Greek word for body), humankind is inevitably subject to ageing, in the sense of senescence, at least if premature death due to external causes – such as accidents, infections, predation, or homicide – can be avoided. Senescence is the result of the weakening of the force of natural selection during the life course, in particular after the end of the reproductive period. Modern culture is on its way to developing life-extending technologies through which future generations will be able to transcend the present species-specific lifespan.

The desire of individuals to live a long and healthy life has paralleled the development of ageism resulting from the competition between generations. Ageism is a quite universal phenomenon, in particular in conditions of relatively scarce resources. So, the human has the potential to live long but is vulnerable to early death, is inevitably subject to senescence at higher age, and may, in the later stages of life, also have to cope with ageism.

Modernisation is gradually changing the social environment away from prejudice against ageing and ageism, albeit with variable success so far. Modern culture increases life expectancy by successfully fighting the causes of external mortality. It also succeeds, by means of health and welfare care or through replacement therapies, to alleviate or compensate for senescent regressive processes. The forces of modernity may, through education and legislation, decrease or eliminate ageist attitudes and practices.

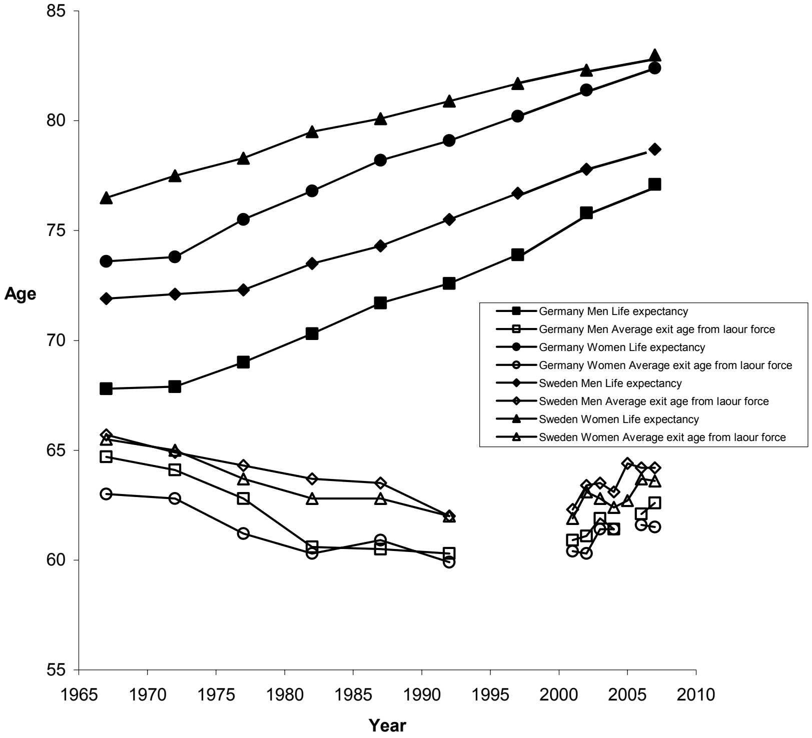

Figure 3.11. Development of life expectancy at birth and mean age at retirement in Germany and Sweden. Source: Gendell (1998), Avramov and Maskova (2003), United Nations (2008).

Modern culture allows senescent degenerative processes to manifest themselves, but also prolongs in an increasing number of cases the dying process, making it sometimes a purely technology-driven process.

How to evaluate all this from an evolutionary perspective?

At first sight, the resources modern culture invests in the extension of life expectancy at higher ages seem to be contrary to the principle of inclusive fitness maximisation, because it may absorb resources necessary to assist the reproduction, education, health care and socio-cultural and socio-economic development of younger generations.

However, a closer look reveals that this apparent contradiction needs to be qualified. Avoiding morbidity and mortality at younger age and allowing people to reach old age gives people the opportunity to fully develop their own genetic potentialities, and also creates the conditions for their parental and grandparental investment. It also prolongs the potential for the overall contribution to society by each individual. This potential may still need to be translated into practice so that the lengthening of lifespans and improvement of health conditions for people at higher ages help foster increasing social involvement of elderly people. In this regard, some current practices, such as early retirement schemes and relatively low mandatory retirement ages, need to be revisited.

Investing resources in prolonging the lifespan when senescent deterioration has gravely progressed, or when the dying process has irrevocably set in, also needs to be carefully evaluated both from individual, family and societal points of view, since euthanasia is an option that requires great reflection, consultation and regulation.

Modernisation is characterised by strong ambiguity towards older citizens. On the one hand, its humanitarian ethics, based on principles laid down in the United Nations Universal Declaration of Human Rights (United Nations, 1948) and, for older people especially in the United Nations International Plan of Action on Ageing (United Nations, 2002), firmly rejects and combats ageist attitudes and practices. On the other hand, modernity’s competitive economics, particularly in the current era of globalisation, fosters intergenerational competition and discrimination against people at higher ages, or at least their marginalisation. However, ageism is incompatible with the ethical and scientific-technological achievements of modern culture, which has produced a revolutionary increase in life expectancy and vitality at higher ages. In modern culture, ageism has become a maladaptive practice.

As far as concerns life-extending strategies, we must be aware of the fact that the present species-specific human lifespan is the result of an evolutionary adaptation to the long maturation period required by the human infant/adolescent/young adult to be fully socially functional. It is also an adaptation to the monoparous parturition which requires several consecutive pregnancies to guarantee intergenerational replacement. Hence, prolongation of the species-specific lifespan would be evolutionary justified on the condition that the maturation period in human ontogeny becomes longer. Consequently, the meaningfulness of modern efforts to develop life-extending strategies beyond the current species-specific lifespan must, from an evolutionary standpoint, be highly questioned, although there can be little doubt that, from an ontogenetic point of view, many people will be eager to pursue it.

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CHAPTER 4

SEXUAL VARIATION AND SEXISM

INTRODUCTION

The second half of the twentieth century was characterised by a renaissance of scientific and political interest in women's emancipation, culminating at the global level in the drafting of the United Nations charters on gender equity and equality as incorporated in the action programmes of the 1994 International Conference on Population and Development (United Nations, 1995) and the 1995 International Conference on Women (United Nations, 1996). In the developed world especially, women made considerable progress in acquiring equal rights and in improving their social, economic, cultural and political status (cf. Booth and Bennett, 2002).

Almost simultaneously, but independently, the biological sciences, in particular evolutionary theory, showed a renewed interest in sexual variation. Their efforts have substantially improved understanding of the phylogenetic evolution and ontogenetic development of (human) sexual dimorphism and behaviour (cf. Daly and Wilson, 1978; Symons, 1979; Kauth, 2006). This renewed interest in sexual dimorphism has disturbed many feminists who fear that the biological sciences will (again) be used to justify the perpetuation of the social subordination of women and to hamper further progress by the feminist emancipatory movement (cf. Reed, 1978; Connell, 2000). In particular, sociobiology was (and sometimes still is) perceived as determinist, reductionist and sexist (Alper *et al.*, 1978, 485):

> *"Sociobiology cannot be divorced from its sexism. Not only are the postulated human universals sexist, but the asserted mode of their propagation in evolution is sexist as well. This pervasiveness of the sexism in sociobiology is camouflaged by the careless* and *sexist language used by the sociobiologists."*

Without wanting to imply that there are no overt or covert sexists among present-day (socio)biologists, it will be argued here that, contrary to feminist fears and allegations, the advances of the biological sciences, especially in sociobiology, provide powerful arguments in favour of emancipatory feminism. These must be duly taken into consideration if the feminist movement wants to achieve its goals (Cliquet, 1984a). Sociobiology is a scientific discipline that, just as with any other scientific field, seeks to explain the phenomena it studies, not to justify them (Batten, 1994).

EVOLUTIONARY ORIGINS OF SEXUAL VARIATION

The origin of human sexuality goes far back in the history of life, virtually to the origin of life. The origin of the sexual organisation of life is now explained as a feature that, despite its high cost (sexual organisms transmit only half of their genes to their offspring), provided individual organisms with advantages for their own survival and the survival of their offspring. According to Bernstein *et al.* (1985), the original function of sexual conjugation or fusion consisted in repairing or masking unfavourable mutations. Several other scholars (e.g. Haldane, 1949; Hamilton, 1980; Bremermann, 1980) see the sexual advantage in the protection it provides against disease and parasitism, and in the establishment of an efficient immune system.

Whatever the original advantage may have been, the result of sex was an increase in heterozygosity and the promotion of genetic polymorphisms, namely of genetic variation between individuals within breeding populations, an idea that goes back to Weismann (1889) and that was later refined by Fisher (1930) and Muller (1932). Emerging as a selective advantage against internal (mutations) and/or external (parasites) forces, sex favoured – as a by-product – genetic variation and created opportunities for more rapid adaptation to changing environmental conditions. Sex speeded up the pace of evolution and helped create conditions for the super-exponential increase of the number of life forms observed during evolution (Barghoorn, 1971). Without the sexual organisation of life, the human species would not have emerged yet. Bernstein *et al.* (1984, 339) summarised their view as follows:

> *"Species are a consequence of sex, and*
> *sex is a consequence of genetic damage."*

The development of two distinct sexes, as well as the general story of human sexual differentiation is the result of a long evolutionary history. The human species shares the general differentiation of its primary sexual characteristics – its sexual and reproductive organs – and its secondary sexual features – the other characteristics by which the two sexes differ – with other mammals, particularly with the primates from which humans evolved. The specific features that are characteristic for human sexual dimorphism, including behavioural patterns, are the result of changes the hominids experienced during the hominisation process.

Sexual selection

The specific sexual dimorphic features of a species are the result of sexual selection. The theory of sexual selection was initially developed by Darwin (1859; 1871). He defined it as an evolutionary mechanism through which individuals acquire, thanks to particular characteristics, reproductive advantages over other individuals of the same sex, and transmit those characteristics to their descendants of the same sex.

Darwin distinguished two complementary components of sexual selection: competition within one sex over members of the other sex, and differential choice by members of one sex for members of the other sex. The first mechanism is mainly found within the male sex and is known as 'male-male competition'; the second one predominates among the female sex and is labelled 'female choice'. Both these reproductive strategies coevolved since natural selection must have compromised between the reproductive interests of males and females (Irons, 1983; Voland, 1993).

In recent decades the theory of sexual selection strongly has again come to the fore (cf. Cronin, 1992; Andersson, 1994; Batten, 1994). It started with Trivers' (1972) thesis about the sexually differentiated parental investment in offspring. Building on Bateman's (1948) theory about sexually differential energetic investment in gametes, Trivers developed the idea that sexual selection and its consequences – for reproductive strategy, sexual dimorphism of secondary characteristics, and sexual differentiation of mortality and sex ratio – can all be explained from one single determining variable, namely the sexually differentiated relative parental investment in offspring. He thereby provided the ultimate theoretical framework for explaining sexual selection.

In sexually reproducing organisms, one sex invests heavily in individual offspring, whereas the other sex invests minimally. This basal sex difference can be observed starting at the level of the gametes, with numerous small spermatozoa produced in the male and a much lower number of larger ova released in the female. Males are the least investing sex, while females invest much more in individual offspring. Differential parental investment determines all sexual strategies and the effects thereof.

The sexual difference in parental investment leads to sexually different reproductive strategies. The strongly investing sex in offspring produces fewer descendants than the weakly investing sex. The strong investors will, consequently, develop a qualitative or K-strategy in order to ensure that each offspring produced has maximal opportunities for survival. The reproductive success of the weakly investing sex, in contrast, will be favoured by producing as many offspring as possible; it will develop a quantitative or r-strategy (Daly and Wilson, 1978).

These different reproductive strategies lead to different mating strategies. The less investing sex – usually the male sex – tries to get and inseminate as many partners as possible, leading to intra-sexual competition ('male-male competition'). The more investing sex runs more risks. It will consequently be more choosy ('female choice'), since its interest is to get partners who are likely to guarantee a high chance of survival for their offspring.

Together, male-male competition, on the one hand, and female choice on the other result in an enlargement of the sexual dimorphism of characteristics that fulfil functions in partner choice and adaptation. This double sexual selection leads to sexual differences in morphology, physiology and psychology. For the less investing sex, these differences result either in epigamic traits[1] or, in case of selection via physical contest, in larger and more robust body build and higher potentiality for competitive and aggressive behaviour. Between-species comparison of sexual dimorphism is a valuable instrument for studying differential sexual behaviour between species.

Based on observations of the spreading of the Khan Y-chromosome[2], Sykes (2003) distinguishes, in addition to 'male-male competition' and 'female choice', a third variety of sexual selection, namely 'female coercion'. Although it is undoubtedly meaningful to distinguish 'female choice' from 'female coercion', it is possible to consider the latter merely as a consequence of 'male-male competition', certainly as far as concerns its effects on sexual dimorphism.

Amongst mammals (Alexander and Noonan, 1979), including primates (Clutton-Brock and Harvey, 1977), there are clearly positive correlations between the difference in parental investment and sexual dimorphism, between differential parental investment and polygamy, and between sexual dimorphism and polygamy. On the basis of its sexual and mating behaviour, the human species appears to rank amongst mammals as a moderately polygynous species (Alexander *et al.*, 1979).

Feminisation of the human male

The evolution of the hominids has been characterised by a general regression of robustness in body build. These changes have occurred not only in skeletal structures and musculature, but also to dental features such as tooth size and the length of canines. This phenomenon has been labelled 'the gracilisation process' during hominisation (e.g. Churchill, 1997).

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[1] Epigamic traits: characteristics that serve to attract or stimulate members of the opposite sex.

[2] Khan Y chromosome: an y-chromosome lineage that originated in Mongolia approximately 1000 years ago, the dissemination of which is supposed to be due to Genghis Khan and his descendants (Zerjal *et al*., 2003).

Hominid gracilisation occurred both in males and females, but was much more pronounced in the originally more robust male sex than in the more delicately built female sex. In the course of hominisation, the male sex has gradually come to resemble the female sex in its secondary sexual characteristics (Figure 4.1). The evolution of the hominid male is characterised by a feminisation process (Cliquet, 1984a; 1984b).

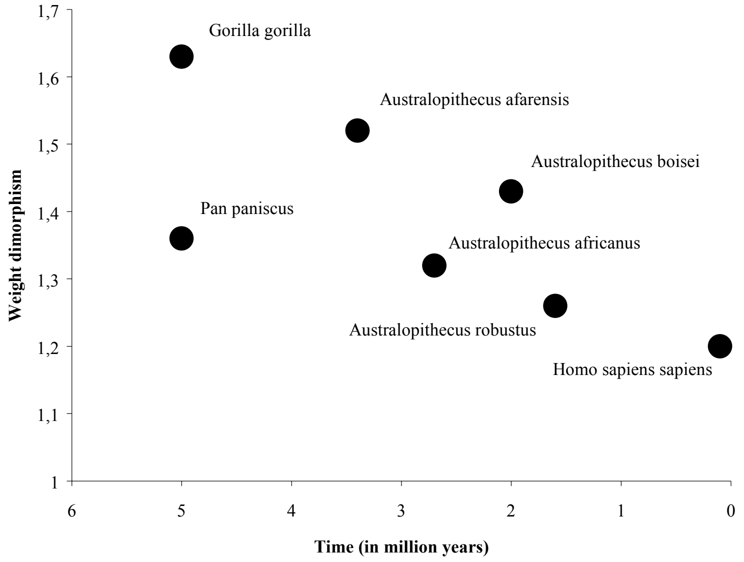

Figure 4.1. The feminisation of the human male during the hominisation process (weight dimorphism). Source: Plavcan and van Schaik, 1997.

This feminisation of the male is related to the evolving parental strategies of hominids, in particular the increasing male care, provision, and protection of the sexual partner(s) and offspring.

The idea of a reduction of sexual dimorphism during human evolution was already advanced by Darwin (1859; 1871), as well as by many later anthropological scholars (e.g. Bonnet, 1919), but it is only in recent decades that more specific data on the subject have been published (e.g. Armelagos and Van Gerven, 1980; Brace, 1973; Ghesquière *et al.*, 1985; Hall, 1982; Plavcan and van Schaik, 1997). All available data on the earliest hominids, namely the Australopithecine (Wolpoff, 1976), particularly their oldest representatives, the

Australopithecus ramidus and *afarensis* (Johanson and Edey, 1981; McHenry, 1991; White *et al.*, 1994; Richmond and Jungers, 1995) show that those creatures were characterised by an outspoken sexual dimorphism[3]. Starting with the *Homo erectus* phase in human evolution, sexual dimorphism begins to decrease substantially. This reduction has continued during the more recent stages in hominid evolution. Even within the current *Homo sapiens sapiens*, a gradual though limited further decrease occurred between the Upper Paleolithic era and the present (Armelagos and Van Gerven, 1980; Van Vark *et al.*, 1989; Steerneman *et al.*, 1992).

Reduction in sexual dimorphism can also be witnessed in behavioural characteristics. This can obviously only be done by comparing particular patterns of behaviour, such as the intensity and forms of male-male competition, in extant primate species, including the human species.

Sexual evolution of the human female

During hominisation, the human female also underwent important changes. While the male transformation mainly concerned secondary sex characteristics, the evolutionary changes of the human female have predominantly had to do with primary sexual features including: concealed ovulation, large breasts, orgasm, multiple erogenous zones, face to face interaction accompanying bipedalism, and menopause (Lancaster, 1985).

Several of these changes may be related to the shift from a cyclical toward a non-cyclical sexual readiness – a rather rare feature among mammals. Whilst amongst most non-human primate species, and mammals in general, females are usually prepared for sexual intercourse only during a short period during their ovulatory cycle, namely around the period of ovulation, the human female is able to have sexual intercourse at any time during her complete menstrual cycle. This has been misinterpreted in the ERV-theory ('ever ready vagina') (Beach, 1978), and it is important to note that there is some variation in female libido and coital frequency distribution over the menstrual cycle, with a major peak around ovulation and a second peak before menstruation (Manson, 1986). It is nevertheless a fact that sexual activity in the human female is not restricted to the ovulation period (James, 1971; Cherfas, 1984).

In this respect, one of the most remarkable evolutionary changes in female sexuality is concealed ovulation. This intriguing feature has been, and still is, puzzling to biologists. How can a trait that hides female fecundity, be adaptive?

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[3] According to Reno *et al.* (2003), *Afarensis* may have been somewhat less sexually dimorphic than indicated by older authors.

Many explanations have been given for this phenomenon, such as family formation (Etkin, 1954), group cooperation (Wickler, 1967), acquisition of male investment (Alexander and Noonan, 1979), avoidance of reproductive risks (Burley, 1979), concealment of extra pair copulation (Benshoof and Thornhill, 1979), prevention of infanticide (Hrdy and Hausfater, 1984), hormonal changes related to bipedalism (Spuhler, 1979), and female-female competition (Ridley, 1993) – but most authors see concealed ovulation as a function that helps establish more enduring relationships, which may reduce male-male competition and aggression which, in turn, is a function of the increasing necessity for long-lasting care of dependent infants (e.g. Daniels, 1983).

Another remarkable human sexual characteristic is the occurrence of female orgasm. This does not mean that female orgasm has not been observed amongst other primates (cf. Hrdy, 1981; 1988), or that orgasm is experienced by all human females (cf. Fisher, 1973). Most authors consider female orgasm to be an evolutionary adaptive trait that favours male-female attachment. Rancour-Laferriere (1983; 1985) has nuanced this adaptive theory and distinguishes four adaptive functions of female orgasm: hedonic function, domestic bliss function, male potency function, and paternal confidence function. All these are obviously proximate functions, the ultimate effect of which lies in the genetic benefits that can be expected.

Evolution of sexual steering

The most important, though probably least well known, specific human sexual characteristic concerns the means by which sexual behaviour is controlled. The evolutionary process from the lower primates toward present-day *Homo sapiens* has been characterised by a gradual but significant shift in the control of sexual behaviour, whereby the role of hormones and the older parts of the brain decreased relative to the large brain hemispheres. This change in the steering mechanism is responsible for the shift from rigid, instinctive behaviour, largely determined by blood physiology, toward behavioural patterns that are more sensitive to learning and conscious mental processes. Thus, the modern human appears to be more apt to be sexually stimulated and activated, but also to be more inhibited, compared to its predecessors. The modern human, consequently, shows a much larger autonomy and variability in sexual behaviour in comparison with the earlier stages of evolution (Ford and Beach, 1951).

The increased influence of the large brain hemispheres on human sexual behaviour has important physical and psychic dimensions, and also means that sexual satisfaction is difficult to achieve. In the human, the anatomical and physiological aspects of sexual life easily result in psychological wear and tear

(Duyckaerts, 1964). Psychological satisfaction appears usually to be a vital additional requirement for an enduring and harmonic sexual relationship.

Explanation of human sexual dimorphism

The human species has been called the sexiest species in the animal kingdom: among the primates, the human male has the longest and thickest erect penis; the human female has the largest visible breasts, can experience orgasm, is endowed with multiple erogenous zones, and can have intercourse throughout her complete menstrual cycle. Human coital behaviour is not only characterised by the prevalence of frontal copulation, but at the same time by a greater intricacy, variation and duration than that of other species. All of these characteristics appear to be adaptations aimed at the establishment and preservation of enduring relations. The sex-specific human sexual characteristics discussed above, ranging from the decreasing robustness and behavioural competitiveness of the human male – the feminisation process – to the shifts in the sexual morphology and physiology of the human female and the changes in the steering mechanism of sexual behaviour, contribute to this adaptation.

However, this is only the proximate explanation for human sexual specificity. The ultimate explanation for this specificity is to be found in the singularity of the human offspring, which requires, due to its long-term neediness, enduring and intensive care. The need for sustained care of children, not just their procreation, lies at the basis of the specificity of human sexuality.

The human sexual dimorphism in body size, musculature, assertiveness and energetic activity, competitive and aggressive behaviour, etc., has not yet disappeared completely. The hominid transition from a scavenger-gatherer economy to a hunter-gatherer economy was accompanied not only by increased paternal investment, but resulted in and even necessitated a sex-specific task and role division. Women continued to specialise – very successfully – in caring for and socialising ever-slower maturing children and in more sedentary food gathering (Dahlberg, 1981; Slocum, 1980). Men, in contrast, concentrated on strongly mobile (group) hunting, initially on small game, and later also on larger prey, and on the defence and conquest of women and territories (Chagnon, 1990). This task and role division engrafted itself onto the existing sexual dimorphism in robustness of the early hominids, though robustness was decreasing due to the increasing paternal investment and relaxation of natural selection due to the development of technology (Brace and Ryan, 1980; Frayer, 1980; Frayer and Wolpoff, 1985). It is not impossible that still other factors, such as protection against predators (DeVore and Washburn, 1963), the effect of larger body size (Leutenegger and Cheverud, 1982), or the remnants of ancestral genetic make-up (Cheverud *et al.*, 1985) have also played a role in the reduction of sexual dimorphism in present-day humans. Very probably, the current sexual dimorphism in *Homo sapiens sapiens* is multifactorial in nature and in its phenotypic variation (Plavcan, 2001).

The moderate sexual dimorphism of *Homo sapiens sapiens* is a nice example of an evolutionary compromise, whereby selective pressures operated in different directions, resulting in the preservation of (reduced) male robustness and aggressiveness which is at the same time adapted to the needs of group hunting and territorial defence and conquest and to the enhanced requirements of cooperation and sociability with respect to relational and parental investments in large-brained and long-maturing offspring.

ONTOGENETIC DETERMINANTS OF SEXUAL VARIATION

Sex and gender identity/role

The ontogenetic development of sexual differentiation is the result of a multivariate and sequential process that involves genetic, hormonal, neurological, morphological and socio-cultural factors (Ellis, 1982; Money, 1987). This implies that the human was not completely genetically programmed for the emergence of its sexual dimorphism. The attributes of gender identity do not necessarily correspond completely to the originally genetically programmed sexual features. The various sexual determinants can function concordantly and result in a gender identity in which genetic, hormonal, neurological, morphological and psychological gender features completely correspond and mutually reinforce each other. But, at one or more of these levels, discordance can occur, meaning that a divergence from the originally programmed sex can emerge. Ontogenetic and socialisation processes can run counter to genetic predisposition.

In order to distinguish the result of the sequential determination process from the original endowment, in the 1950s Money (1955) coined the concept of ‘Gender Identity/Role’, as a result of a multifactorial and sequential growth process (Figure 4.2).

In a presidential address to the Population Association of America on the nature of gender, Udry (1994) recalled all this and formulated a synthesis of the biosocial relations that are known to exist between the within- and between-sex/gender distribution of natural feminine-masculine predispositions and gendered social behaviour. More important, however, is the fact that in this address Udry reported the results of his study on the relations between gendered behaviour in a sample of adult women and their prenatal and adult exposure to androgen: one forth of the gendered behaviour of this sample could be explained on the basis of prenatal and adult androgen levels and their interaction. Unfortunately, due to a scientifically obsolete understanding of the human ‘nature versus nurture’ dichotomy combined with ideology and fears about biological reductionism and determinism, many social and behavioural scientists associate the gender concept with cultural sex and set it in opposition to biological sex. In recent decades this type of sex-gender distinction has become particularly prominent in feminist theory, in which gender is considered to be a social or cultural construction which can be deconstructed and reconstructed, whilst sexuality is not considered to be a naturally driven force (cf. Oakley, 1972; Jackson, 1978; Correa, 1997). In much of the social science literature on gender, there is no reference to the biological components of the gender differences or to the interactions between biological and socio-cultural determinants (e.g. Chafetz, 1991). As Money (1994, 163) remarked:

> *“The definitions of gender* and *gender identity vary on a doctrinal basis. In popularized* and *scientifically debased usage, sex is what you are biologically; gender is what you become socially; gender identity is your own sense or conviction of maleness or femaleness;* and *gender role is the cultural stereotype of what is masculine* and *feminine.”*

Obviously, gender cannot be limited to cultural or social elements. The gender identity one eventually adopts is not the result of socio-cultural learning or conditioning, but of all of the above-mentioned factors – including social and cultural learning and conditioning – that influence the ontogenetic process. Hence, gender is not to be considered simply a social or cultural construct, but the result of the interaction between a number of biological factors which operate at different levels and phases during the life course together with socio-cultural learning and conditioning processes (cf. Ridley, 2003).

More recent valuable contributions of the social sciences to the fine-tuning of the gender concept can be seen in the broadening of the concept from its (traditional) individual conception to the way societies are organised. Riley (1997) formulated this in a pertinent way:

> *“Gender has come to be described as the way that societies are organised rather than just as attributes of individuals. Here, whether the differences between women and men are biologically or socially driven is less important than the ways societies are organised around those differences.”*

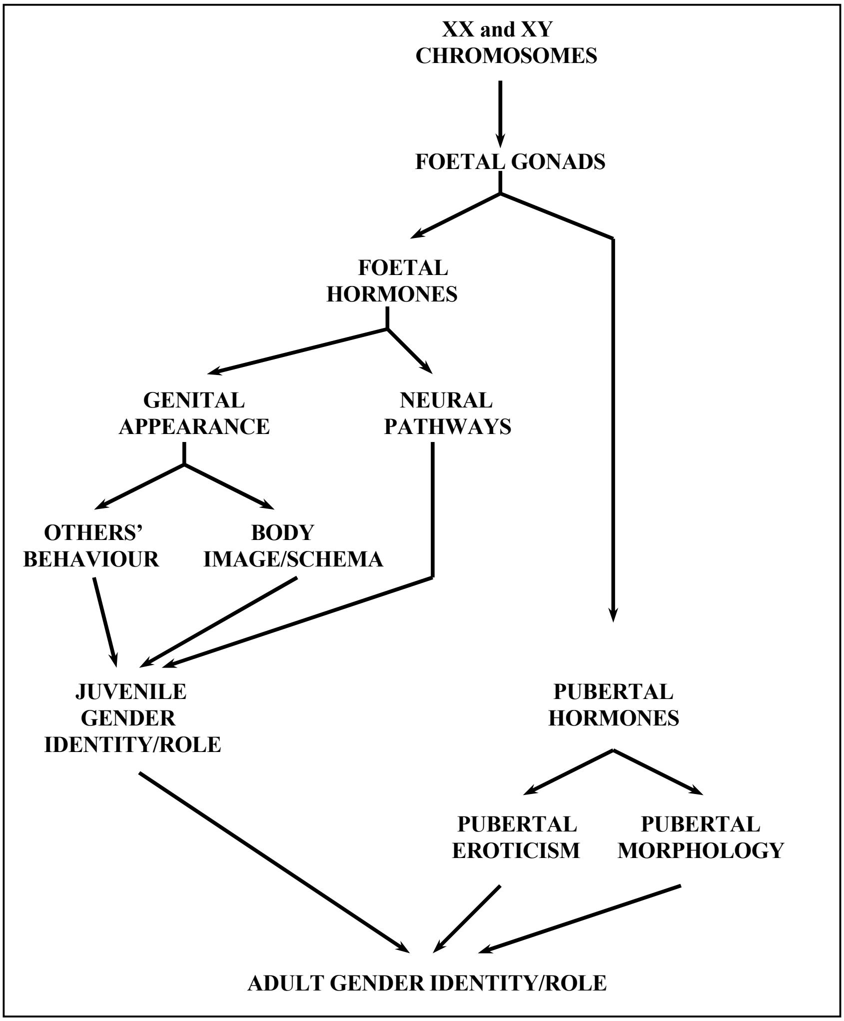

Figure 4.2. The multivariate and sequential determinants of gender identity/role. Source: Money (1987).[4]

The societal organisation of gender can lead to different degrees of equality and equity between women and men. It can be responsible for differences in prerogatives and power, in participation in societal life, and in opportunities for education and social mobility.

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[4] Gonads are the organs that make gametes.

In conclusion, gender is the outcome of a multi-dimensional biosocial process, in which genetic, prenatal and pubertal hormonal, neurological, morphological and socio-cultural factors are involved. At the individual level, it shows between- as well as within-sex variation. In addition to individual attributes, gender differentiation can be organised at the societal level with multiple implications for the social relations between the sexes, such as their dominance-subordinate relations, their rights and prerogatives, their emancipatory opportunities, and their power positions.

Socially important aspects of sexual determination and differentiation

The genetic difference between the two sexes is a well-known phenomenon: women possess two identical sex chromosomes (XX); men have only one X-chromosome, which they receive from the mother, and one Y-chromosome, coming from the father (XY) (cf. Craig *et al.*, 2004). Less well known is the fact that, quite early during the embryonic development of the female foetus, one of the X-chromosomes in each cell is deactivated (Lyon, 1962; 1981; Chow *et al.*, 2005) due to the presence of an Xist-gene in the X-deactivation centre (Xic) of the X chromosome (Percec and Bartolomei, 2002). This deactivation occurs at random, meaning that the body of a female individual consists of a mosaic of cells, approximately half of which has an active X-chromosome of paternal origin, and the other half an active X-chromosome of maternal origin. This means that, in cases where a woman is heterozygous for an X-linked allele pair, both alleles can be phenotypically expressed.

The sexual difference in sex chromosome combination (XX and XY) and the heterogeneous composition of the female body with respect to the active X-chromosome are the reasons why genetic impairments which are controlled by X-linked genes express themselves less, or in a more moderate way, in women than in men. A genetic disease controlled by a recessive X-linked gene always expresses itself in the male, because he is not protected by the presence of a second X-chromosome. Amongst women, in contrast, the negative effect of a recessive X-linked gene can be compensated against by the normal allele on the other X-chromosome; even in the case of an unfavourable dominant X-linked gene, the trait will express itself less vigorously, because the normal recessive allele on the other X-chromosome is active in approximately half of her cells and consequently has a compensating effect. The difference in the combination and the expression of genes located on the sex chromosomes is one of the main reasons why women are in many respects the biologically superior and less variable gender.

From a biological point of view, the female gender is the basic sex, and not the second sex. In the absence of very high levels of male sex hormones, female structures will develop. The deviation in a male direction, which begins to appear during early prenatal development, is the result of the presence of a gene on the Y-chromosome called SRY (sex-determining region Y) (Berta *et al.*, 1990; Jäger *et al.*, 1990). SRY initiates, through the production of high levels of androgens – male sex hormones – the masculinisation of the embryo. Androgens, however, are produced in both sexes, albeit in different amounts. Androgens are produced by different endocrine glands, such as the testes, ovaries and adrenals. During gestation the foetal androgen level is influenced by the androgen production of the mother (Ellis, 1982).

The early hormonal masculinisation of a genetically male embryo initiates the formation of male sex organs. The male gonads produce high levels of androgens that are responsible for the further morphological, physiological and psychological masculinisation of the male gender during its ontogenetic – both pre- and postnatal – development. The sexual difference in androgenisation that is particularly outspoken during the first trimester of gestation – the genital developmental phase – decreases somewhat during the two subsequent trimesters – the neuro-organisational phase – and decreases still further during the infantile phase, and increases again very strongly during puberty (Figure 4.3).

Prenatal hormonal masculinisation not only initiates the formation of male genital organs, but also influences the structure and function of other body parts, particularly the brain (cf. Goy and McEwen, 1980; Hines, 1991; LeVay, 1993; Knickmeyer and Baron-Cohen, 2006), including brain cell physiology and brain organisation. The prenatal masculinisation of the brain was first discovered based on animal experiments and is well documented (cf. Austin and Edwards, 1981). Research has revealed that this is also the case in humans, based mainly on the study of pathological conditions such as congenital adrenal hyperplasia (CAH) and complete androgen insensitivity syndrome (CAIS) (cf. Hines *et al.*, 2004; Meyer-Bahlburg *et al.*, 2004; 2006; Cohen-Bendahan *et al.*, 2005), and analysis of the effects of prenatal administration of (de)masculinising drugs such as synthetic progestins with androgenising potential and diethystilbestrol (DES) (Saunders and Reinisch, 1985; Ehrhardt *et al.*, 1989). Today, a considerable amount of data has been gathered establishing substantial evidence of a causal relationship between sexually differentiated prenatal neuro-hormonal organisation and post-natal behavioural differentiation (cf. Knickmeyer and Baron-Cohen, 2006).

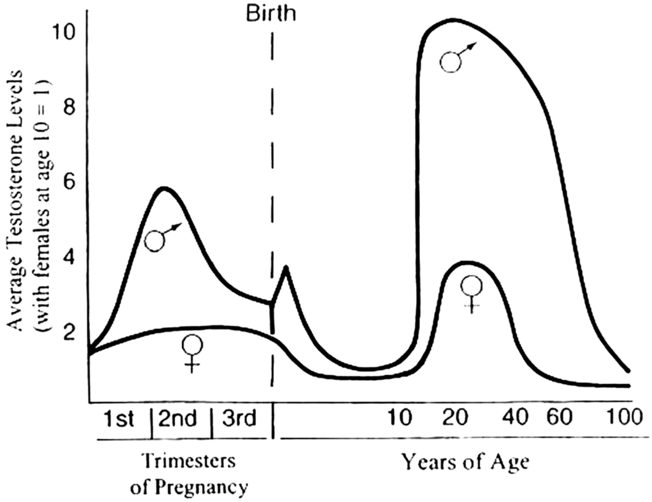

Figure 4.3. The androgenisation process during ontogeny. Source: Ellis, 2003.

This prenatal differentiation in brain organisation and functioning is of essential importance for understanding the sexually differentiated behaviour during postnatal life. However, the sexually differentiated masculinisation of the brain is not a dichotomous feature. Each gender shows a between-individual variability, resulting in a partially intersexual overlapping of the degree of masculinity (cf. Ehrhardt and Meyer-Bahlburg, 1979; Ellis, 1982).

The gender-specific genital morphology and physiology as well as the non-genital biological differences between the sexes not only determine different sexual behaviour, but also reinforce the learning processes concerning gender differentiated behaviour and gender identity and self-image (Shuttleworth, 1959).

Finally, socio-cultural factors can, especially during the first years of life, strengthen or weaken the gender identification process. Children develop their gender identity during the second year of life. During their third year of life they know how to sexually classify themselves and others. This recognition of one's own gender is internalised in what is called the gender role identification. This includes the internalisation of the gender role that is typical for the society in which one lives (cf. Hines, 1991; Udry, 2000).

All in all, both pre- and postnatal biological factors and cultural factors can influence the gender identification process. Discrepancies between biological sex and gender identity will show up more easily when there is a combination of hormonal, neurological, phenotypic and cultural ambiguity.

Wherever socio-cultural factors emphasise masculine-feminine dimorphism, the frequency distributions for gender specific behaviour will be wedged apart, inducing a disruptive development, whilst in the opposite case they will grow towards one another, favouring androgynous development. In this respect, Hrdy (1981, 14) stated the following:

> *"...it will be well to keep in mind a central paradox on the human condition – that our species possesses the capacity to carry sexual inequality to its greatest known extremes, but we also possess the potential to realize an unusual social equality between the sexes should we choose to exercise that potential."*

Most cultures neglect this plasticity and interpret or even try to model gender identity according to dichotomous and non-continuous categories, allowing Waber (1980, 57) to conclude:

> *"Thus, it is the culture which creates the dichotomies, not biology."*

MAJOR SOCIALLY RELEVANT CHARACTERISTICS OF HUMAN SEXUAL DIMORPHISM

It should be recalled that differences between the two genders must always be considered in the context of their evolutionary history. At the same time within-gender variability must also be duly taken into consideration, for many characteristics result in a substantial overlapping of the gender frequency distributions (Figure 4.4). Both the between-sex variability and the within-sex variability of many variables can considerably moderate existing or presumed between-gender differences. However, when a large number of characteristics are considered together, the male-female frequency distributions separate much more clearly (cf. Bayley and Bayer, 1946).

It is extremely difficult and quite artificial to dissect sexual dimorphism into various components. Sexually differentiated behaviour in a particular domain is in most cases related to several other domains of behaviour. Nevertheless, some broad categories of sexually differentiated characteristics can be distinguished. Here, five major groups of socially relevant biological differences between the sexes in the human are discussed: mind, body build, genital sexuality, reproduction, and health.

Mind

Some readers will probably be surprised to see this topic as the first issue being dealt with in this section. If the above-mentioned categories were to be considered from a purely biologically point of view, indeed, some other subjects, such as genital sexuality or reproduction might have been given priority. From the point of view of social relevance, however, it makes sense to start with the mental aspects of sexual differentiation.

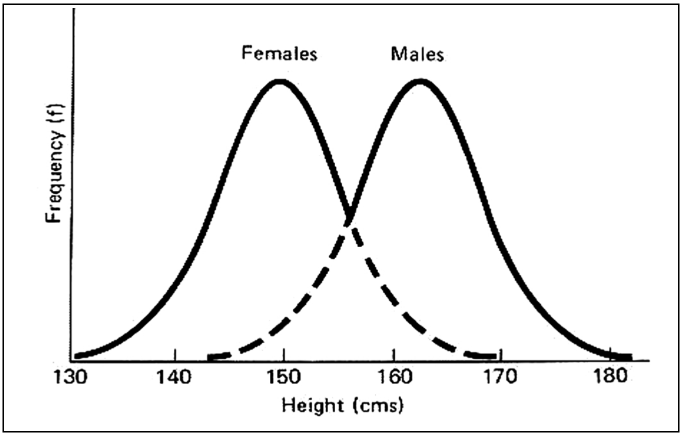

Figure 4.4. Within and between variability of sexually secondary characteristics. Source: Bennett, 1979.

As was explained above, starting during gestation the human brain undergoes an important sexual differentiation under the influence of a differential androgenisation. This differential neurological masculinisation – between as well as within each one of the sexes – continues and is reinforced from puberty onward and decreases only in the last stage of life, namely during senescence. In most cultures, value and norm systems (especially those of religious institutions) as well as socialisation processes (education) reinforce the behavioural outcome of this neurological differentiation. The sexual differentiation of the human brain and its behavioural consequences appear according to recent neuro-hormonal research to be quite substantial (cf. Hines, 1991; Moir and Jessel, 1992; LeVay, 1993; Baron-Cohen, 2003). As early as 1978, Witleson stated in this respect:

"The brain is a sex organ."

The sexual differentiation of the human brain influences both the emotional and cognitive personality characteristics of both sexes. During the first years of life, the effects of the differential masculinisation of the brain show up in the sexually differentiated play and social behaviour of boys and girls: boys engage more in rough-and-tumble play, are more interested in toys and other 'things', and are more fascinated by competitive and aggressive games, whereas girls are more interested in people and social contacts.

Later, in adolescence and adulthood, in interaction with sexual hormones, variability in the degree of masculinisation of the brain influences gender-specific behavioural patterns (cf. Money and Ehrhardt, 1972; Ehrhardt and Meyer-Bahlburg, 1979; Dörner, 1979; Legros *et al.*, 1979; Meyer-Bahlburg *et al.*, 2004): men are more driven toward energetic activity and assertiveness, are more violent and competitive, and are more risk-taking, features – features which, in particular circumstances, easily turn into aggressive behaviour. Men are more self-centred and single-minded, are more indifferent or hostile towards strangers or newcomers, and are less able to express their emotions. Men are obsessed with power and status, and are more interested in competitive (and violent) sports, economics and politics. Women, in contrast, are more sensitive to sensory stimuli and integrated perception, are more nurturing, are more interested in personal relationships and communication, and are more oriented towards social, religious and aesthetic values. Women are, on average, better than males at interpreting body language, vocal tone, and facial expression, are better at attributing subtle mental states to a person when interpreting the eye region of the face, and are better at identifying emotions overall. Women are, on average, better at making inferences about people's mental states and adjusting their behaviour accordingly. These data fit quite well the hypothesis about the evolved differences between male and female psychological mechanisms related to their respective mating and nursing strategies (cf. Connellan *et al.*, 2000; Lutchmaya and Baron-Cohen, 2002; Baron-Cohen, 2003; Knickmeyer and Baron-Cohen 2006; Van Vugt *et al.*, 2007; Pawlowski *et al.*, 2008; Pinker, 2008).

As far as concerns cognitive abilities, a distinction should be made between average and variance in general cognitive performance, and between general and specific cognitive abilities.

The question whether there are gender differences in average cognitive ability is a disputed matter. In most overviews it is concluded that tests measuring general intelligence appear to show no average gender differences (e.g. Maccoby and Jacklin, 1974; Colom *et al.*, 2000), but it seems that most intelligence tests have been constructed in such a way that they are sex-neutral (cf. Lynn, 1994; McGuinness, 1985). Applying several methods of measuring sex differences in intelligence, Lynn and Irwing (2004) and Jackson and Rushton (2006) report results showing that males would, on average, have a higher mean IQ than females, with the range of male advantage lying between 3 and 5 IQ points.

Whereas the gender difference in average general intelligence is a disputed matter, there is general agreement that there exists a small, but statistically significant between-sex difference in cognitive variance: the human male appears to show a somewhat larger variability in realised intelligence than the female who tends to congregate somewhat more around the mean. The larger male variability, moreover, exists for both extremities of the frequency distribution (cf. Ninton and Schneider, 1980; Deary *et al.*, 2003) (Figure 4.5). The male IQ distribution is one standard deviation larger than the female, implying that there are twice as many males with an IQ below 55 and above 145 (cf. Lubinski and Dawis, 1992; Jensen, 1998).

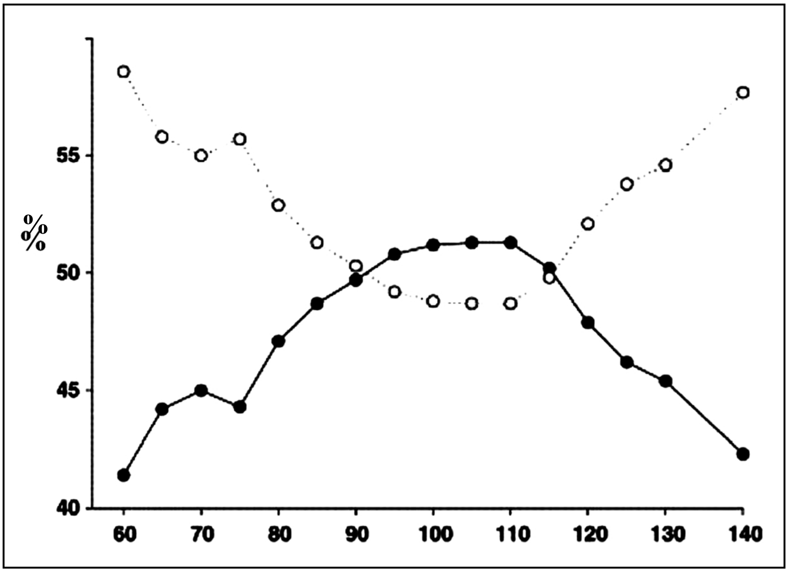

Figure 4.5. Percentages of boys and girls found within each IQ score band of the Scottish population born in 1921 and tested in the Scottish Mental Survey in 1932 at age 11. Source: Deary et al., 2003.
Legend: ● girls; o *boys. The y-axis represents the percentage of each sex in each 5-point band of IQ scores.*

In most cases, the higher frequency of mental retardation among males has a direct or indirect genetic cause (cf. Herbst, 1980; Vandenberg, 1987; Skuse, 2006). Men lack the advantage of the buffer effect of two X-chromosomes and display, moreover, a greater vulnerability during their ontogenetic development.

Men are also better represented in the higher intelligence categories. Furthermore, there appear to be more male creative artists, writers and scientists (cf. Eysenck, 1995; Kanazawa, 2003). For the moment, whether genetic factors are the main cause of these phenomena cannot be ascertained. Several explanations have been advanced which refer to the multiplicative or synergistic effect of several factors. Benbow and Lubinski (1993) have suggested that gender differences in values or commitment to full-time work might produce marked differences in achievement. Eysenck (1995) has advanced another possible explanation: psychopathology. Creativity appears to be closely related to psychoticism – a dispositional trait underlying schizophrenia and manic-depressive psychosis. Psychopathology in turn is twice as common among men as among women. Consequently, the lower creativity of women might be due to the fewer instances of psychopathology amongst females. Still another explanation might be that the sexually differentiated endocrinological profile interferes with cognitive abilities: androgenes could be responsible for the higher male drive for intellectual competition and performances (cf. Gooren and Kruijver, 2002; Correia *et al.*, 2005). The combined sex-age distribution of productivity in creative fields might be explained in this way (Figure 4.6). However, there can be no doubt that in most cultures, including the present (post)industrial one, women have fewer cultural opportunities to develop their intellectual talents (Graham and Birns, 1979).

Contrary to general intelligence tests, specific aptitude tests show statistically significant mean sex differences. On average, women appear to do better on verbal tests and memory tests, whereas men perform better on spatial and mathematical tests (cf. Maccoby and Jacklin, 1974; Kimura, 1999). There are also differences with visuo-spatial tasks: men are better with spatial ability tasks related to three-dimensional issues, whilst women are superior in object and location memory (cf. Silverman and Eals, 1992).

These average differences should not make us lose sight of the fact that the gender frequency distributions of the test results largely overlap, meaning that these differences are insignificant in everyday interpersonal relations. At the societal level, however, they may be relatively important in the sense that a substantially larger proportion of one or the other gender is present in particular occupational groups requiring specific aptitudes.

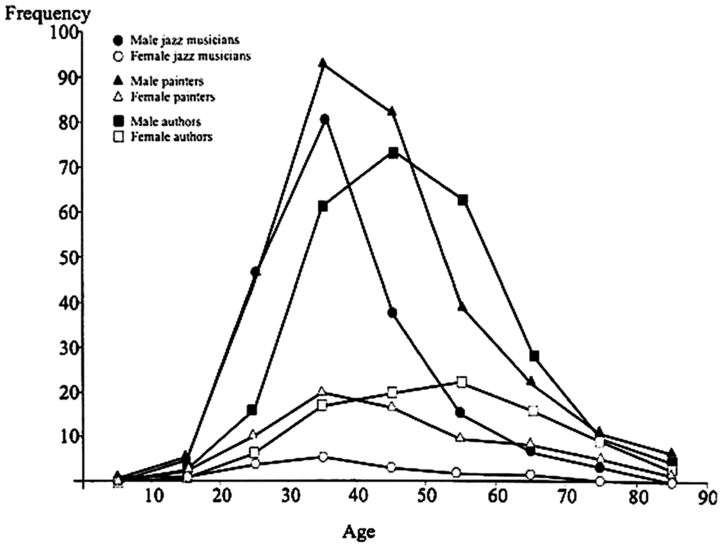

Figure 4.6. Sex-age productivity in creative field. Source: Kanazawa, 2003.

The proximate – i.e., ontogenetic – causes of gender differences in emotional and cognitive personality characteristics are now quite well understood. They are the direct consequence of the differences in prenatal masculinisation of the brain by androgens. At the same time, the ultimate causes – the evolutionary origin – of gender differences in emotional and cognitive personality are no longer a mystery. The specific human gender differentiation emerged during the hunting and gathering phase of human evolution. Men adapted to the requirements of hunting and agonistic behaviour and developed spatial skills for territorial exploration and weapon manipulation. Women, in contrast, specialised in gathering and nurturing, developed stronger social and verbal skills, and honed specific abilities such as object and location memory (cf. Correia *et al.*, 2005).

Body build

In terms of body build, men and women show, on average, many significant and subtle differences. From a social point of view there are two gender-specific features which are of salient importance: male body strength and female beauty.

The average larger male body build and greater muscular strength and speed is a well-known phenomenon. Selected to function well during hunting and agonistic activities, particularly during male-male competition, the male body build, combined with the neuro-endocrinologically programmed drives for energetic activity and assertiveness, is proximately valued as a sign of strength and health, and ultimately as an indication of ability to provide. However, in conflict or socio-pathological situations, larger and stronger male body build can easily lead to aggressiveness and dominance and create problems for women, who are, by and large, greatly underestimated. In such situations, it is usually women who are the victims of physical threats and harassments, abuse and rape. Practicing or viewing competitive and combative sports can act as a useful surrogate or escape for releasing the male drive for energetic activity (McGuinness, 1985).

The socially most important feature of the female body build has to do with beauty (Ridley, 1993). Although norms about female beauty show some between-cultural variation, beauty ideals are universally related to youth characteristics and to the typical hourglass body shape of women, both being indicators of the capacity to reproduce and the ability to give birth to the large-brained human infant. The male obsession with youth is characteristically human: due to the necessity to engage in enduring relationships and long periods of child-rearing, the value of female youthful appearance, which indicates a long reproductive period ahead, is culturally nurtured even beyond menopause (cf. Singh, 1993; Cellerino, 2003; Jasienska *et al.*, 2004).

Genital sexuality

Some socially important sexual differences are also to be noted with respect to genital sexuality. The differences in sexual morphology and physiology have a significant differential influence on perceptions, experiences and learning processes. Male sexual morphology and physiology is more clearly localisable and identifiable in time and space, which leads to more easy and rapid learning processes and reinforcement of sexual behaviour (Figure 4.7). Female sexuality is less sharply localised and perceptible. It is more diffuse and is more related to total personality. Rewarding learning and reinforcing processes, leading to orgasm, initially demand more time (Shuttleworth, 1959). However, whilst men appear to have, with respect to libido and orgasm, a lead in the initial stages of sexual life, women appear, after a somewhat more difficult start, to retain in the later phases of their sexually active life, and up until high age, a high potentiality to sexual activity (Kinsey *et al.*, 1953; Masters and Johnson, 1966; Fisher, 1973; Brewis and Meyer, 2005).

The specific female sexual potentialities were for a long time unknown – for many they still are – but in many cultures they were strongly suppressed either as a consequence of sexual taboos or due to fear of pregnancy or contraceptive abstinence. Sociobiologists usually explain sexual taboos against female sexuality as a consequence of human sperm competition resulting in male fear of female adultery which can, as a consequence of concealed ovulation, easily lead to a situation in which the male invests in offspring which he did not beget (Daly and Wilson, 1978).

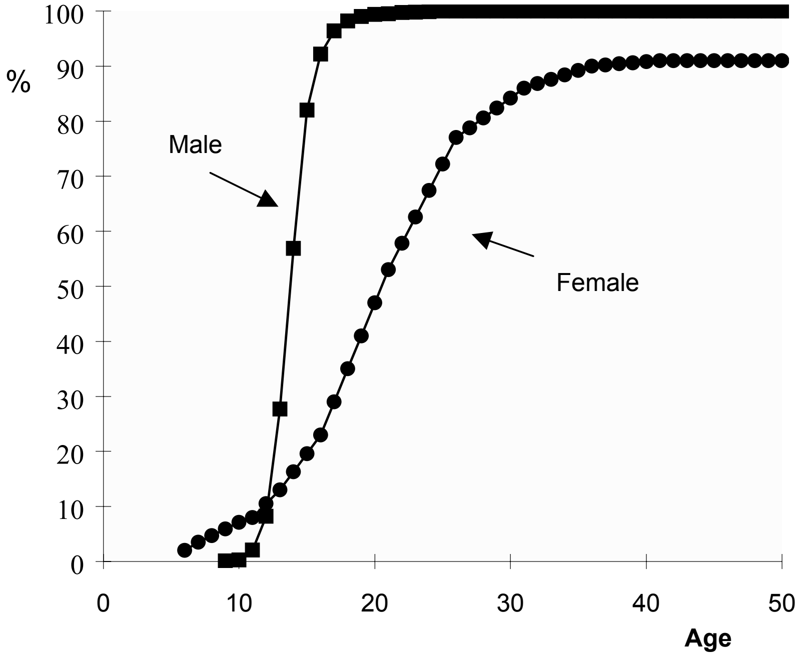

Figure 4.7. Cumulative incidence of orgasm from any source, by age and sex. Source: Kinsey et al., 1949; 1953.

This fear sometimes takes the form of an obsession with a double standard of morality with much stronger restrictions on female than on male partner choice and sexual behaviour resulting in practices or norms such as female-only concealment of features with a headscarf, wig, the chador, the niqab, the burqa, the chastity belt, seclusion, and genital mutilation. The latter – euphemistically called 'female circumcision' – is currently still practiced in a number of central and East African countries, and Near-East countries (Stutsman, 1990; Wikipedia, 2009). It consists of the surgical removal of the foreskin of the clitoris, or of the excision of the entire clitoris, and of all or part of the *labia minora*. In the most severe form – infibulation – the *labia majora* are also removed and the two sides of the vulva are sewn together, a procedure that is repeated after each birth. Such practices are aimed not only at preventing premarital or extramarital conception, but also to deny women sexual pleasure, and can be considered an extreme form of the male strategy to control female sexuality in order to protect paternal confidence and avoid the risk of cuckoldry (Batten, 1994). Male genital mutilation has also been explained, through its likelihood of reduced insemination efficiency, as an instrument of male-male competition (Wilson, 2008).

Neuro-hormonal sexual differentiation obviously also results in differences in sexual behaviour. However, even though males have a stronger drive toward energetic activity and assertiveness, resulting from higher androgen levels, this does not mean that women are necessarily passive and less receptive in sexual matters (Faulkner, 1980; Campbell, 2002). Female sexual specificity does not lie in a supposed higher passivity, but in a neuro-hormonal predisposition which incites her to more selective and choosy behaviour. For women sexual behaviour is still a much more risky enterprise with much more important implications than it is for men.

The predisposition in the human male toward a higher parental investment and a more enduring partner relation does not mean that his specific sexual physiology – the periodic urge for ejaculation – cannot lead to forms of sexual outlet – such as masturbation, promiscuity, prostitution, rape, paedophilia, and animal sex – that are less predominant among women. In the human male, the ontogenetic masculinisation of the brain leads to higher rates of risk-taking and sexual deviance: transvestism, voyeurism, exhibitionism, sadomasochism, fetishism (Figure 4.8).

Reproduction

Undoubtedly the most salient aspect of human sexual dimorphism is the larger share of females in reproduction: pregnancy, delivery, lactation, and primary care of infants. These features are not only controlled by neuro-hormonal processes, but are also associated with specific behavioural patterns or changes. The entire reproductive process, moreover, has substantial effects on the female perception and experience of life. Last, but not least, the reproductive process has important social implications, at the microlevel (relationships with partner and children) as well as at the macrolevel (role in society) (Bernard, 1974).

Health

Large body size, muscular strength, and speed are often interpreted as signs of male physical superiority, and this is associated and confused with better health. However, in modern culture virtually all health parameters indicate that the contrary is true: in matters of health, men are the weaker sex, whereas women constitute the stronger sex. In all age groups, pre- as well as post-natal, women in general show lower morbidity and mortality rates (e.g. Montagu, 1952; Potts, 1970).

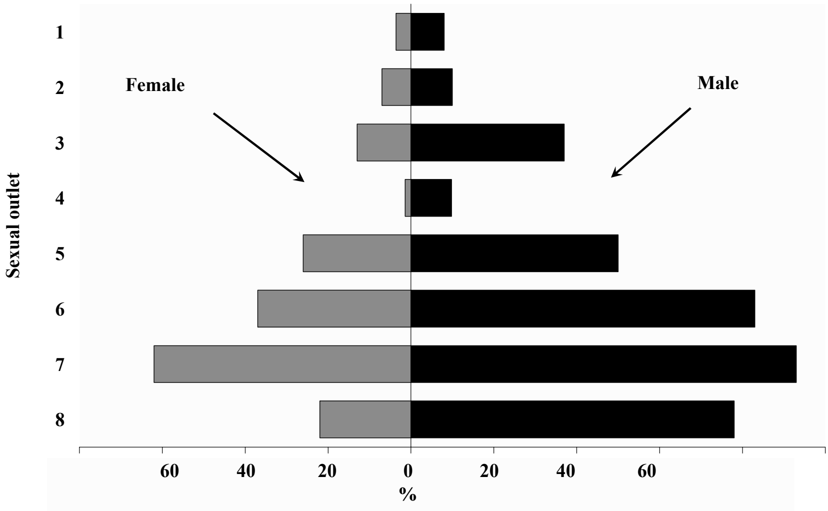

Figure 4.8. Sex differences in sexual outlet. Sources and legend sexual outlet:

1. Cumulative incidence of animal contacts (Kinsey *et al.*, 1953, 437);
2. Intercourse with more than one partner last four weeks (Léridon, 1993, 1388);
3. Cumulative homosexual experience to orgasm by age 45 (Kinsey *et al.*, 1953, 487);
4. Homosexual contacts last four weeks (Léridon, 1993, 1388);
5. Cumulative incidence extramarital coitus at age 40 (Kinsey *et al.*, 1953, 437);
6. Cumulative incidence nocturnal dreams to orgasm by age 45 (Kinsey *et al.*, 1953, 215);
7. Cumulative incidence masturbation by age 45 (Kinsey *et al.*, 1953, 173);
8. Readership of pornographic magazines in US (Shepher and Reisman, 1985).

In pre-modern living conditions, however, the situation was quite different. Girls and women showed a higher morbidity and mortality (Figure 4.9), a phenomenon for which at least two explanations can be given. First, women paid a much higher toll for their intense reproductive investment related to pregnancy, delivery and lactation (cf. Tabutin, 1978; Kruger and Nesse, 2006); second, girls and women, in matters of nutrition and care, were more likely to suffer from neglect and discrimination (Nussbaum and Glover, 1995). Proximate explanations for this neglect may be related to the more important male role as provider and defender, but its ultimate effect may have to do with the calculation by parents that a boy might have a higher chance than a girl in transferring his genes to the next generation.

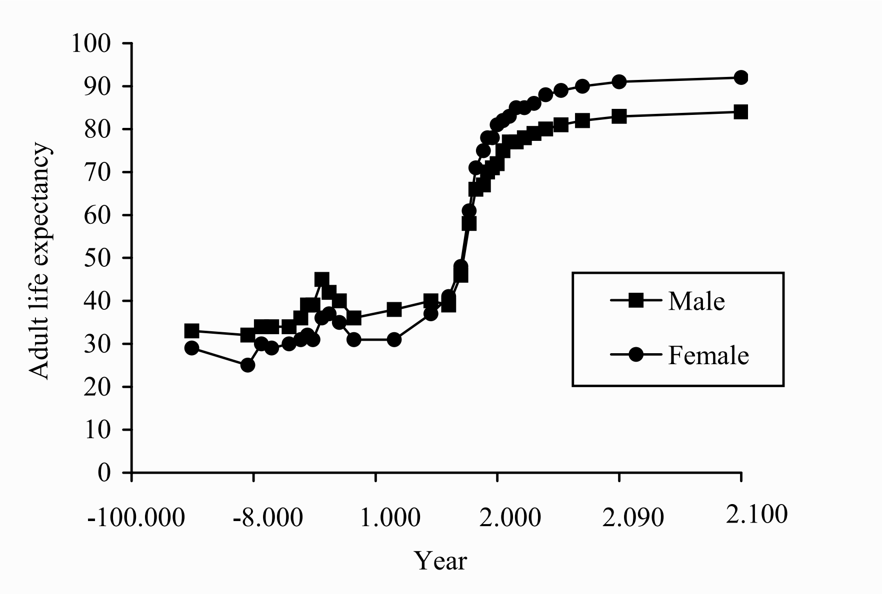

Figure 4.9. Change in life expectancy according to sex.

Interpretation of sexual differences in health status is often mistakenly disputed in a nature-versus-nurture perspective, when they should be approached from an interactive and feedback perspective, resulting in mutual reinforcement.

A direct genetic explanation for some of the male-female differences in morbidity and mortality lies in the Lyon hypothesis discussed above (Lyon, 1962; Gartler and Cole, 1981). Genetic factors are indirectly involved in the differential morbidity and mortality with regard to the slower maturation, and consequently the greater vulnerability, of the male (Waber, 1977). The same can be said for the health consequences of the greater recklessness and risk-taking behaviour males display as a result of their stronger neuro-endocrinological predisposition for competitive and agonistic behaviour. The higher frequency of criminality, traffic accidents, alcoholism and drug abuse, tobacco use, competitive sports activities, etc., and their associated health problems, must be interpreted in that perspective (cf. Harrison, 1978; Taylor, 1985; Wilson and Daly, 1985).

Some of the differential morbidity and mortality associated with occupational activities might, at first sight, be ascribed to socio-cultural factors, but here also genetic factors may be involved via a differential choice of occupational activity.

The greater physical resistance of women could, from an evolutionary point of view, be explained by the higher demands of their reproductive role, at least in pre-scientific living conditions. Pregnancy, delivery and prolonged lactation took a high toll. In present-day, modern living conditions, reproductive risks have been reduced in a double way: through better medical care and lower fertility. Moreover, thanks to the democratisation of modern culture, the former 'benign neglect' of girls and women has decreased (Cassidy, 1980). Now, the superior female resistance can be more fully revealed: in many developed countries the average life expectancy of women surpasses that of men by six years – in some countries even eight years is observed (Vallin, 2002).

OTHER SEXUALLY DIFFERENTIAL BEHAVIOURAL FEATURES

Crime

As argued in Chapter 2, criminal behaviour is one of the most striking differences in biologically related gender behaviour. Notwithstanding the fact that gender differences in crime rates have been decreasing slightly, particularly for minor offences, lasting recent decades (Wilson and Herrnstein, 1985), crime remains predominantly a male – especially a young male – form of behaviour (e.g. Smith and Visher, 1980; Moir and Jessel, 1995). Male criminality appears to be strongly associated with aggressiveness and other primary drives, and can show up at young ages, before learning and socialisation have had the opportunity to differentiate gender behaviour (Maccoby and Jacklin, 1974).

At the proximate level, these differences can largely be explained on the basis of sexual dimorphism in morphology and physiology – the larger body build, stronger musculature, masculinised brain physiology, higher levels of androgen production, ejaculation physiology, etc., of males. Ultimately they are to be explained by the differences in sexual and reproductive strategies, resulting in a more intense male competition associated with higher risk taking, particularly at younger ages. This does not mean that every male is a potential criminal – within-sex variability should not be lost sight of – but that in particular circumstances of deprivation and/or moral decay, many more males than females are tempted by various forms, in particular violent forms, of criminal behaviour (Figure 4.10).

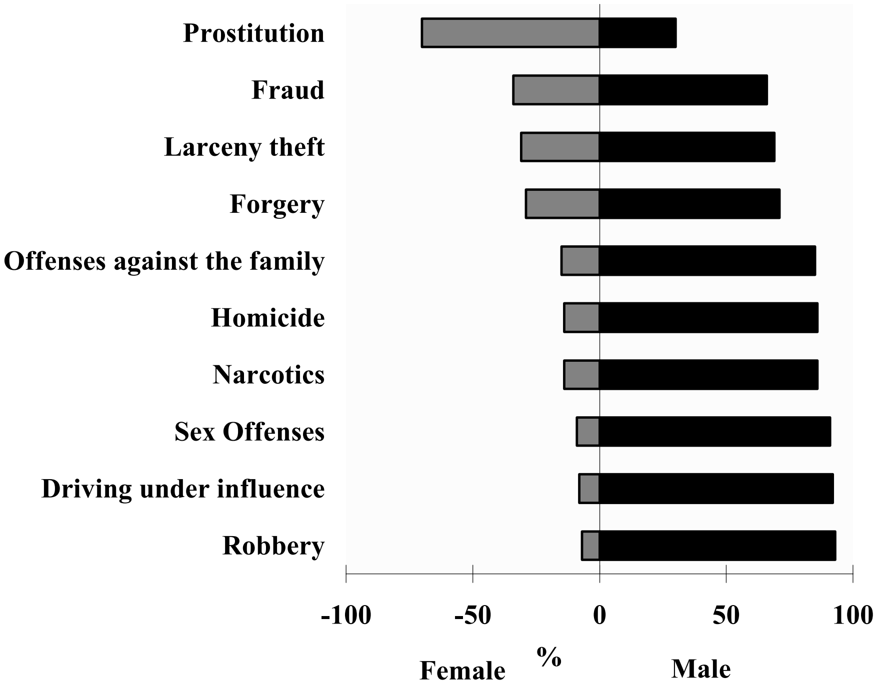

Figure 4.10. Gender differences in criminal behaviour. Source: Wilson and Herrnstein, 1985.

Homosexuality

In recent decades, homosexual behaviour has become a subject of interest in the media and a topic of discussion in policy quarters. Various factors may have contributed to this rising interest: the increasing ideological pluralism in advanced democratic societies, the progress of egalitarianism in general, the advance in scientific knowledge about homosexuality, the shift from a belief-based towards a knowledge-based ethics, the impact of the 'holebi' social movement (= homosexuals, lesbians and bisexuals) that has succeeded in getting its demands on the public agenda. The attention, if not commotion surrounding this issue is greatly disproportional to its demographic prevalence. Both historical-ideological and biological factors are probably at the root of this controversy.

It appears from probability sample surveys in different countries that the prevalence of same-sex couples is statistically very limited (Diamond, 1993). In addition, the proportion of people identifying themselves as homosexuals or having a homosexual relationship is very low. In the American National Health and Social Life Survey of 1992 (Laumann et al., 1994) 2.8 percent men and 1.4 percent women reported some level of homosexual (or bisexual) identity. The percentages reporting any same-sex partners since age 18 amounted to 4.9 percent among males and 4.1 percent among females. A recent British survey reports 5.2 percent of men and 2.7 percent of women ever having had any homosexual experience (Wellings *et al.*, 1994). A recent French survey reports 4.1 percent of men and 2.6 percent of women having had any same-sex partner in their entire life (Spira *et al.*, 1993). These figures may be somewhat underestimated, due to the lingering effects of the traditional ideological rejection or prohibition of homosexual behaviour, which still may prevent some people from overtly expressing their homosexuality (Muscarella *et al.*, 2001). Santtila *et al.* (2008), found in an investigation on homosexual behaviour in 6001 female and 3152 male twins that 33 percent of the men and 65 percent of the women reported a potential to engage in homosexual behaviour but 92 percent of these men and 98 percent of these women reported no overt homosexual behaviour during the preceding twelve months, thus largely confirming the results of the above-mentioned probability surveys.

Proximate causes of homosexuality

Research has well documented that male homosexuals have more feminine traits than male heterosexuals just as female homosexuals are more masculine than female heterosexuals. More feminine males have also a higher probability self-identifying as homosexuals, and being attracted to or have same-sex partners (Udry and Chantala, 2006).

The determinants of homosexuality have long been and are in some quarters still a matter of vigorous dispute. It is one of the examples of the age-old nature-nurture controversy that sets the social and biological sciences in opposition (cf. Ruse, 1988). Hence, it is not surprising that there are several theories about the proximate causes of homosexuality, although the weight given to them has substantially changed in recent decades. Until the 1960s, homosexuality was largely considered, in the Freudian tradition, to be the result of early childhood influences such as an over-involved mother and distant, hostile father. By the middle of the 20th century views on the causes of homosexuality shifted to hormonal imbalances at different levels of development. In recent decades the study of genes and their influences on homosexual behaviour has become more prominent (Muscarella *et al.*, 2001).

There can be no doubt that particular situational circumstances (such as the absence of access to partners of the opposite sex in boarding schools, prisons, army, or cloisters) or cultural values and norms can elicit, at least among part of the population involved, a (temporary) situational homosexual behaviour (cf. Gagnon and Simon, 1973; Diamond, 2003).

With regard to lasting homosexual behaviour, some believe that learning processes and parental influences – dominating, overprotective or smothering mothers, and authoritarian or absent fathers – during the early phases of life when sexual identity needs to be fixed or reinforced, can influence the course of sexual orientation later in life (e.g. Bieber *et al.*, 1962; West, 1968; Cass, 1979; Fisher and Greenberg, 1977; Troiden, 1989). However, most scholars in the field are of the opinion that social and cultural causes show only a small effect (cf. Bailey and Pillard, 1991) or, which is more probable, that they interact with genetic or ontogenetic predispositions (cf. Byne and Parsons, 1993; Satinover, 1996).

A first indication for the probable role of biological factors in the aetiology of homosexuality is found in studies of gender-nonconforming behaviour that show them to be the strongest predictor of a homosexual orientation for both men and women (cf. Bailey and Zucker, 1995; Zucker, 2005), although such studies don't say anything about the exact biological factors involved. Cochran and Ewald's (Cochran *et al.*, 2000) speculative theory about a pathogenic origin of homosexuality, suggesting that homosexuality might be caused by an infectious disease, has so far not found any support in the profession.

At the same time, in recent years further hard evidence has been brought to the fore in several domains of the biological sciences confirming earlier findings that neuro-hormonal and genetic factors can be involved in the aetiology of homosexual behaviour.

Endocrinological findings

Earlier findings on the relations between homosexuality and adult hormonal levels have not generally been confirmed. Recent comparative studies instead point to the conclusion that adult hormonal levels are not an important factor in sexual orientation. In contrast, investigations on prenatal hormonal influences on sexual orientation seem to be more conclusive. The differential exposure to hormone levels during foetal development, as a result of foetal and maternal immune systems, maternal consumption of certain drugs, maternal stress, or direct injection, may influence the process of masculinisation of the brain in homosexual men (cf. Gooren, 1990; Meyer-Bahlburg, 1990; Cohen-Bendahan *et al.*, 2005).

In 1997, it was discovered that in men, sexual orientation correlates with the number of older brothers, each additional older brother increasing the odds of homosexuality by approximately 33 percent (Blanchard, 1997; Blanchard and Klassen, 1997). This fraternal birth order effect was hypothesised to reflect a progressive immune response of the mother to androgens and/or Y-linked minor histocompatibility (H–Y) antigens that, by maternal transfer of these immune antibodies to the foetus, could impair brain masculinisation of the foetus. The fraternal birth order effect has been confirmed in several other epidemiological studies suggesting that a late birth order and a higher brother to sister ratio in the family correlate with a homosexual orientation in men. The mother's body appears to 'remember' previously carried sons, altering the foetal development of subsequent sons and increasing the likelihood of homosexuality in adulthood (Blanchard, 2001; 2004; Gooren, 2006). However, James (2004) finds the evidence for the hypothesis of postnatal learning to be stronger.

Neurological findings

In recent years a number of sections of the brain have been reported to vary according to sexual orientation. Several researchers (e.g. Allen *et al.*, 1989; LeVay, 1991; Swaab *et al.*, 2001) have documented various differences in the anatomical structure of the hypothalamus between homosexual and heterosexual men. Swaab and Hofman (1990) also reported a difference in the size of the suprachiasmatic nucleus between homosexual and heterosexual men and Allen and Gorski (1992) reported a difference related to sexual orientation in the size of the anterior commissure. Recently, differences in brain structure have also been reported according to sexual orientation in women: compared with heterosexual women, homosexual women display less grey matter bilaterally in the temporo-basal cortex, ventral cerebellum, and left ventral premotor cortex. The relative decrease in grey matter is most prominent in the left perirhinal cortex. Thus, in homosexual women, the perirhinal cortex grey matter displays a more male-like structural pattern (Ponseti *et al.*, 2007).

Genetic findings

The earlier genetic studies on twins and other degrees of relatedness (cf. Kallmann, 1952; Schlegel, 1962; Heston and Shields, 1968), about the high concordance in homosexual behaviour according to the degree of genetic relatedness have been confirmed by newer investigations (e.g. Pillard *et al.*, 1982; Hoult, 1984; Eckert *et al.*, 1986; Bailey and Pillard, 1991; Buhrich *et al.*, 1991; King and McDonald, 1992; Whitman *et al.*, 1993; Hershberger, 2001). Averaging the available studies today, the heritability of male sexual orientation is estimated to be about 50 percent, implying that either chance or non-genetic agents also play a substantial role in the aetiology of male homosexuality (James, 2005). Female sexual identification would be more a matter of environment than of heredity (Hamer and Copeland, 1998).

Several research teams have identified genetic markers on the X chromosome linked to male sexual orientation (Hamer *et al.*, 1993; Hu *et al.*, 1995; Mustanski *et al.*, 2005). It has also been reported that mothers of homosexual men have a higher prevalence of extreme skewing of X chromosome inactivation than mothers without gay sons (Bocklandt *et al.*, 2006).

All of these findings suggest that prenatal hormonal, neurological, and genetic factors can play a role in the development of homosexuality. As far as concerns the question of the degree to which social and biological determinants contribute to the aetiology of homosexuality, it appears that most experts are of the view that it is, as yet, difficult to quantify the respective effects of genetic factors, intra-uterine influences and the post-natal environment. Given the current fragmentary knowledge, it is particularly difficult, if not impossible, to say in what combinations and with what frequencies different determinants manifest themselves in the homosexual population. In some cases, it may be mainly genetic factors, in other cases it can be intra-uterine influences, and in still others it could be identity-shaping social living conditions and learning processes early in life that predominate in the development of the homosexual personality (James, 2005). However, most authors are of the opinion that sexual orientation is shaped at an early age through complex interactions of biological, psychological and social factors (e.g. LeVay, 1993; Byne and Parsons, 1993; Satinover, 1996).

Evolutionary explanations

Within the *Ordo Primates* long-lasting homosexual behaviour, outside the maturing life phase or in the presence of both sexes, seems to be a specifically human characteristic (cf. Ford and Beach, 1951; Nadler, 1990). Occasional homosexual behaviour among animals arises from factors such as dominance-submissive relations, crowding, captivity or the absence of members of the opposite sex.

Human homosexual behaviour, in the sense of a lasting erotic and emotional preference for members of the same sex, creates a paradox for sociobiology: how can homosexuality be transmitted and maintained in the population if its carriers don’t produce as many children as heterosexuals (Ruse, 1988)? Although many homosexuals reproduce, their fertility is, indeed, markedly lower than that of heterosexual people (Bell and Weinberg, 1978). However, according to some scholars (e.g. Mellen, 1981), homosexuality occurs much too frequently to be accounted for only by recurrent chance mutations. That is the reason why evolutionary biologists have been looking for other mechanisms through which genes or ontogenetic processes promoting homosexuality would have been favoured in human evolution. Several explanations have been given for this paradox (Muscarella *et al.*, 2001).

An old but obsolete explanation, apparently going back to Aristotle (Kirsch and Weinrich, 1991), is the idea that homosexuality provides a mechanism to limit population size. Since homosexuals are supposed to produce fewer offspring, homosexuality would spread under conditions of high population density, resulting in lower population growth. This 'density-dependent maintenance of homosexuality' is a typical example of 'group selection' theory that has been shown to be at odds with the basic mechanism of Darwinian selection (Trivers, 1985).

The current evolutionary explanations of homosexuality can roughly be classified into three major groups: (1) homosexuality is an evolutionary maladapted form of behaviour and is being selected against; (2) homosexual behaviour has some selective advantages resulting from interactions with other genes or interactions between individuals, the latter including theories based on kin selection, reciprocity, parental manipulation, and homosociality; (3) homosexuality is a by-product of one or more facets of the hominisation process, in particular of the increasing plasticity of the human brain and the feminisation process during human evolution.

The theory that homosexuality is a maladaptive characteristic or a biological error (genetic or ontogenetic), is a classical explanation (cf. Ellis, 1898; Alexander, quoted in Ruse, 1981). Mutations, unfavourable gene combinations or ontogenetically caused homosexual orientation introduce the deviant behaviour in the population in each generation and selection through lower fertility reduces its frequency and limits its prevalence to a minority phenomenon, just as is the case with other morphological, physiological or behavioural deviations. In modern, advanced democratic societies, where egalitarian ideologies have gained a firm foothold, many reject the maladaptive explanation, mainly on ideological grounds. In 1973 the American Psychological Association removed homosexuality from its 'Diagnostic and Statistical Manual of Psychological Disorders' and in 1994 it stated that "homosexuality is neither a mental illness, nor a moral depravity, but it is the way a portion of the population expresses human love and sexuality". Explanations of particular sources of biological variation are combined with ethical attitudes to be taken towards such sources of variation.

The view that homosexual behaviour has some selective advantages resulting from interaction with other genes is based on the 'Balanced Polymorphism' or

‘Superior Heterozygote’ theory (Hutchinson, 1959; Kirsch and Rodman, 1982; Miller, 2000). This theory is based on the hypothesis that genes determining sexual orientation would have a reproductive advantage in heterozygous combination over both homozygote genotypes – a phenomenon also known as ‘heterosis’.

The possible multiple phenotypic effects of some genes on the X chromosome appear from an epidemiological study by Camperio-Ciani *et al.* (2004). In this study it was found that female relatives of homosexual men tend to have more offspring than those of heterosexual men. The researchers hypothesised that genetic material is passed down on the X chromosome that promotes both fertility in the mother and homosexuality in her male offspring. Zietsch *et al.* (2008) also inferred from their findings on a large community-based twin sample that a predisposition to homosexuality might confer a mating advantage in heterosexuals, which could help explain the evolution and maintenance of homosexuality in the population.

Some sociobiologists (e.g. Weinrich, 1978; Wilson, 1978) have explained homosexuality via the theory of ‘kin selection’ that states that the genes of an individual can be selected not only through his or her direct descendants, but also via the descendants of relatives whom one altruistically supports. In the case of homosexuality, this would imply that people with such an orientation, who reproduce themselves at a lower rate or even not at all, but would, through their altruistic support, enhance the reproductive success, namely the inclusive fitness of their close relatives. Depending on the degree of relatedness between the homosexual and his or her supported kin, the genes of the homosexual would thus also be transmitted to the next generation and remain in the population’s gene pool. The kin selective effect of homosexuality might be of particular importance if homosexuals were characterised by socially valuable characteristics such as enhanced sociality or intelligence (Rancour-Laferriere, 1985). Kirkpatrick (2000) has argued that homosexual behaviour results from individual selection for reciprocal altruism, which would have contributed to a reduction in inter-male aggression. Based on Trivers’ (1974) theory about parent-offspring conflict, Ruse (1984; 1988) refers to parental manipulation as a possible cause for homosexuality. Several scholars (e.g. Ross and Wells, 2000) have advanced the theory that homosexual behaviour is favoured by the advantages of same-sex bonding. In the course of human evolution, homosociality, particularly among males, contributing directly to survival and indirectly to reproduction, would have elicited homosexual behaviour.

Many researchers are of the view that homosexuality in the human is a by-product of the plasticity of the human brain and the resultant variability of human sexuality (cf. McKnight, 1997; Thiessen, 1996; Rahman and Wilson, 2003). Mellen (1981) sees homosexuality as a side-effect of a galloping hominisation that advantaged less aggressive, more social, sensitive and communicative males, resulting in an excessive feminisation of some male individuals or as a consequence of neotenic changes which in some individuals caused certain terminal stages of male behavioural differentiation to arrest at a late premature stage. This type of explanation links up with the classical view that homosexuality is a deviation, a development which went a little bit too far in its trend, but which could be genetically transmitted via heterosis or kin selection. This hominisation side-effect theory would also explain why homosexuality is much less prevalent among women who had, in the Environment of Evolutionary Adaptedness (EEA), no reason to become more masculine. Mellen (1981, 256) formulated it as follows:

> *"...it was then advantageous for males to become a little*
> *more like females in those respects – but not vice versa."*

More recently the idea of linking the development of homosexuality to the feminisation process in human evolution has been further developed, albeit with some variation in emphasis. Thus, Miller (2000) has suggested that male homosexuality is a by-product of variable brain feminisation, produced by a polygenetic system in which single alleles for greater sensitivity, empathy, tenderness, and kindness make heterosexual carriers of those genes better fathers and more attractive mates. Rahman and Wilson (2003) proposed that variations in genotypes produced hominid males who were more feminine in behavioural traits and bisexual in sexual preferences. Females were attracted to such males because they were associated with decreased aggression and infanticide, and superior parenting behaviour. Over time, this choice led to the evolution of alleles associated with exclusive homosexual interest.

Homophobia

All known cultures favour copulation between males and females (Ford and Beach, 1951), whereas exclusive homosexuality as a sexual option is not favoured, even in those societies where homosexual behaviour is generally approved. There exists, however, a cross-cultural variation with respect to the acceptance of homosexuality as a minority or supplementary behaviour (Carrier, 1980; Ruse, 1988).

In Western societies, the traditional attitudes toward homosexuality derive from Judeo-Christian ideology that strongly condemns, punishes and persecutes same-sex relations. Behind this homophobia, Marmor (1980) sees deep-seated fears and anxieties, fostered by one or more of three major factors: deep-seated insecurity concerning one's own sexuality and gender-identity, strong religious indoctrination, and simple ignorance about homosexuality. Without denying the impact of those factors, sociobiologists would point to still another and perhaps more basic cause for homophobia: in terms of maximising their inclusive fitness, people may, indeed, have an interest in the sexual orientation of their offspring (Gallup 1995; Gallup and Suarez, 1983).

The future of homosexuality

In the immediate future, the prevalence of homosexual relationships, as they become less stigmatised, may be expected to further increase, or at least to become more visible. As the evidence is corroborated that homosexuality is largely determined by biological (genetic and/or ontogenetic) factors, and with the shift from a belief-based towards a knowledge-based ethics and as egalitarian pluralism further progresses, we may anticipate that the social acceptance of homosexual households and families, as a minority variant, will increase. In most Western countries same-sex couples can now register their partnership and in some countries (including the Netherlands, 2000; Belgium, 2003; Canada, 2005; Spain, 2005; South Africa, 2006; and some states of the United States) they can marry and have the same rights and obligations as heterosexual couples.

On the question of the possible effects of homosexual partnerships on children, the professional literature is still clearly divided, partly because of ideologically oriented positions, partly because of the weak methodological background of many studies (Morgan, 2002; Muehlenberg, 2003; 2005; Redding, 2007).

In our modern multi-million person societies, same-sex relationships do not constitute a threat to the reproductive continuity of society, and whilst they may be tolerated it is unlikely that they will become a model to be widely pursued. At the individual level, one shouldn't expect that the inclusive fitness-related fears about one's own sexual orientation or the gender identity of one's children will diminish or disappear.

A possible longer-term consequence of the lifting of the taboo on homosexual relationships might be that the genes for same-sex preference will decrease in the gene pool, since transmission of genes for homosexuality via (forced) heterosexual relations will be reduced. The increasing number of homosexual unions would likely decrease pairings of unknowing heterosexuals with covert homosexuals. Wilson (1978) also predicted a gradual decrease of the prevalence of homosexuals in modern culture, but on account of a different factor: since increasing mobility decreases the nearness of close kin, humans become more mixed genetically so that selection for altruistic acts can no longer operate on the basis of close relatedness between altruist and recipient.

It is also not impossible that environmentally induced homosexual behaviour, for instance related to early life experiences such as overprotective motherhood and authoritarian fatherhood, could decrease thanks to progress in psychological and pedagogical insights and their social dissemination.

However, if (male) homosexuality is, indeed, evolutionarily linked to the gracilisation, in particular the feminisation of the human male in the hominisation process, and these trends – gracilisation and feminisation – continue to progress, the prevalence of homosexuality might just as easily further increase.

Sex-related social differences

In modern culture, sex-related social differences are characterised by two major features: (1) on average, women are still in a socially inferior position; (2) women are in a process of slow and gradual improvement of their social position (Avramov, 2003).

The socially inferior position of women applies to virtually all spheres of social life: women participate less in political decision making, they are almost not at all involved in control of the economy, and they are less represented within the power and prestige elites in the fields of policy, economy, administration, science and culture. In some more traditional elite groups, such as the military and religious professionals, they are almost completely absent.

In many countries, women still participate at lower rates in higher education, fill less valued jobs, and have fewer opportunities for social upward mobility. Some authors even argue that the prestige of certain occupations is co-dependent with the gender of its members. Women participate at lower rates in the labour force and are more, or even exclusively involved in family labour. In general women have, *de facto* or *de jure*, fewer rights and privileges.

Social inferiority is not only characterised by a less significant participation in political power, economic control, cultural and scientific production, etc. It is also accompanied by a lower prestige in the eyes of the superior group, and by an inferiority complex within the subordinate group itself about its characteristics and potentialities. Usually, this social inferiority complex manifests itself at various organisational levels of social life, ranging from general societal structures, to occupational and leisure relations, to basic social units – families and households – where, incidentally, the sense of inferiority first emerged in previous cultural epochs.

The social subordination of women is reflected not only in socio-economic and legislative data, but also in gender differentiated behavioural data on pornography use (Berger *et al.*, 1991), aggression, harassment, abuse, and rape, as well as on the gender specific protective, if not cloistering, measures taken by husbands and parents with their wives and children (cf. Selverstone, 1989). While from a biological perspective women are in many ways the stronger sex, sociologically women have rightly been identified as ‘le deuxième sexe’ (de Beauvoir, 1949).

The social subordination of women is, from a cross-cultural point of view, a virtually universal phenomenon (cf. d’Andrade, 1966; Goldberg, 1974; 1993), though it has not always manifested itself with the same intensity in the consecutive cultural phases through which the human species passed in the course of its evolution. By and large, the social position of women was better in the hunting and gathering cultural stage than in the following agrarian and early industrial cultures (cf. Gough, 1971; Rohrlich-Leavitt, 1975). In the later phases of industrial culture, women’s social position gradually improved again, but this brings us to our second issue.

The process of modernization has been characterised by a gradual improvement of women’s social position. Several important social changes may be observed. Among the most salient and basic changes is the impressive increase in women’s educational status. In the most advanced industrial countries women now attain the equal and sometimes higher participation rates than men at higher levels of education (Figure 4.11).

Another significant change is the increasing participation of women in the labour force, though the levels reached in the educational field have not yet been achieved in this area of social life (Tiedje *et al.*, 1990). Women’s progress in education has not yet fully translated into a corresponding improvement in occupational upward mobility.

In many countries, the former inequality between the sexes has been or is being changed by the introduction of legislation aimed at realising gender equity and equality (cf. Booth and Bennett, 2002). Even at the international level, the demands for equal rights legislation and other emancipatory measures are now deeply embedded in United Nations charters such as the Action Programmes resulting from the International Conference on Population and Development (1994) and the International Conference on Women (1995).

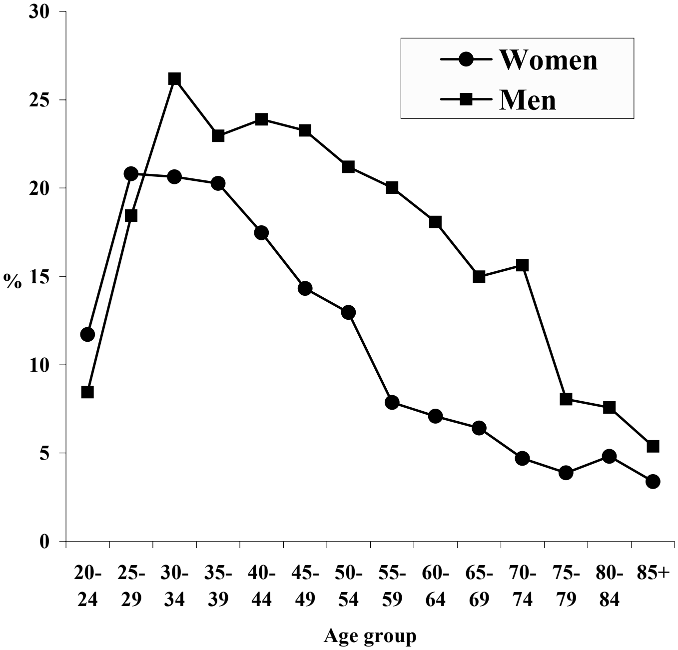

Figure 4.11. Third level education in the European Union by sex and age (ECHP, 1996–1998). Source: Avramov (2003).

The increase in female labour participation outside the house has been accompanied by a tentative shift in male/female tasks and roles division. Whilst one would expect that increasing female labour participation would be accompanied by a comparable increasing male involvement in family labour, surveys continue to document asymmetry in the gender distribution of occupational labour versus family labour. This has resulted in the notorious double (if not triple) load in women's work: whilst women are taking up occupational labour tasks outside the house, they continue to perform their traditional household tasks and caring functions for children and other family members (cf. Hochschild, 1989; Van Dongen *et al.*, 2001; Van Dongen, 2009). This leaves them less time for other life-fulfilling activities, such as leisure and politics. Obviously, there has been a change: more and more men, particularly in the younger age cohorts and of higher educational levels – the dual career group (Thompson and Walker, 1989) – have started sharing household and other family labour tasks with their partners. On the whole, however, men's emancipation in these areas of social life is lagging behind that of women.

The increasing participation of women in occupational labour outside the house has not been accompanied by sufficient changes in social structures allowing women to combine occupational labour with family labour. This is one of the reasons why more and more women are switching to part-time jobs, a situation which is, obviously, not favourable to reaching full equality with men. Part-time jobs, indeed, often keep women in a weak social position with low pay and without prospects for professional advancement (cf. Thompson and Walker, 1989; Benbow and Lubinski, 1993).

Despite important improvements in women's positions in the labour force complete equality is still a distant goal. Even very advanced countries such as Sweden, which have developed progressive gender-related social and economic policies are still gender-segregated class societies with the upper classes dominated by males and the middle and lower classes made up by a majority of females. Moreover, the progress in women's emancipation has sharpened a gender-based class struggle whereby men try to maintain their favourable positions, rather than accept measures to promote equality (Björnberg, 1994).

Sexism

In several respects, biological variation seems to be important to people: it is a source of a variety of gratifications such as enhanced self-esteem, power, opportunities for developing one's own interests, exploration, and fulfillment, but it is also a source of competition and conflict, of envy and frustration.

What about sexual variation? Do sexual differences matter? Many feminists think they do not, and, hence, should be disregarded. Most scientists, however, are of the opinion that they do matter (cf. Zihlman, 1987; Low, 2001).

Sexual dimorphism is important in more than one respect. Biologically, it is the instrument of generational replacement and evolution. It is the most salient source of biological variation, much more significant than most other sources of human biological variation such as general inter-individual variation, and inter-population variation. Socially, sexual variation is associated with forms of social organisation strongly related to social differences in general. It is, however, valued in a differential way in different societies. For individuals, finding and/or keeping a partner of the other gender is one of the major sources of human motivation and action and, last but not least, it is one of the most important, if not the most important source of happiness. It can, however, also be an important source of competition and conflict, of frustration or grief.

It is a virtually universal phenomenon that sex and gender differences are associated with social inequalities and inequities in power, rights, privileges, status, and prestige. Moreover, these inequalities and inequities are, in most cultures, ideologically reinforced and justified (Sharma, 1987). Based on the example of the concept of ‘racism’, the term ‘sexism’ has been coined to define ideological and social systems in which sexual variation is used as a primary criterion to assign normatively differentially valued roles and tasks in society (Duberman and Azumi, 1975).

Sexist ideologies

In most cultures the socially inferior position of women has been codified, if not sanctified in the socially dominant religious and political ideologies and related institutions (Sharma, 1987).

Although tribal societies are, on average, characterised by more equal gender relations than most agrarian cultures, the existence of biosocial differences in tasks and roles of both sexes even in that context reveals the pervasiveness of ideological positions favouring or strengthening male dominance. In particular, the important biological role of women in the reproductive process is perceived by men as frustrating, if not threatening. This stress situation has been countered in history by the development of a male dominance mythology aimed at socially redressing the biological imbalance (Sanday, 1981).

In the agrarian cultural phase two important types of religions can be distinguished: ethnic and universal religions. Whereas the first, largely structured on kinship relations, fostered male dominance with a view of ensuring the purity of the bloodline in order to protect ethnic identity, the second usually started as egalitarian reform movements, initially including women in religious activities that transcended the roles of motherhood and housewife. However, as soon as these reform movements – incidentally, all of which were mainly instigated by men – became embedded in the social structures and processes of agrarian society, they took over the prevailing patriarchal structures and provided ideological foundations for male dominance. The development of agrarian kingdoms that were characterised by an intensification of the male stress syndrome due to a rise in the within- and between-group male competition, warfare, and the desire of the rulers to perpetuate intergenerationally their lineage, formed a favourable breeding ground for the ideological justification of male dominance. Double standards accompanied the propagation of this ideology, especially with regard to sexual matters and job discrimination, particularly in religious and political matters (Karimi-Boosherhi and Rasouli-Nia, 1988; Jogan, 1989).

Sexism, sexual emancipation, and science

In recent decades, several feminist authors (e.g. Easlea, 1981; Fausto-Sterling, 1985; Hubbard *et al.*, 1979; Sayers, 1982) have accurately shown that some biologists and physicians in the nineteenth century and even in the twentieth century unwarrantedly advanced (pseudo)biological arguments to explain and even justify the socially inferior position of women in family and society, and to combat movements or proposals aimed at emancipating women.

One wonders how it is possible that some scientists got involved in such misogynistic and anti-feminist action? This is an important question because they should have approached reality with objectivity and detachment. Scientists bear, due to their advanced knowledge, an enormous social and humanitarian responsibility.

There are probably several explanations for this paradoxical situation. In the first place, scientists – however qualified they may be in their own limited field – do not always sufficiently take into consideration the multisided and multidisciplinary nature of the issues and problems they study. Moreover, some do not adequately distinguish – especially in fields that are not yet well developed – between hypothesis, theory and fact. Last, but not least, scientists do not always succeed in freeing themselves from ideological prejudice or self-interest. It is not merely a chance phenomenon that the scientists who developed arguments confirming the so-called biological inferiority of women, or who fought the women's emancipation movement, belonged to the socially dominant (and male) strata of society. Jason-Smith (1980, 86) rightly articulated this phenomenon:

> *"Historically, at least, science has instead tended to provide such evidence as supports the ideology of the ruling classes who make the political decisions."*

It is not surprising, therefore, that some feminists have concluded that the biosocial sciences bear considerable responsibility for supporting conservative ideologies and legislation aimed at maintaining the traditional political and other inequalities and inequities between the genders, and thus contributed to the perpetuation of the subordinate position of women (Haraway, 1978, 23):

> *"The bio-social sciences have not simply been sexist mirrors of our own social world. They have also been tools in the reproduction of that world, both in supplying legitimating ideologies* and *in enhancing material power."*

Such critiques have been rather successful in feminist circles. In many feminist writings and discussions the biological study of sexual dimorphism, particularly the evolutionary approach to the phenomenon, is often associated with ideological conservatism and sexism, and with unscientific determinism and reductionism. The recent explosive development of sociobiology, one of the major theoretical and empirical components of which, indeed, concerns the study of the evolution of sexual and reproductive strategies, particularly with respect to their behavioural implications, has aroused many negative reactions and has often vigorously been accused of being sexist (cf. Chasin, 1977; Spanier, 1995). Some authors even go so far as to state that the recent intensification of research on sexual dimorphism and strategies can be seen as a reaction to the revival of the feminist movement.

These types of accusations, the hard proof of which still needs to be provided, are resolutely rejected in sociobiological quarters (cf. Ruse, 1981; Cliquet, 1983; Roede, 1988; Segerstraele, 1988; Vandermassen, 2005; Campbell, 2006). It is argued, in response to the critiques, that thorough and sustained research is one way to substantially contribute to the elimination of sexist prejudices and practices. Inequalities and inequities that are considered unacceptable can only be effectively counteracted if their real causes are known and addressed. Otherwise, political action will merely succeed in addressing the superficial symptoms and can obtain only poor results. Fortunately, there are more and more feminist scientists who use an evolutionary framework to examine the behaviour of women and men based on their dynamic interactions throughout human evolution (e.g. Lancaster, 1991; Gowaty, 1997; Vandermassen, 2005; Hannagan, 2008).

The evolutionary approach to interpreting sexual and reproductive strategies, or the genetic study and explanation of differences in sexual behaviour, physiology or morphology should not be equated with sexism. The study of sexual dimorphism aims at describing and explaining the origin and development – ontogenetically as well as phylogenetically – of sexual variation, while sexism is a concept that refers to the existence of social inequities in valuation or treatment on the basis of gender.

If the above-mentioned line of argument against sociobiology were carried to its logical conclusion, most of the work related to the study of variability being done in fields such as biological and cultural anthropology, psychology and sociology, would have to be abolished. The result would be not only that our knowledge of human affairs would seriously diminish, but also that the possibility of changing the undesired inequities and inequalities would considerably be hampered.

The feminist critique of the (socio)biological study of gender may have left the impression, at least in some quarters, that science, particularly biological science, has substantially contributed to the preservation of the traditional, subordinated position of women in family and society, or even to the restriction of women's emancipation. Nothing is further from the truth.

In contrast to the undeniably antifeminist ideology of some scientists stands the scientific knowledge itself, created and supported by a massive army of researchers, the majority of whom indeed belong, largely for historical reasons, to the male gender.

If modern culture succeeded in initiating the process of improving women's societal position, if a modest degree of emancipation has been reached, it is also thanks in part to the new knowledge furnished by modern science in general, and the biological sciences in particular, as well as to new living conditions which were created by the application of this new knowledge.

Modern science, in particular biological science, fundamentally changed the knowledge about human life. New knowledge about the differences in the nature and the abilities of both sexes makes possible the necessary changes in conceptions, attitudes, values and norms. Modern biology simply swept away the traditional views on the nature of the sexes and destroyed the ideological foundations of gender inequality and inequity. From present-day (social) biology, a completely different picture has emerged about women's biological nature. Contrary to traditional beliefs, the human female cannot, from a biological point of view, be considered the physically weaker, intellectually inferior, and sexually more passive gender. In reproductive matters, women not only have a much more important share in child bearing and rearing than men, but they have, through the transmission of the genes of their cell nuclei and mitochondria[5], a larger input in the genetic inheritance of children than men. Biologically, women do not form 'le deuxième sexe' (de Beauvoir, 1949), but are the basic sex, the first sex (Fisher, 2000), whilst the male is but a vulnerable – albeit indispensible – variant.

At least equally important, however, is the application of modern science in the fields of medicine, economy, and technology. In the first place, bio-medical knowledge has induced a revolutionary level of mortality control, the ultimate condition for women's new opportunities. Modern medicine not only largely freed women from the risks of infant and maternal mortality and morbidity, but the control of mortality allowed – and in the end even forced – fertility control, liberating women from virtually permanent reproductive functions and allowing for the establishment of another balance between reproductive, productive, and recreational functions in modern society. Modern science also allowed for the transition from agrarian towards industrial culture with its new opportunities for

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[5] Mitochondria are membrane-enclosed organelles found in most eukaryotic cells, the major function of which is to generate most of the cell's supply of adenosine triphosphate (ATP), used as a source of chemical energy.

paid female work and its associated growing economic independence of women. Finally, modern technology is increasingly eroding the traditional male physical advantage with respect to muscular strength and speed. Thanks to modern technological means of replacement or aid, women can now perform tasks for which men were, on average, better adapted in pre-industrial living conditions.

The social changes induced by the development and application of modern science have not only altered the objective social position of women in society, but have also had a considerable impact on their subjective perceptions and experiences. Psychologically, women are moving into a completely different position of power and negotiation position in what some authors call 'the battle of the sexes' (Van der Dennen, 1992). All the achievements of modern science have contributed to this change. New scientific knowledge brings new insights about the position of women, and undermines the traditional ideological prejudices about female inferiority. New bio-medical living conditions have freed women from the risks and fears of reproductive hazards. Of considerable importance in this respect is the development and availability of safe and effective methods of birth control. Merely one generation ago, men could still threaten – and some did, as scholars in fertility research observed in their surveys – their wife with another pregnancy if they did not conform to the master's desires or caprices. The changing economy has provided women with important opportunities for financial independence and, moreover, modern technology gives them access to jobs that were formerly the exclusive domain of men.

Considering sexual dimorphism in general, based on interspecies comparison, or considering the present human species separately, in its present-day appearance, may lead to the perception that sexual dimorphism in the human is, indeed, of an overwhelming dimension. In some of their popularizing publications, some sociobiologists may have contributed to this perception by carelessly using animal observations to derive conclusions about human sexual dimorphism, or by failing to put current human sexual dimorphism in its correct evolutionary perspective. This is probably the only sexist claim of sexism that could be made against some zoological sociobiologists (cf. Barash, 1979). The implications for understanding the biosocial nature of human behaviour based on insights gained from animal research should be considered and evaluated with great care to avoid the pitfalls of the naturalistic fallacy (Spanier, 1995).

Indeed, human sexual dimorphism must be put in an evolutionary perspective. The most important feature that appears from an interspecies comparison, particularly with regard to the hominisation process, is the reduced significance of human sexual dimorphism. From an evolutionary point of view, the differences between the sexes in the human species have become relatively less important. This does not mean that they should be neglected, or that they do not play an important role in social relations, but that they should not be interpreted in a lopsided way or over-evaluated.

Female social inferiority versus biological superiority: a paradox?

From a biological point of view, the sociologically subordinate position of women appears to be a paradox: biologically, women are the basic sex, with a much more important share in reproduction, overall better health, a more balanced personality, more inclined towards social interaction, more resistant against stress, etc., but socially, they find themselves in virtually all cultures and societies in an inferior position – according to Hrdy (1981), even in a far worse position than that of females in all but a few species of non-human primates. How to make sense of this biosocial sex paradox?

Several explanations are to be found in the literature. Due to ideological prejudices or conflicts of interests as well as to incomplete information, these explanations are often contradictory. Within the feminist community, many believe that cultural determinants are the major cause of the social subordination of women, whereas sexists usually stress the importance of biological factors. Reality, however, is much more complex.

Building on its prehominid heritage (Hrdy, 1997), the human-specific sexual dimorphism originated during the hunting-gathering phase of human evolution. The variations between the sexes were adapted to the combination of the emerging biological specificity of the human, in particular the need to provide care during the lengthy period of infant maturation, and the natural and cultural ecology of early humankind. This sexual dimorphism is of such a nature that it can, depending on cultural and ecological conditions, lead to variable intersexual dominance-subordination relations. Recalling the bio-cultural living conditions of early humankind, with its sexual division of labour and its associated differential production and use of tools and weapons, it is not difficult to understand that the male has taken advantage of his biologically selected potentiality for agonistic and competitive behaviour and extended this tendency to the domination of women and children.

There seems to be general agreement about the fact that in agrarian culture the social position of women degraded considerably as a result of a concurrence of circumstances such as the accumulation of (private) property due to subsistence surpluses (cf. Engels, 1884; Martin and Voorhies, 1975), and increasing population size (Alexander, 1979), allowing men, or at least some groups of men, to use and abuse of their sex-specific biological characteristics to acquire more and more power over others – women, children, slaves, serfs, lower social strata – and to establish stronger hierarchical social relations, between societies, within societies, and also within families. It was in this type of biosocial ecosystem that the large world religions emerged and in which the above-mentioned biosocial dominance-subordination relations between the sexes were ideologically codified and ascribed to a divine origin and justification.

The development of women's social position in industrial culture is somewhat more complicated. In the beginning, the traditional power relations from the agrarian period seemed to fit quite well with the newly emerging social structures (Martin and Voorhies, 1975). However, as soon as the great material and immaterial triumphs of modern culture – such as modern scientific knowledge, technological development, mortality and fertility control, individual emancipation, democratisation, and ideological pluralism – started to disseminate, the biosocial ecological basis for patriarchy began to dwindle away, and the process of gender emancipation became possible.

Feminism and masculism

All the major modern political emancipatory ideologies – including Marxism (with its socialist and communist variants), liberalism and Christian-democracy – eventually included principles and policies with a view of restoring – or perhaps better put, of establishing at last – social equity and equality between the two sexes. Wherever these societal ideologies were given practical application by those in political power, they contributed more or less to female emancipation, but so far they have not succeeded in realising full gender equity and equality. Thus, it is not surprising that a specific women-oriented ideology – feminism – emerged to accelerate the gender emancipatory process (Humm, 1992).

This occurred in two waves. The first feminist wave, whose roots started growing as early as the 17th century (Jaggar, 1983), was principally concerned with equality. Participants in the movement devoted themselves to achieving equal legal rights, general suffrage, equal access to higher education, and equal entry into the professions in order to obtain self-determination and independence. The second feminist wave, the origin of which is said to be associated with Simone de Beauvoir's (1949) '*Le deuxième sexe*' and Betty Friedan's (1963) '*The Feminine Mystique*', and which has shown an accelerated development since the 1960s, shares the first wave's politics of legal, educational, and economic equal rights for women, but surpasses it in the breath of its concerns and the depth of its critiques. This second wave, known as the women's liberation movement, concentrates on more subtle issues such as reproductive rights, sexual oppression and domestic violence, sexual stereotypes, sexism and patriarchy in all spheres of life, and on more general societal problems such as armed conflict, environmental pollution, and Third World development.

In the course of modernisation, particularly in the second half of the twentieth century, feminist ideology has had substantial successes, as can be seen from the trends in the social, economic, cultural and political participation of women. However, feminism has still a long way to go. One of the major stumbling blocks it faces is precisely the integration of biosocial dynamics of gender in various domains of social life, such as the combination of productive, reproductive and recreational activities, the active participation of both genders to political life and decision making, and the disciplining and peaceful management of male drives for competition and dominance. Many feminists have the tendency to minimise, if not to ignore, the biological sex component, because of the classical misapprehension that biology is synonymous with unchangeability, determinism and reductionism. It is a shortcoming that is present both among 'equality feminists' and 'difference feminists' (Gatens, 1996). The egalitarians obviously completely miss the biological dimension in the gender controversy; they think biological differences simply do not matter in social affairs. But even many 'difference feminists' overshoot the mark. According to Humm (1992), for example, second wave feminism has focused on the specifications of women's differences from men and from each other, and thus has turned to psychoanalytic and social theories about gender difference in order to explain such issues as the increase in sexual violence and to construct a fresh 'feminist' ethics. It is not surprising then that this feminist theory has failed to succeed in developing appropriate strategies to change gender relations in modern culture, as it neglects so blatantly the fundamental background of the gender controversy, namely the biosocial basis of sexual dimorphism.

Neglect of the biosocial factor in gender relations makes this feminist approach non-productive. From an analytical standpoint, making the transition from facts to norms and from norms to facts is a delicate matter (Zeiss, 1982). Just because some situations are considered undesirable does not mean that underlying facts should be ignored or underestimated. Undesirable social situations can only be changed when their real causes are adequately understood and addressed.

Moreover, some feminist ideological stands suffer from a certain contradiction. On the one hand, it is asserted that men and women are equally suited to all jobs, but on the other hand it is argued that if women did particular jobs, they would be done differently. For instance, compassionate values would predominate, more co-operation and less competition would be promoted, there would be less war, etc. (Ridley, 1993).

Feminism is sometimes characterised by generalised, unqualified anti-male attitudes. As a male feminist-minded person who has participated in feminist meetings or conferences, we have been struck by the vigorous anti-male attitudes of some activists. Some, such as the American lesbian theologian Mary Daly

(1978), try, sometimes as keynote speakers, to impose themselves and set the feminist tone at conferences. For example:

> *"The fact is that we live in a profoundly anti-female society, a misogynistic 'civilisation' in which men collectively victimize women, attacking us as personifications of their own paranoid fears, as The Enemy. Within this society it is men who rape, who sap women's energy, who deny women economic and political power. To allow oneself to know and name these facts is to commit anti-gynocidal acts. ... As a creative crystallising of the movement beyond the State of Patriarchal Paralysis, this book is an act of Dispossession; and hence, in a sense beyond the limitations of the label anti-, it is absolutely Anti-androcrat, A-mazingly Anti-male, Furiously and Finally Female."*

Feminist aims are shared by many men, and these ideals can best be realised through a co-operative effort of both genders.

The feminist movement has elicited in recent decades a masculist movement, the major aims of which are healing the wounds suffered by heterosexual men by emancipatory gender movements (Goldberg, 1988; Farrell, 1993; Bly, 2004), and defending hegemony of men (Connell, 1995).

There can be no doubt that, in modern(ising) societies, many men go through a difficult period of adaptation. The dwindling power of patriarchy must for many be a frustrating experience, especially for men who have little opportunity to satisfy their drives for assertiveness, competition, performance, and dominance within a broader general societal context. Those in charge of our major social institutions in economy, politics, bureaucracy, army, religion, science, sport, entertainment and media obviously can still satisfy their hegemonic drives, because all of those institutions continue to function largely on the basis of vigorous competition within the market for dominance and power acquisition (Connell, 1995). However, the poor and less endowed men who have no power, status or prestige at work and who might have found some compensation within their families by venting their frustrations and expressing their needs for hegemonic masculinity, are now facing a change in which gender as the major source of hegemonic experience is fading away. In the modern world, women are less and less available for that kind of abuse. The broader society grants women equal rights, they are equally well-educated, earn their own income, are in control of their fertility, and can increasingly perform tasks which formerly were done only or mainly by men. Above all, women feel less and less powerless and no longer accept subordination. It is not surprising that in persisting patriarchal societies, women are less and less interested in (traditional) marriage (cf. Tsuya, 2000) or vigorously limit their fertility (Golini, 1999; Palomba, 2002).

Willingly or unwillingly, men will have to adapt to the new situation. In family matters, the masculist movement can only fight rearguard actions, or enclose itself in competitive sport clubs, gun clubs, playboy clubs, paramilitary training camps, or violent gang activities.

The masculist movement is not limited to maintaining hegemonic masculism. It also addresses perceived discrimination against males in modern society. It refers to a whole series of male role problems, including lower male life expectancy, higher morbidity, higher retirement age, military conscription, more severe punishment for criminal behaviour, higher professional risks, male achievement compulsion, career stress, night work, shortage of friends, paternal deprivation, extreme alimony obligations, etc. According to Farrell (1993), for instance, the male is the subjugated sex: men are more often war victims, men have higher suicide rates, are more often the victims of violent crime, experience more motor vehicle fatalities, and have a higher chance of becoming homeless, contracting AIDS or being imprisoned. Men, moreover have less influence on children, and have more economic obligations to women. The male sex, in one word, is the disposable sex (cf. Etkin, 1979) (Figure 4.12).

Most of these complaints, although relying on well-established facts are the direct or indirect social consequences of masculine drives and endeavours, more resulting from the risk-taking behaviour related to competitive action that, in turn, can be traced to the neuro-hormonal, and ultimately, the genetic specificity of the human male. The adverse effects enumerated by Farrell (1993) have little to do with social discrimination. The male disposability syndrome is either due to the competitive drives of most men themselves or to societal structures and processes created and driven by dominating males – generals, politicians, business leaders or owners, etc. – who exploit subordinate men (and women) with a view of maintaining or increasing their own power or resources.

However, men do have legitimate grievances in a number of countries, particularly with respect to the custody of children in cases of divorce or separation. Joint custody, fairer visitation rights, and less abuse of children (and grandchildren) in the psychological wars that often precede or accompany the divorce process, would do justice to a number of male-linked inequities.

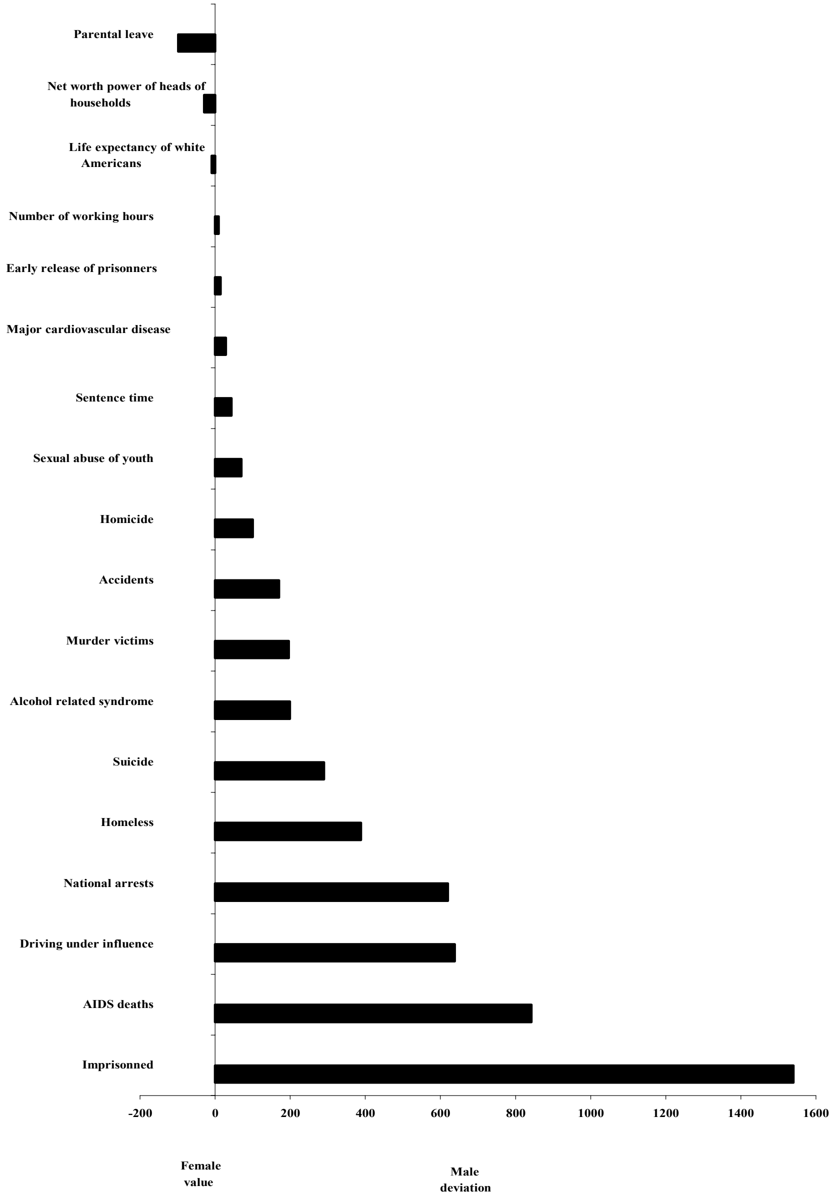

Figure 4.12. The disposable sex. Source: Farrell (1993).

MALADAPTATION OF SEXUAL DIMORPHISM IN MODERN CULTURE

The biological basis of sexual dimorphism in *Homo sapiens sapiens* evolved in the hunting-gathering phase of human evolution as an adaptation to the biosocial ecology of that era. Given the duration of that period – 99 percent of human existence to date – it can be hypothesised that the human specificity in sexual dimorphism was relatively well adapted to the living conditions in small hunting and gathering societies, which were composed of individuals well-equipped for performing hunting and agonistic tasks on the one hand, and for bearing and rearing a large number of offspring on the other.

Living conditions in industrial society, particularly in its advanced stage, are substantially different from those in prehistoric times of hunting and gathering. Moreover, modern culture has evolved at such a speed that, on an evolutionary time scale, it appears as a sudden cultural mutant. In many respects modernisation has created previously unseen and unpredictable new opportunities for humans to cope with environmental challenges, to facilitate adaptation, and to steer their future developments. At the same time, in several domains of biosocial interaction it has provoked serious discrepancies between the biological evolutionary stage humankind has reached and the new cultural developmental take-off it is realising. Modern socio-cultural change progresses at such a fast tempo that biological adaptation cannot keep pace – certainly not in the field of genetics, and in many respects not even in the field of ontogenetics. The result is an increasing dyschronism between biological and cultural adaptability.

The ultimate reason for this dyschronism is that biological evolutionary change depends on the vertical transmission of variants (genes), namely change between generations, whereas socio-cultural change moves in both a vertical and in a horizontal manner, namely between and within generations. In other words, genes can only be transmitted from one generation to the next, so generational transmission is necessary to judge whether evolutionary changes occur. Cultural units of selection like ideas can be transmitted and changed both within and between generations. Even without generational transmission socio-cultural evolutionary change occurs.

Sexual dimorphism is one of the most striking domains where this bio-cultural discrepancy appears. Above, it was argued that the hominisation process has been characterised by a decrease in sexual dimorphism with respect to physical robustness and that it has been accompanied by a feminisation of the human male, but at the same time that dimorphism for secondary sexual characteristics which play a role in male-male competition and in hunting and agonistic behaviour, have not disappeared completely. In modern, peaceful living circumstances, secondary sexual characteristics such as male robustness, capability of dominant and agonistic behaviour, and all other features that support traditional gender-differentiated tasks and role divisions, have become less functional, and have lost their adaptive value. Due to the rapidity of the modernising revolution, the biological feminisation of the human male has not been able to keep up with the process of cultural feminisation. In sexual matters as well, the human species is facing a dyschronism between biological evolution and cultural development.

The argument developed above, however, applies only for a peaceful, sustainable culture that is oriented toward the development of the human species in its entirety, in harmonious co-existence with nature and the environment. Such a culture is, among other things, dependant upon two fundamentally important conditions: social relations, both within as well as between countries, are to be regulated by peaceful means, and co-operation must prevail over competition. To what degree are these conditions met in modern culture?

Since World War Two, most industrial countries have – so far – experienced a period of relative peace, and since the fall of the Berlin Wall and the collapse of the communist regimes in the East, the probability of a long-lasting peaceful future even seems to have increased. Contemporary fundamentalist Islamic violence is probably only a temporary rearguard action against the inevitable modernisation process that Islamic societies cannot escape in the long term. But at the same time most countries have continued to actively – and expensively – prepare themselves for warfare, or for what is now sophistically called ‘peace operations’. Therefore, most of these countries are in a frustrating, ambivalent situation: experiencing peace, but still preparing for war to ensure their dominant positions in the world.

The same somewhat ambiguous situation exists with respect to co-operation *versus* competition. No doubt that co-operative efforts have greatly increased in modern societies, within as well as between them. Co-operation has not only intensified, but also involves many more people. At the same time, most social processes still seem to be permeated by the competitive spirit and drive to acquire means of subsistence characteristic of pre-modern humankind: politics, the economy, education, science, and sport are dominated by competitive processes; unsustainable ecological exploitation and pollution, if not destruction, continues to spread, faster than ever before in history.

Both with respect to peace/war and co-operation/competition, modern culture features profound ambiguity and increases the feelings of frustration originating in the bio-cultural dyschronism characterising sexual dimorphism. Under such conditions, the promotion of feminisation or androgyny seems to be almost a utopian goal.

Is male dominance thus inevitable, as Goldberg argued in his controversial books *The Inevitability of Patriarchy* (1973) and *Why Men Rule* (1993)? Given the sexually differentiated biological heritage on the one hand, and a number of seemingly persistent features of modern society on the other, one could, at first sight, tend to agree, or at least have some sympathy for Goldsberg's point of view. Goldberg argues that the relationship between hormonal sexual dimorphism and the domination-subordination differentials between the two genders in society make patriarchy and male dominance inevitable. This view may be historically accurate, but his line of reasoning does not necessarily apply for the future – a future that has already begun. Goldberg acknowledges that modernisation has been accompanied by an increase in female opportunities and a rise in women's socio-economic status, but observes that this rise has mainly been limited to middle positions. In the future, Goldberg predicts that men will continue, as long as we are physiologically constituted as we are now, to occupy the overwhelming majority of the top hierarchical positions in all major spheres of social life such as politics, the economy and finance, science, religion, and obviously the army (Goldberg, 1993, 116):

> *"…the desire of some feminists that males no*
> *longer dominate will never be satisfied."*

Goldberg makes the same mistake as those feminists who think that biology is synonymous with determinism in the sense of unchangeability, *status quo ante*, etc. A characteristic is not unchangeable because it is genetically determined, especially in the human. One of the essential features of living organisms, and in particular of the human species, is change and adaptability. This can occur via two channels: ontogeny and phylogeny.

Notwithstanding the accelerated pace of human evolution, phylogenetic adaptation can be largely left out of consideration here, given the time scale on which such change occurs. But the ontogenetic plasticity of the human species forms a point of application for fundamental social change. Human behaviour is determined not only by hormonal action, which in particular circumstances can easily lead to male competition, aggression and dominance, but also by the activity of the (large) brain which allows behavioural potentialities to be developed in different ways via conditioning, imprinting and learning processes. Human behaviour, moreover, not only shows a strong plasticity, but its concrete expression also depends largely on the socio-cultural and ecological context in which it develops.

However, it cannot be denied that gender relations in modern culture are challenged by two powerful sets of opposing forces: on the one hand there is the male biological heritage, still oriented towards assertiveness, competition, aggression, dominance, and hegemony; and this should not be underestimated.

On the other hand, there is also the internal dynamics of modern culture, the further progress of which demands competition, risk-taking exploration, dynamism, etc. Last but not least, it is important to keep in mind the powerful conservative forces of traditional ideologies, trying to preserve the old (male-dominated) system with its prerogatives and advantages. At the same time, there are the emancipatory forces made possible by modern culture: the shift from a family-based economy toward family-transcending types of economic production, increasing educational opportunities, female paid labour, mortality and fertility control, democratisation, individualisation, ideological pluralism, etc. These new conditions have fundamentally changed the rules of the game and cannot be ignored.

The future of gender relations in modern culture will depend on human inventiveness to accommodate both biological and social forces, with a special need to channel male-specific drives into socially, culturally, and ecologically useful and constructive actions. In accommodating those forces, society will, however, have to take into account a phenomenon that we will tentatively call the ecological challenge.

The current ecological challenge is one of the major unfavourable consequences of modernisation. Many of the innovations of modern culture – such as the rate of population growth, the scale of consumption of natural resources, the quantity and quality of environmental pollution, the risk of mass destruction by modern weaponry – are of a dimension which no longer allows for the continued application of traditional, masculine drives oriented toward competition, conquest, exploitation, and destruction. Inter-group warfare has become too dangerous for the parties involved. It has become obsolete, maladaptive.

The achievements of modern culture have largely been produced by males; they can be seen as the result of specific masculine drives and actions for which the male secondary sex characteristics seem to be well adapted: competition, conquest, domination, exploitation. Some authors (e.g. Holliday, 1978) rightly argue that our modern type of culture is the result of the male-specific biological endowment.

At the risk of oversimplifying, one could say that the driving force behind the modernisation process has been the masculine *modus operandi*. Paradoxically, the male approach has made possible – and necessary – a more feminine approach. The masculine way of life has been so successful that, in the end, it must abolish itself. The masculine approach has become too dangerous, too destructive, both for the human species and its ecological base. It has become maladaptive.

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CHAPTER 5

FAMILY VARIATION AND FAMILISM

INTRODUCTION

Some readers might be surprised to find a chapter on family variation in a textbook about social biology. What has family to do with biological variation? Is the family not an archetypal social phenomenon, one of the favourite study subjects of sociologists and psychologists? Many social scientists (cf. Ditch *et al.*, 1995; Zonabend, 1996) go so far as to state that the family is in no way a natural phenomenon, that biological considerations alone cannot explain the existence of the institution, but instead it is a social construct based on social and psychological factors that can be listed and defined.

In response, the reader must first be reminded of the fact that this treatise is concerned with sources of biosocial variation, implying that our scope of investigation is not limited to sources of individual biological variation, but also includes several sources of biological group variation. Second, information presented in this chapter suggests that the origin of the human family is indeed of a biological nature and that even today, especially in modern culture, the only functions that keep families together remain biosocial in nature. The family is a typical sociobiological group phenomenon. The relations between adult family members are usually of a sexual nature while those between adults and children are usually of a reproductive nature. Siblings usually share not only a substantial fraction of their genes, but also a largely common family environment that influences their phenotypic development.

Family variation consists of two major components: partnership and parenthood variation. The first of these is the main subject of this chapter, and the second is included in the next chapter which deals with reproductive variation.

Modernisation, especially since its acceleration in the 1960s, has changed family structures and dynamics quite substantially. These changes, and their demographic consequences, have raised considerable concern, if not panic, in several quarters. Doom-mongering about the die-off of Western society, war over the meaning of the family, and the end of the family, if not the disappearance of society itself, has been advanced or discussed in many contexts (e.g. Berger and Berger, 1983; Van Mechelen, 1987; Wright and Jagger, 1999).

At the United Nations International Conference on Population and Development in Cairo in 1994, conservative forces both from the developed world, led in large part by the Vatican, and from developing countries, largely under pressure from Islamic fundamentalists, waged an ideological war to have 'The Family' mentioned as the basic unit of society and to eliminate from the Cairo document any reference to the plurality of family forms or unions (Cliquet and Thienpont, 1995). Modernisation has so thoroughly changed the traditional living conditions of families that 'the family' has become a source of a heated ideological and political controversy.

The ideological debates about the family are very much at right angles to the scientific progress in understanding the origin and functioning of families. Several domains of biosocial research, such as sexology, behavioural genetics, behavioural endocrinology, behavioural pharmacology, neurosciences and sociobiology/evolutionary psychology, (cf. Van den Berghe, 1979; Filsinger, 1988; Booth *et al.*, 2000; Salmon and Shackleford, 2007), have already contributed considerably and may, in the future, increasingly gain more in-depth knowledge about various family-related forms of behaviour, such as the establishment (and termination) of sexual relationships, the dynamics of gender relations, reproductive and parenting behaviour, parental-children relations, etc. The approaches have not only brought new insights into the origin and the functioning of the family, but will in all probability also be of crucial importance for the future orientation of the family.

BIOLOGICAL ORIGINS AND FUNCTIONS OF THE FAMILY

The traditional family structures in the West – heterosexual and indissoluble monogamy founded on marriage – are often thought to be the heritage of Christianity. Christian institutions – churches, political parties, religious associations – often appoint themselves as the major, if not only, true defenders of 'the family'. Undoubtedly, Christianity has had a major influence, but the impact of the cultures on which it was built should also not be lost sight of. Moreover, Christian doctrine on the family and family related matters is far from invariable and has evolved and differentiated quite a bit during the course of history (De Donder, 1994). Also, contemporary legislation and customs concerning marital and family life in the West have been influenced by other ideologies such as secular humanism, liberalism, socialism, and feminism.

What is not always sufficiently acknowledged is that the predominant determinant of the family as a universal phenomenon is of an evolutionary-biological nature. The evolutionary framework for viewing the formation, stability, organisational structure, and social dynamics of biological families is based upon three conceptual pillars: ecological constraints theory, inclusive fitness theory, and reproductive skew theory[1]. Knowledge of four basic parameters, (1) genetic relatedness, (2) social dominance, (3) the benefits of group living, and (4) the probable success of independent reproduction, not only explains many aspects of family life in birds and mammals, but this evolutionary perspective also provides insights into understanding human family systems as well (Emlen, 1995).

Particularly in modern culture, with its protective, community-based social security institutions such as education, health care, welfare services, military and police protection, and administrative regulations, etc., the basic human biogram with respect to family relations – and its variation – is prominently displayed.

Both the doom-mongering view and the social-constructionist view of the family are examples of short-term, proximate and non-evolutionary thinking. A long-term, evolutionary and cross-cultural approach, in contrast, shows that the ultimate and fundamental *raison d'être* of the human family is of a biological nature (Lévi-Strauss, 1986; 1996, 5):

> *"As a social institution with a biological foundation, the family must be a universal presence, whatever the type of society."*

The universality of a feature or drive is a strong indication, but no absolute proof, of its biological origin. *Vice versa,* the absence of universality, within or between populations, of a particular behaviour, is no proof for the absence of its biological basis or of its cultural determination (Filsinger, 1988).

Parental investment in slowly-maturing offspring

The origin, universal existence and future continuity of the (nuclear) family is a result of the hominisation process that produced the human-specific brain which requires, in turn, a long post-natal maturation and socialisation process (Gough, 1971; Van den Berghe, 1979; Mellen, 1981). Families are the social extension of uterine life based upon the needs of slowly maturing human children – several of which must be produced to guarantee intergenerational continuity. Indeed, the human species is characterised by monoparous gestation. In conditions of high infant and child mortality, which was characteristic for hunters-gatherers – one half to two thirds of live-born children died before puberty (Acsádi and Nemeskéri, 1964; 1970) – fertility must have amounted to five to eight children if the danger of extinction was to be avoided. The development of family life and love were 'inventions' that kept infant and child mortality

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[1] Reproductive skew: the extent to which breeding is monopolised by dominant individuals (Johnstone, 2000).

below the levels of extinction and allowed hominids to evolve to present-day *Homo sapiens sapiens* (Van den Berghe, 1988, 43):

> *"The human family is, very simply, the solution our hominid ancestor evolved over three to five million years to raise brainy, slow maturing, neotenic, highly dependent, and therefore, very costly (in terms of parental investment) babies."*

For his normal physical, psychological and social development, the human child appears to be in need, particularly during the first years of life, of an enduring and profound affective bond with a small number of adults. In normal circumstances these will be its biological parents and possibly also other close kin such as older siblings and grandparents, but the parental affectionate functions can obviously also be performed by other adults who may assume the parental role, as loving adoptive and stepfamilies show.

Research on children who have grown up in conditions of affective deprivation – in isolation, in neglectful families, or in some institutional environments – even with perfect material living conditions, show that emotional deprivation leads to behavioural disturbances (aggressivity, delinquency, asociality), intellectual retardedness (lower IQ), and even physical retardation (stunted growth, illness, and increased mortality) (cf. Bowlby, 1951; Montagu, 1957; Rutter, 1972). Experiments with collective childrearing in the early Soviet Union soon had to be abandoned not only because of the considerable economic costs, but mainly because of the mediocrity of the results (cf. Prigent, 1955).

The origin and evolution of love

The human-specific maturation pattern is responsible for the selection of several human-specific sexual characteristics as well as for the neuro-hormonal equipment that facilitates the development of enduring and affective partnership relations (cf. Mellen, 1981; Lampert, 1997; Fisher, 2004; Pedersen, 2004).

The origin of love between heterosexual adults can, just as with the family itself, be traced back to the earliest hominid ancestors, because it formed the psychological foundation of the social bond that made an essential contribution to the survival of children (Mellen, 1981). Several arguments support this view.

As discussed in Chapter 4 on 'Sexual Variation and Sexism', several male and female biological features have been selected for in the course of the hominisation process which in all probability can only be understood as facilitating the establishment of enduring social relations: the reduced robusticity and aggressiveness in the male, the appearance of concealed ovulation, orgasm, and large breasts in the female (Jasienska *et al.*, 2004).

The experience of love can be detected in virtually all human populations: strong evidence of its existence are found not only in all literate civilisations (e.g. Mellen, 1981; Buss, 1994), but also in most preliterate societies (e.g. Westermarck, 1922; Jankowiak and Fischer, 1992).

The presence of biological predispositions for love does not mean that they will automatically and universally manifest themselves. These predispositions need to be socially and culturally developed. Love may get competition from other drives or its expression may be suppressed in particular living conditions. The experience of love may depend upon the degree of enduring compatibility between partners. Last but not least, there may be individual variation in the (genetic and ontogenetic) ability to develop long-lasting affectionate feelings. One may, consequently, expect a substantial variation, within as well as between populations, in the prevalence and the degree of development of durable affectionate relations.

In situations where people have a relatively broad opportunity to choose their type of partnership and living arrangement, as is increasingly the case in Western societies where earlier social (community and parental) control systems are disappearing or at least weakening, most men and women continue to opt for durable attachments instead of promiscuity (cf. Laumann *et al.*, 1994; Corijn and Klijzing, 2001). Even those who end a cohabitation or marriage often rush into a new durable partnership or hope to establish a more successful or more satisfactory enduring relationship.

The view that human love is an evolved feature, selected for its function in meeting the needs of slowly-maturing offspring, is perhaps less easy to accept than the conclusion that relationships between parental affection and child development have an evolutionary basis. Indeed, in many cultures, the drives for protection, survival and economic security in partnerships seem to be preponderant over affectionate needs, as can be seen, for instance, in arranged marriages. Moreover, cross-cultural studies of marital patterns (cf. Westermarck, 1922; Murdock, 1961; Mellen, 1981) as well as studies on sexual behaviour in modern culture (cf. Kinsey *et al.*, 1948; 1953; Spira *et al.*, 1993; Laumann *et al.*, 1994; Wellings *et al.*, 1994) have documented the mildly promiscuous or polygamic nature of the human – a feature which, at first sight, might seem to be at odds with the need for enduring love.

The presence of and competition between several drives such as the need for love, the desire for several sexual partners, and the urge for resource acquisition, does not repudiate their existence and functionality. Obviously in some socio-ecological conditions, one or the other of these drives may become predominant. It is quite understandable that economic drives may prevail over affectionate needs in conditions of material hardship where mere survival is a question of life or death, just as it is quite understandable that, according to Roussel (1989a), from the end of the eighteenth century, the idea of happiness became the preponderant foundation of marital and family life in the West. In conditions where vital basic needs, essential for individual or group survival, are satisfied, emotional (or nonvital) basic needs, and of course also derived and acquired needs, may take precedence (Montagu, 1957; Maslow, 1972). Thus, the process of modernisation very probably is characterised by a shift from survival to love as the basis of family life (Farrell, 1993). However, it would be a mistake to think that romantic love is a Western invention (Jankowiak and Fischer, 1992; Buss, 1994).

A derived biological function of the family concerns the control – biological and social – of sexual behaviour. Enduring relationships, resulting from the needs of slowly maturing children, are incompatible with permanent sexual competition, and consequently male-male competition and sexual promiscuity must be reduced. Moreover, the care of long-maturing offspring requires sexual fidelity, particularly by women, because adultery (extra-marital sex) might lead to cuckoldry, the situation in which a male makes parental investment in genetically foreign offspring. The rearing of slowly maturing offspring also requires the establishment of incest-avoiding behaviour, for proximate reasons – limitation of sexual competition within the family unit (Malinowski, 1929) – and for ultimate reasons – avoidance of unfavourable genetic combinations due to inbreeding (cf. Westermarck, 1922; Wolf, 1995). To the extent that sexual attraction to other partners is not completely genetically suppressed in people in enduring partnerships, social control mechanisms, in the form of family values and norms, must limit sexual competition, impose sexual fidelity, and strengthen incest-avoiding behaviour.

Virtually all other family functions, such as social control in general, cultural development, economic production and consumption, health care, and welfare services, are also biologically derived functions, the concrete form of which depends upon the ecological, cultural and economic living conditions in which people have to function. All of these social functions of the family are of course of the greatest importance, and most of them are essential for survival. However, such functions would have to be fulfilled in any case, no matter the particular social structure. The fact that they are linked to family life and not to other social structures has to do with the specificity of the slowly maturing human child. In absence of its basic biological function – primary socialisation of slowly maturing offspring – it is very unlikely that the family would ever have reached its present universal status and would have fulfilled, in addition to its biological functions, all of its traditional cultural and economic functions. In modern culture, where macro-societal structures have taken over many of the traditional family functions, it might even have disappeared completely.

Although the human-specific sexual and neurological equipment facilitates the development of enduring and affective partnerships, these features are only partly genetically programmed and are in competition with other aspects of the human sexual and reproductive biogram. Moreover, they deal with interpersonal relationships and consequently require, in the absence of a completely genetically programmed control system, social ordering mechanisms. It is not surprising, then, that cultural values and norms universally developed to regulate, control, and in the end limit, in one or another way, the sexual drives of men and women. Such regulatory value and norm systems are embedded in all biologically successful ideological systems, namely systems that succeeded in achieving the intergenerational continuity of their population (cf. Reynolds *et al.*, 1983).

In conclusion, put in present-day sociobiological terms, the family is a social institution whose essential function is of a multiple biological adaptive nature, namely by contributing to the optimalisation of the inclusive fitness of its members. The existence and the future of the family can only be understood taking into account this biological-evolutionary point of view.

FAMILIES IN MODERN CULTURE

The twentieth century has witnessed remarkable changes in family structures and dynamics in Western Europe, North America and other overseas Anglo-Saxon countries, as well as in non-western countries where modernisation is being introduced: smaller household sizes, the continuing shift from extended to nuclear families, a decrease in nuptiality and an increase in separation or divorce, the appearance of new forms of unions such as unmarried cohabitation and living-apart-together, changing gender and intergenerational relations, and, last but not least, a substantial decrease in fertility, often to below-replacement levels.

In the 1960s, the influence of several of these family-changing phenomena started accelerating because they spread over larger sections of western or westernised populations due to the combined effects of a number of inter-related and mutually reinforcing economic, technological and cultural factors which speeded up in that period (cf. Hoffman-Nowotny, 1987; Van de Kaa, 1987; Cliquet, 2003).

Recent trends in family (related) behaviour

In most developed countries, premarital sex has virtually become a general behavioural pattern, although differences in age at first intercourse continue to exist – earlier in Northern Europe than in Central Europe, and especially Southern Europe. In most countries in recent decades, both birth and abortion rates have declined amongst teenagers, but despite an increase in the use of effective contraceptive methods, the incidence of unwanted adolescent pregnancy has not yet disappeared completely. A particularity of the United States is its persisting high (though declining) incidence of teenage pregnancies, one of the highest rates in the developed world (cf. Jones *et al.*, 1986; Ventura *et al.*, 2001). Several explanations have been given for this remarkable transatlantic differential, but the most important factor is probably the more traditional, religiously inspired attitudes toward sexuality resulting in more ambiguous or even negative attitudes toward sex education and contraceptive information and use. Such attitudes are often promoted in parental homes, schools, the media, and by public authorities.

Nuptiality has decreased considerably in most developed countries, mainly as a consequence of the postponement of the first marriage. In the second half of the twentieth century the total first marriage rate fell in many countries from close to 100 percent to half or even less. At the same time, remarriage rates decreased. These spectacular declines in marriage and remarriage rates do not, however, have to be interpreted as a sign of disintegration of the family as a social unit. Marriage and remarriage appear to be replaced by other forms of unions, mainly consensual unions, or are postponed. Eventually a large majority of couples marry (Kiernan, 1993; Council of Europe, 2006). Marriage rates, however, no longer represent a correct picture of the timing and intensity of family formation. In many countries the dramatic decrease of nuptiality of recent decades has slowed down and in some cases even seems to have stabilised at stationary level.

Both in North America and in Europe postponed marriage has increasingly been replaced or preceded by cohabitation or ‘Living-Apart-Together’ (LAT) relations. Unmarried cohabitation is increasing, both before marriage as well as after separation, divorce or widowhood. However, there is still considerable between-country variation: in some of the Scandinavian countries, premarital cohabitation is a quite generalised form of behaviour; in countries such as France and the Netherlands, it is fast increasing; in other regions, such as Flanders, Scotland, and Wales, and in Southern and Eastern Europe it is still a minority phenomenon. In most countries cohabitation occurs as a premarital stage in the life cycle (cf. Trost, 1979; Corijn and Klijzing, 2001).

Some people have an intimate relationship but temporarily maintain, partly or completely, separate households. For most, this is a result of occupational or other compelling circumstances, less often as a conscious choice (cf. Rindfuss and Stephen, 1990; Trost, 1998). These are the so-called LAT-relations (Living-Apart-Together). Some of these relationships can be classified as commuter marriages, others as visiting marriages (Fisher, 1992). It is still a minority phenomenon and will probably remain so given its financial costs, and in some cases also its psychological stress.

In recent decades the formation of single-person households has become more common amongst different age groups. Amongst young adults it seems mainly to be the result of a conscious choice related to the desire for more independence, or for educational or occupational reasons. However, in weak economic times this trend has been observed to slow down or even reverse slightly (cf. Cherlin *et al.*, 1997). Amongst older adults, separation or divorce is the major cause of the increase in singlehood. Amongst the elderly, the increasing sexual difference in life expectancy adds to the creation of single households (Corijn and Klijzing, 2001).

In most Western European countries, the total divorce rate is about 30 percent, whilst in the Scandinavian countries, the United Kingdom, and the United States it is close to 50 percent or even higher (for data, see Council of Europe, 2006; Sardon, 2006). Just as with nuptiality, divorce figures no longer measure the real prevalence of the separation of unions. If divorce rates are combined with separation figures for cohabitating couples, partnership dissolution appears to be a much more frequent phenomenon. For Sweden Trost (1996) estimated the total disruption of unions over the complete life course at 75 percent. Divorce rates were still on the increase in the 1990s, but in Northern Europe, in the United Kingdom and the United States, where a high prevalence had been recorded in previous decades, a slowdown, stabilisation or even a slight decrease was observed.

Accompanying the increased divorce rate is a rise in the number of one-parent families, which are mostly headed by women (cf. Van Delft *et al.*, 1988; Burghes, 1993). Single-parent households, however, result not only from separations, but are due to the growing number of single mothers by accident or choice (Miller, 1992; Barber, 2005). The degree to which single motherhood by accident is on the increase is not completely clear, because many studies use only formal criteria such as marital status to identify lone mothers. More thorough sociological studies show that, at least in some countries, many unmarried mothers are living together with a partner (who may or may not be the father of the child, or children). They also show that single motherhood can be only a temporary, transitional stage in the union formation. Many unmarried mothers, in other words, should not necessarily be considered lone parents. Single motherhood by choice, particularly among older, better-educated, working women, also seems to be on the rise (Miller, 1992), but this phenomenon is not yet well documented. In contrast with all these various categories of one-parent families, the number of widowed lone-parent families is, as a result of mortality control, sharply declining.

After exiting a union, most people – 75 percent of women, 80 percent of men, enter a new union, either in the form of a consensual union or in the form of a marriage. Some authors (Fisher, 1992) interpret this trend as the re-establishment of old-fashioned serial monogamy. Today, however, this is a result of divorce rather than death of the spouse. The epithet 'serial' requires some qualification. Given the limited number of unions that are formed over the life course, it is probably more appropriate to refer to this phenomenon as 'successive monogamy'.

Background of the modern family transition

In order to understand the most important trends affecting families in the new millennium, it is crucial to consider the essential functions of the family and the changes modern culture has wrought upon them.

On the one hand, in modern culture the family has lost several of its historical functions, most importantly the fact that several of its survival and welfare functions have partly or even largely been taken over by broader societal structures. On the other hand, it's the family's emotional caring functions, for both children and adults, have become much more prominent in a culture where the stakes of biopsychic and social quality of life have been raised so considerably.

Three broad groups of factors – socio-biological, socio-economic, and socio-cultural – have contributed to the modern family transition. All of them are related to developments in modern science and their application in modern technology.

The socio-biological causes of the family transition have primarily to do with the demographic transition, namely the shift from high to low mortality and fertility levels. Mortality control does not in all societies precede fertility decline and its associated effects on the family; it is, however, the pre-condition for the perpetuation of the modern demographic transition and its associated family transition. Without mortality control, the decrease in fertility and all of the other observed family changes could not continue over time. Low fertility in the presence of high mortality would ultimately result in a disappearance of the value systems or social conditions that produced it.

The significant increase in life expectancy in modern culture has had four major consequences for family life: (1) an important motive to produce a large number of children disappeared; (2) parents are in a position to attach themselves emotionally much more strongly to their children; (3) partnership becomes virtually a lifelong probability, and (4) most people can now experience the company of three, four, and even five generations simultaneously.

Mortality control, in turn, has made possible and even necessitates fertility control beyond levels ever seen before. This resulted in a fertility decline that was expected to evolve toward a new equilibrium with mortality but which is currently more or less below replacement levels in most developed countries. The expanding availability of effective and safe methods of birth control makes it much easier for couples to limit the number of offspring to their desired quantity, largely by eliminating excess fertility. It has also major implications for the psychosocial dynamics of partnership and gender relations.

Socio-economically, the modernisation of the family has been characterised by the transition from a familial toward a socialised production system which is associated with industrialisation and urbanisation. In family-transcending systems of production, individuals, particularly those at higher ages or in periods of vulnerability, are no longer directly dependent upon a large number of children or other close kin for their basic need satisfaction (Caldwell, 1982; Turke, 1989). Their economic security depends much more on their individual abilities and performance in a formal employment setting. Times of risk, especially in old age, are covered by social security systems. In general, many traditional family functions have partly or even largely been taken over by broader societal structures. Increases in economic opportunities have also allowed people to marry at younger ages. Increased opportunities for social and geographical mobility have further weakened the extended family and isolated the nuclear family. Cultural and economic changes have also given rise to the practice of divorce, which has increasingly taken the place of widowhood as the leading cause of couple disruption.

Socio-biological and socio-economic changes associated with the modernisation process have also profoundly changed the biological, social and psychological position of women. Not only have various pressures to achieve numerous pregnancies largely disappeared, but increasing opportunities in education and economy and the availability of effective methods of birth control, have also offered women a degree of independence which has fundamentally redefined power relations within marriage and the family.

Modernisation, in addition, has created enormously extended leisure opportunities that compete with traditional family values and patterns, in particular the historic norm of having (a large number of) children (Keyfitz, 1987). The forces of modernisation also make much higher demands with respect to individual development, not only in the field of education and training, but also in the fields of partnership and parent-offspring relations. The increasing expectations and requirements in modern culture for personality development combined with the increased possibility of fulfilling and safeguarding human needs in the welfare society have made people more sensitive and vulnerable to factors that threaten and degrade well-being. This increased sensitivity to relative deprivation, particularly given the continuing inequality in opportunities within the population, must divert people from family-building or -extending goals. Not only does this typically lead to a smaller number of children per household, but probably also to more scrutiny and hesitation with respect to the start of an enduring relationship, resulting in the postponement, among other things, of marriages and births (Schmid, 1984).

Related to the development of science and technology, and the economic transition, modernisation has also induced important changes in values and norms, such as the rise of secularisation, democratisation, and individualisation. Not only have the foundations of the traditional normative systems and institutions been undermined, but also new ideologies and normative institutions have had the opportunity to develop and spread. This has resulted not only in a broader ideological pluralism, but also in a more pronounced relativism, changeability and tolerance (Lesthaeghe, 1985; Inglehart, 1990). In general, it can be stated that family-related normative forces are shifting from external toward internal control, in other words from the societal towards the individual level (Hoffmann-Nowotny, 1987). This results not only in an increase in freedom and personal choice of behavioural patterns, but also in increasing anomie and decreased socio-normative control (Kirk, 1983).

All in all, modernisation has resulted in a situation where individual and societal needs with respect to intergenerational continuity no longer coincide. Individuals and couples can, under modern living conditions, be satisfied with one or two children, whereas society needs, for its long-term continuity, a substantial proportion of three and four child families to compensate for the childless and one-child families (Cliquet, 1998).

Determinants of recent family changes

What factors, precisely, caused the modern changes in family structures and processes to generalise and accelerate in recent decades? A variety of explanations have been given: economic development after World War Two, the oil-boom, technological innovations in different domains (ranging from jetair-planes, the development of television and the Internet, to modern contraceptives and medically save abortion methods), women's emancipation, and changes in cultural values, particularly individualisation and secularisation (Lesthaeghe and Van de Kaa, 1986). In the minds of many researchers, however, no one single factor alone can explain this generalised and accelerated change; rather it is the result of the synergy of a number of interrelated and mutually reinforcing economic, technological and cultural factors which gathered speed in the 1960s (cf. Kooy, 1985; Roussel, 1989a; Cliquet, 1991; McDonald, 2000).

Obviously, a number of scientific and technological innovations have played an important role in recent demographic and family changes. Widespread technical innovations such as television, the worldwide web, and rapid and affordable means of travel have considerably increased peoples' physical and mental horizons and can be supposed to have contributed to the change in their attitudes and expectations and ultimately also their behaviour in the sphere of family-building. Particular attention should be paid to the contraceptive transition or revolution, which took place starting in the mid-sixties of the last century (Ryder and Westoff, 1971; Cliquet and Lodewijckx, 1986; De Guibert-Lantoine and Léridon, 1998).

PARTNERSHIP IN MODERN CULTURE

Having discussed the general effects of modernity on family variation in recent years, it is necessary to look somewhat more closely at the dynamics of two of the family's major components separately – partnership and parenthood.

From an ontogenetic or life course approach, it is quite logical first to address partnership. Three aspects will be dealt with: partner choices, types of partnership, and relational dynamics within partnerships. Parenthood will mainly be dealt with in the next chapter.

Partner choice

Taking into consideration existing general biological (inter-individual) variability on the one hand, and the sexual difference in parental investment and the associated differences in mating and reproductive strategies[2] and tactics on the other, it can be expected that partner choice amongst humans is non-random. This raises several questions: what features do partners prefer, which traits do they choose, and what combinations of partner features prevail?

An important specific question is how these aspects of partnership are developing in modern culture, where family formation more and more depends

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[2] In evolutionary biology the term 'strategy' is used in a metaphorical sense. In no way does this term imply conscious decision-making or conscious reproductive goals. Biological strategies are designed by natural selection for the optimal allocation of mating and parenting efforts (Liesen, 1995, 148).

on personal decisions rather than social or family coercion, and where fertility is largely controlled.

Preferred and selected partner features

Evolutionary theory provides two major approaches from which specific hypotheses about mate preference and choice can be derived: the first is of a general nature, applicable to both sexes alike, and has to do with the selection of 'good genes' (Barber, 1995). The second relates to sexual selection *sensu stricto* and the sexually differential partner preferences in mate strategy and tactics. In this respect, Buss (1989) distinguishes three major issues: (1) parental investment, (2) reproductive value, and (3) paternity probability.

Empirical data largely confirm the evolutionary predictions. This is particularly true for the predictions derived from the good genes theory, parental investment theory and reproductive value theory. The predictions from paternity confidence theory also hold, but with a stronger between-cultural variation.

The 'good genes' theory

The 'good genes' model refers to the preference for and choice of mates who possess features displaying viability, parasite resistance, immuno-competence and developmental stability (Barber, 1995). As early as 1921, Westermarck argued that the making of judgements about sexual attractiveness is a species-typical feature of human psychology that evolved by selection because attractiveness universally connotes fecundity and health, and thus attractive individuals confer more reproductive potential on those who choose them as mates.

Since some sexually attractive features may be favoured by heterozygosity, and this in turn is associated with phenotypic averaging, traits that are close to population means might be more attractive than extreme phenotypes. In the same way, since pathogens may disrupt morphological development, producing bilateral asymmetry, regularity and symmetry of traits, especially in the face, can act as a marker of phenotypic and genetic quality and may be found attractive (Gangestad and Buss, 1993; Perrett *et al.*, 1999). Empirical data amply confirm the 'good genes' theory: features expressing physical fitness, population average and bilateral symmetry are clearly preferred in mate choice, by both men as well as women (cf. Buss, 1994; Honekopp *et al.*, 2004; Roberts and Little, 2008; Craig and Little, 2008). Physical attractiveness, particularly facial good looks is slightly positively correlated with good health (cf. Singh, 1993; Shackleford and Larsen, 1999). Attractive people receive more attention and other investment from others and are viewed more positively in general (Thornhill and Grammer, 1999).

Parental investment theory

The concept of parental investment (Trivers, 1972) implies, for a species such as human beings where males contribute significantly to the upbringing of their offspring that females seek to mate with males who have the ability and willingness to provide resources that will benefit their children (Alexander and Noonan, 1979). Amongst humans, especially in the context of modern culture, resourcefulness translates into earning capacity. This implies that females will value and seek out male personality characteristics such as intelligence, ambition, and industriousness, social features such as high educational level and high social status (which are associated with or result in increased earning capacity), and physical features such as height and strength (Barber, 1995). Other desirable attributes might include: dominance, maturity, emotional stability, reliability, fidelity, willingness to provide resources, sociability, and love (Buss, 1994; 2008). It is young-to-intermediately aged individuals that are likely to possess the highest breeding values of fitness (Hansen and Price, 1995). But it can also be expected that women will value somewhat older men, due to the positive correlation between age and income and the fact that older men are more likely to possess valued resources. Older men may also be preferred because they may be somewhat more mature and emotionally stable, and less likely to desert a relationship (Greenlees and McGrew, 1994). But the men should not be too old, since old age would mean high risks of increased mortality and morbidity.

According to Cashdan (1993) evolutionary theory can also explain individual variation in behaviour that is a consequence of the social and learning environment. This explains variation in strategies for attracting a mate. Cashdan argues that women who expect to find little paternal investment in their mates are more likely to engage in sex and to flaunt their sexuality. Display of material resources is a tactic used by males disposed toward high paternal investment, and by females who expect a low level of parental investment from their mates. Non-investing males are more promiscuous and flaunt their sexuality, whereas investing males emphasise their chastity and fidelity as a way of advertising their willingness to invest.

Reproductive value theory

Reproductive value (Fisher, 1930; Williams, 1975) is the degree to which individuals of a given age and sex have the capacity to produce additional viable offspring, and, hence, to transmit their genes to future generations. In the human species, the male's reproductive capacity is huge and is, from puberty onward, relatively independent from age (Nieschlag, 1986). In contrast, women's fecundity is low and strongly time dependent (Figure 5.1). Moreover women's age-specific natural fertility varies quite substantially: it increases in the first years after puberty, peaks in the mid twenties, and thereafter it gradually and increasingly declines with age, especially after 35 years of age (Figure 5.2).

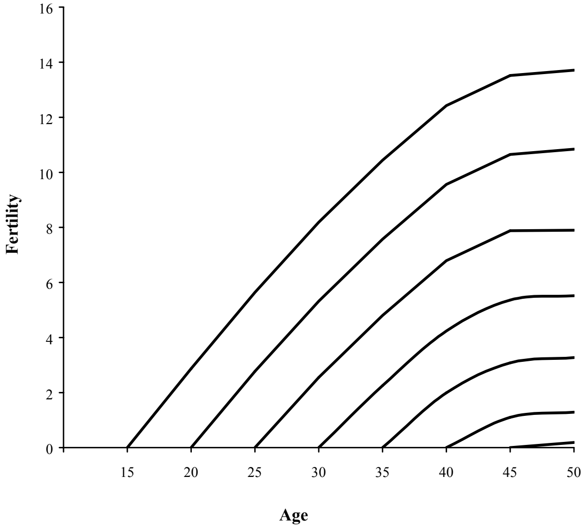

Figure 5.1. Women's future reproductive capacity according to age, calculated on the basis of the age-specific fertility rates of the Hutterites. Source: Eaton and Mayer, 1953; Charbonneau, 1979.

At the same time, women's future reproductive capacity is strongly associated with age-varying physical and behavioural features such as general body build, in particular waist-hip ratio, youthful facial traits, breast form, skin and muscle tone, fat distribution, and energy level (Barber, 1995). Physically attractive and behaviourally dynamic features peak at younger ages. Therefore, youth and physically attractive features are considered strong indicators of high reproductive value and are consequently highly valued by men since women's fecundity is a limited and, hence, precious resource. Wiederman and Allgeier (1992) rightly argue that selection could not have designed a psychological mechanism to detect female age per se, but instead may have favoured development of mechanisms sensitive to female physical characteristics that are reliably correlated with youth for a significant span of time. During the Era of Evolutionary Adaptedness (EEA), those women who preferred resource-providing mates enjoyed immediate material advantage both for themselves and their offspring, and enhanced reproductive advantage for their offspring.

These age-related and gender specific differences in reproductive value and the strong association of high future reproductive capacity with youth and beauty imply that men, more than women, will seek youthful and physically attractive partners as potential mates (Buss, 1989). According to Ridley (1993), the human male is obsessed with female youth. This is characteristic for a species that is oriented toward the establishment of enduring, if not life-long relations, because of the biological exigencies related to the long and slow process of child-rearing.

Figure 5.2. Reproductive value (expected future live births) as a function of female age, in a natural fertility foraging society. Source: Howell, 1979.

Evidence supporting the existence of gender differences in mate preferences for resourcefulness, youth and beauty (physical attractiveness) can be found in a variety of data sources (Wiederman *et al.*, 1999): surveys on self-reported preferences, manipulation experiments, publicity studies, content analyses of personal advertisements, behavioural studies of male and female courting strategies, demographic data, etc. The observed trends are, moreover, relatively time and culture invariant (cf. Buss, 1989; Thiessen *et al.*, 1993; Bereczkei and Csanaky, 1996).

Women systematically show a stronger preference for resourceful, somewhat older, caring men who are willing to invest time, energy and emotion. Women also have preference for men with bodily and facial features that express strength, social dominance, but also sociability and confidence. Height is a typical and well-known example of such a feature: it is a sign of social status, dominance, and protection (Ridley, 1993).

On the other hand, more than men, women advertise and display their physical appearance, groom their body hair, wear striking jewellery and sexy clothes, take care of their diet, and apply cosmetics. Competing with one another for a limited number of desirable males, women maximise their differences (Kachigan, 1990). In modern culture, the clothing, jewellery, and cosmetics industries subtly, but overwhelmingly exploits these evolutionarily based inclinations.

Men's high valuation of female youth and beauty is equally well documented. On average, men marry younger women, and often divorce in order to remarry with younger women. Men are more sensitive to youth and physical appearance, as can be seen in their general behaviour, in the vision-oriented erotic and pornographic industry, in the advertising industry, and in their interest in women's displays of (un)dress, jewellery and cosmetics (cf. Kachigan, 1990; Moir and Jessel, 1992).

In recent decades, the importance of attractiveness seems to have been increasing dramatically. According to Buss (1994) this trend corresponds to the rise in television, fashion magazines, advertising, and other media depictions of attractive models. Without denying the influence of these factors, however, we should also consider as possible explanations the general affluence and suppression of life threatening conditions in modern culture, as the more fundamental background factors that encourage such behavioural patterns.

Gender differences in the appreciation of beauty (physical attractiveness) do not imply that this issue is only valued in women by men. Physical attractiveness is clearly a generally valued feature. It is commonly supposed to be associated with positive moral qualities and social success. Research shows that physically attractive individuals have a higher mating success (cf. Rhodes *et al.*, 2005).

Physically attractive persons are thought to display more socially desirable features such as physical fitness, health, emotional sensitivity, sensuality, friendliness, sociability, etc. (cf. Honekopp *et al.*, 2007). Physically attractive persons are also expected to be socially more successful in life: they may be more prestigious, they may have happier marriages, they may have more promising opportunities in life, etc. Not that several of these features are related to the 'good genes' theory discussed above.

A puzzling feature is the waist-hip ratio in women. Why would men prefer women with an hourglass figure? Women with a waist-hip ratio of about 0.7 are universally preferred above women with higher or lower ratios, regardless of their general weight (cf. Singh, 1993; Hughes and Gallup, 2003; Streeter and McBurney, 2003). Several explanations have been given for this aspect of female physical attractiveness: it corresponds to the age of high fecundity, it is an indication of long-term health status, and it signals lack of current pregnancy – all features that are indicative of high reproductive value (Buss, 1994).

A feature that, at first sight, seems to refute the evolutionary explanation of the gender differentiation in preferred body build, is the fact that there exists a cross-cultural variation in male preference for plump versus slim female body build (Ridley, 1993). On closer investigation, however, it appears that the type of preferred body build is related to the degree of modernisation. Plumpness is preferred in cultures where food is scarce and thinness might be a sign of poverty and low fecundity, whereas in affluent cultures with their very low levels of desired fertility, a slender body build is predominantly a sign of youthfulness.

Paternity confidence theory

Paternity certainty (Daly and Wilson, 1978) is a sensitive issue in a species where the male contributes quite substantially to parental investment. Whereas maternity can never be doubted, paternity can. Parentally investing males, consequently, have a genetic interest in securing paternity confidence in order to avoid cuckoldry, the investment in offspring that is not theirs (Platek and Shackleford, 2006). Paternal investment will, consequently, lead to a relatively stronger experience of male sexual jealousy and to a stronger male preference for female chastity and fidelity. This evolutionary prediction finds confirmation in many traditional sexually asymmetrical socio-cultural practices and double standards: female sequestration (Dickemann, 1979), veiling, genital mutilation, virginity protection, foot binding, mate guarding, chastity belts (Batten, 1992; Buss, 2002), spousal homicide, legal restrictions on female sexual behaviour (Daly *et al.*, 1982), wife beating, penalties for adultery, conjugal dissolution (Betzig, 1989), daughter guarding (Perilloux, 2008), etc.

Sexual jealousy, however, is not limited to men. In fact, it is rather universally and equally present in both genders. What differs are the types and intensity of behavioural experiences and reactions. In particular, the reasons for sexual jealousy differ: males fear cuckoldry, females fear resource loss. Quite rightly, Ridley (1993, 227) speaks in this respect about ‘men’s cuckoldry paranoia’, whereas Lawson (1988, 294) refers to ‘women’s terror of loss’. Men are, indeed more upset about sexual infidelity whilst women are more disturbed by emotional infidelity (Geary *et al.*, 1995; Wiederman and Kendall, 1999).

In modern societies, with their highly effective birth control practices and other developments facilitating female emancipation, many traditional double standards related to sperm competition and protection (Baker and Bellis, 1995; Todd *et al.*, 2006) are clearly waning. The decreasing importance that is given to female chastity in Western countries is a salient example (Buss, 1989). Nevertheless, fidelity continues to remain an important issue, especially once a union has been established (Lawson, 1988). Indeed, it would be a mistake to think that sperm competition has become a bygone issue. It can manifest itself or flare up in different guises. Batten (1992), for instance, interprets the contemporary anti-abortion movement as an extreme example of organised sperm protection, campaigning to safeguard fertilisation by any man's sperm. From an evolutionary point of view, she argues, the anti-abortion movement can be seen as the most recent instalment in a long history of efforts, both primitive and civilised, to protect men's investment and control women's reproductive biology.

Combined partner features

The preceding overview of patterns in preferred partner choice provides us with some hints about the nature of (dis)assortative mating, about the way in which general partner features might be combined in unions and which Ridley (1993, 236) summarised as follows:

> *"Wealth and power are means to women;*
> *women are means to genetic eternity."*

There are, however, still other sources of biological information and evolutionary theory from which predictions about the combination of partner features can be deduced. They relate to mate selection, sex assortment, kin assortment, and genetic assortment in general. Overall, there are two types of feature assortment that must be distinguished: within- and between-variable combinations. Within-variable combinations are relevant for mate, sex, kin, and biological features in general, whereas between-variable combinations are only relevant for the last category.

Mate selection

The first issue to be dealt with is mate selection – the question whether one chooses a mate or not. At first sight, this may seem a trivial issue, but it is not. Choosing or not choosing a mate is both genetically and ontogenetically of the greatest importance.

From a genetic point of view, mate selection is obviously relevant only when people who do not choose a mate have genetically distinct features from those who do. In such cases, (sexual) celibacy constitutes one of the mechanisms by which genes are eliminated from the gene pool. It is a selective mechanism that is often lost sight of. The more refined studies on differential reproduction (e.g. Higgins *et al.*, 1962; Retherford and Sewell, 1988) have amply shown the methodological and empirical importance of considering mating behaviour in a comprehensive way and of not limiting it to nuptiality.

Mate selection obviously also has diverse ontogenetic effects. In many cases celibacy is associated with loneliness and all of the sad feelings accompanying it, but for some people it means freedom from the responsibilities and burdens of living together with and caring for others.

As a life course event, celibacy is a stage of life which most people experience, during adulthood, either at the beginning or at the end of their relational life. It is a form of ‘partnership’ that very few desire. Lifelong celibacy is therefore an extremely rare phenomenon. The lifelong absence of sex within a partnership appears to be even rarer. In the American National Health and Social Life Survey (NHSLS) (Laumann *et al.*, 1994), about two percent of the respondents above age 45 reported never having had a sexual partner. In the French “*Analyse des Comportements Sexuels en France*” (ACSF) survey this figure was 1.4 percent for men and 2 percent for women above age 45 (Spira *et al.*, 1993). In the British National Survey of Sexual Attitudes and Lifestyles (BNSSAF) (Wellings *et al.*, 1994), these figures are 1.5 percent for both heterosexual women and men aged 45–59.

In the past, celibacy – defined as the proportion of people who have reached the age of reproductive life and never married – was not an uncommon phenomenon, either for economic or religious reasons (cf. Laslett, 1965; Abbott, 2001). It varied considerably, however, between regions and with time. In the French population, for instance, celibacy increased from about five percent in the seventeenth century to about 14 percent at the end of the eighteenth century and decreased to some 10 percent in the nineteenth century. In some Scandinavian countries the prevalence was much higher, reaching almost 20 percent of the population in the middle of the nineteenth century (Henry and Houdaille, 1978). In the Netherlands, the prevalence decreased from 15 percent in the nineteenth and the first half of the twentieth century to some 10 percent in the 1970s (Engelen and Kok, 2003). In Ireland, in the second half of the nineteenth and the first decades of the twentieth century, celibacy proportions reached incredibly high levels – 26 percent among women and even 40 percent amongst men aged 40–44 – and later decreased to 18 percent among women and 29 percent among men in the 1970s (Dixon, 1978). In modern culture, the instance of religious as well as economically motivated celibacy seems to be in decline. On the other hand, the very recent decrease in nuptiality should not be considered a new increase in celibacy. Marriage has simply been replaced by other forms of unions.

It is difficult to evaluate the genetic effects of changes in mate selection in the modern era. The earlier forms of celibacy probably had very diverse genetic effects (cf. de Lapouge, 1896). The current dramatic reduction of those who obey the call to priesthood in catholic regions, and who undoubtedly are amongst the more gifted members of the population, might be considered to have a positive eugenic effect. But what about the other changes in mate selection? On the whole, one can anticipate that the decrease of celibacy is likely to induce a decrease in selection, resulting in an increase in population genetic heterogeneity.

Sex assortment

Sex assortment is the only aspect of partner choice for which heterogamy – unions composed of members of different sex – largely predominates. As was illustrated in the previous chapter, the overwhelming majority of people choose a partner of the opposite sex. Homosexuality is a minority phenomenon. Given the increasing societal tolerance of a plurality of lifestyles, including the decreasing suppression of overt homosexual behaviour, the formation of homosexual couples may be expected to increase. As a consequence mixed hetero-homosexual unions will decrease. To the extent that homosexual behaviour is underpinned by genetic factors (cf. Kallmann, 1952; Bailey and Pillard, 1991; Hamer *et al.*, 1993; LeVay, 1993), this trend will, in the long run, reduce the representation of those genes in the gene pool, and so lead to a decrease of homosexuality itself.

The ontogenetic effects of sex assortment can only be expected to be positive wherever natural predispositions – be they of a homo- or a heterosexual nature – can manifest themselves. Empirical data, as a matter of fact, show that mixed homo-hetero couples are often confronted with marital problems and conflicts (cf. Ross, 1990).

Kin assortment

Kin assortment in partner choice leads to consanguinity, a relationship between two individuals who share one or more near ancestors (Reid, 1973). Genetic inbreeding is a consequence of biologically consanguineous matings, resulting in offspring with a higher than random risk of carrying a double dose of genes that were present in a single dose in the common ancestor (see Chapter 2).

Inbreeding is well known to have unfavourable genetic effects wherever the fitness of the homozygote genotypes is lower than that of the heterozygotes. Moreover, many genetic diseases are determined by rare recessive genes. Consanguinity substantially increases the probability of bringing recessive genes into homozygous combination and making recessive diseases visible. With random mating, such genes are largely hidden in heterozygous genotypes, as can be calculated from the ratio of the heterozygote genotypes to the homozygote recessive genotypes: $2pq_{Aa}/q^2_{aa}$.

The increased genetic risks of consanguineous matings are based not only on population genetic theory, but also have been extensively confirmed by empirical studies which systematically show inbreeding to be associated by substantially increased levels of pre- and postnatal morbidity and mortality. The effects are positively correlated to the degree of consanguinity. These results have been reviewed many times (cf. Cavalli-Sforza and Bodmer, 1971; Bittles, 1994). Inbreeding depression has been shown for major recessively inherited malformations, for intelligence, and for other biometrical characteristics. For the latter effect, however, socio-economic factors may be partially involved because inbreeding occurs more often amongst the less well to do (Bittles, 1994). For the moment, data on the consequences for fecundity and fertility seem to be inconclusive. Some studies show reduced levels of primary sterility in consanguineous marriages, but others point to lower fecundability. Fertility levels often are higher among consanguineous couples, but this could be due to demographic factors, such as younger age at marriage as a result of cultural traditions, or as a reproductive compensatory behaviour for increased postnatal mortality (Bittles, 1994). At high levels of inbreeding, unfavourable recessive alleles become visible and may be subject to negative selection, thus lowering the equilibrium allele frequency for lethal genes (cf. Khoury *et al.*, 1987). The lower incidence of some of these diseases might, however, also be due to the higher mortality rates in isolates and to the depletion of lethal alleles through inbreeding (Neel, 1992). Notwithstanding the risks of inbreeding depression, many societies favour modest forms of inbreeding, avoiding the chief negative effects of close inbreeding involving relatives of the first degree (father-daughter, brother-sister relations) on the one hand, and taking advantage of the socio-economic profits associated with the maintenance of or increase in family property on the other hand (Van den Berghe, 1980).

Endogamy is to be distinguished from consanguinity. It refers to the practice of marrying within a geographically or culturally defined population. If the population is small, the risk of consanguinity increases because the number of potential partners is limited and the chance of meeting a close relative increases. Exogamy is the opposite of endogamy, resulting in an increase of heterozygote genotypes at the expense of homozygotes. Racial crossing is an extreme example of exogamy – an issue which will be dealt with in Chapter 8.

Incest is consanguinity between closely related persons such as father and daughter, mother and son, and brother and sister. This is usually not taken into consideration in population inbreeding studies, which, consequently, must underestimate the inbreeding levels.

Humans, like other animals, are known to display incest avoidance behaviour. Most but not all human societies are, moreover, characterised by incest taboos, a cultural custom which is in line with the biological predisposition and strengthens its effects.

Several explanations have been given for incest avoidance behaviour: Oedipal attachment theory (Freud, 1913), cognition theory (= knowledge of the deleterious effects of inbreeding) (e.g. Morgan, 1877), group alliance theory (e.g. Lévi-Strauss, 1949), group-harmony theory (e.g. Malinowski, 1929) and natural selection theory (Westermarck, 1891).

The Darwinian explanation for these phenomena, which can be traced back to authors such as Hutcheson (1725) and de Buffon (1749–1804), and several other authors in the nineteenth century – among others, Darwin himself – was most extensively and clearly developed by Westermarck (1891). It holds that close inbreeding is genetically (in the case of incest avoidance) as well as culturally (with respect to incest taboo) selected against because it reduces the reproductive fitness through an increased probability of the appearance of harmful recessive genes in homozygous combinations. Empirical data seem to increasingly support Westermarck's (1891) hypotheses concerning the proximal mechanisms determining these phenomena, namely that, in the case of incest avoidance behaviour, early-childhood familiarity suppresses erotic arousal in adulthood, and that, in the case of incest taboo, the emotional aversion against sexual relations with people with whom one has grown up, leads to moral disapproval and prohibitory customs or laws (Van den Berghe, 1980; Wolf, 1995). Bevc and Silverman (2000) refined Westermarck's hypothesis in the sense that proximity beginning early in life that continues as one reaches reproductive age does not appear to deter sexual interest, but creates a specific barrier against intercourse.

Four major bodies of evidence have been advanced in support of Westermarck's hypotheses (Wolf, 1995). First, there are observations of the incest avoidance behaviour among other primates (cf. Itani *et al.*, 1958; van Lawick-Goodall, 1968). Incest does occur, but it is exceptional. Early association inhibits sexual attraction.

Second, the same phenomenon is observed in human societies. It is known that in several historical societies, such as ancient Egypt, dynastic incest occurred, probably because of its political or economic advantages. However, only a minority of the dynastic incestuous unions appear to be characterised by early-childhood familiarity. Moreover, the absence of the incest taboo in such societies did not result in a generalised custom of incest (Hopkins, 1980).

Third, taking advantage of the peculiar situation in some parts of China where a substantial proportion of married women were adopted as infants and raised by their future mothers-in-law, Wolf (1966; 1995) found that such marriages were plagued by adultery, often ended in divorce and resulted in lowered fertility. Also, in Lebanon McCabe (1983) found a higher incidence of divorce and fewer children amongst married cousins who had been raised as siblings. Bevc and

Silverman (1993) found a positive relationship between early separation of siblings and consummatory sexual behaviour.

Last, but not least, there is the remarkable experience of the Israeli kibbutzim where the practice of collective child rearing under conditions of intimate and intense association resulted in the total absence of marriages involving couples reared as members of the same peer group (Shepher, 1971; 1983; Spiro, 1958; Talmon, 1964).

In his recent masterly defence of Westermarck's theory, Wolf (1995) interrelates it with Bowlby's (1951) attachment and caregiving theory, arguing that the hominisation process necessitated the coevolution of increasing attachment and caregiving behaviour, which pushes infants ever closer to their genetic relatives, and the contrasexual predisposition toward the caregivers. This implies that incest-avoiding predispositions might be reinforced by the engagement of people in caregiving tasks.

Some of the social theories which have been proposed to explain the incest taboo, such as group-harmony theory (Malinowski, 1929) and group-alliance theory (Lévi-Strauss, 1949), are not necessarily in contradiction with the sociobiological explanation. Outbreeding may, indeed, have several advantages, some of a socio-biological, other of a socio-psychological or a sociological nature.

Incest is a phenomenon which seems to have attracted a great deal of attention in recent decades, particularly with respect to its ontogenetic effects. The number of scientific and popularising publications on this issue, indeed, has increased substantially. It would, however, be a mistake to interpret the fact that this phenomenon became more public as a sign of its increasing prevalence. The increasing openness with regard to sexual matters and progress in women's emancipation might be partly responsible for the growing public interest. Nevertheless, some studies report, on the basis of a comparison of different age groups, an increase in incestuous behaviour over time (Russell, 1986). However, taking into consideration the strong sexual taboos which prevailed in earlier days, the question remains to what degree the age-related differences are not biased by differential underreporting.

Notwithstanding the fact that incest may still be underreported, it must be acknowledged that it is a rare phenomenon, at least as regards close kinship relations such as father-daughter, mother-son, or brother-sister relations. Several surveys (cf. Wyatt, 1985) indicate that, as a child, ± 2 percent of the populatiobn experiences either attempted or actual physical contact (in the broad sense of the word) between fathers and daughters or brothers and sisters. However, ± 20 percent of the population has experienced incestuous contacts when all categories of family relations are considered.

The qualitative effects on the victims of forced incest, the large majority of whom are girls, however, are square to its quantitative prevalence. The social and psychological consequences of incest on the victims are appalling in many respects. The effects of incest victimisation include, among children: guilt, anxiety, fear, depression, anger, hostility, and inappropriate sexual behaviour; among adolescents: promiscuity/prostitution, runaway behaviour, chemical dependency, suicide, self-mutilation, and hysteria; and among adults: depression, self-destructiveness, distrust, sexual problems, unstable relationships, and multiple personality disorders (Meiselman, 1990; Kendall-Tackett *et al.*, 1993). The increasing public awareness and ethical disapproval and prosecution of this phenomenon may help to decrease its prevalence and suppress its emergence.

Assortative mating in general

Assortative mating is characterised by mate choice on the basis of the presence of particular phenotypic similarities or dissimilarities between the partners. In the first instance, the term positive assortative mating or homogamy is used, in the second case negative assortative mating or heterogamy. Garrison *et al.* (1968) distinguish assortative mating and assortative mate choice, the difference being that the former is accompanied by the production of offspring whereas the latter is not.

Homogamy – likes tend to marry likes – has been observed for many social, psychological and physical characteristics (cf. Eckland, 1968; Epstein and Guttman, 1984), including: level of education, socio-economic status, social attitudes, age, racial or ethnic background, attractiveness, personality factors, IQ (e.g. Tharp, 1963; Johnson *et al.*, 1980; Schwartz and Mare, 2005; Prokosch *et al.* 2009), somatometric characteristics such as stature and constitution type (e.g. Spuhler, 1968; Roberts, 1977), blood groups (Ashton, 1986), olfactory sensitivity factors (Smith, 1989), physiognomic features (Russell *et al.*, 1997), second-to-fourth digit ratio (2D:4D) (Voracek *et al.*, 2007), and eye and hair colour (Laeng *et al.*, 2007) (Figure 5.3).

Heterogamy, on the contrary, has only been observed for a few emotional personality characteristics in small-scale investigations, leading, amongst others, to Winch's (1958) theory of complementary needs.

Why this preponderance for homogamy? Why do people look for partners who resemble themselves in so many characteristics? Two major, complementary explanations have been advanced for this remarkable phenomenon; one is of a proximate nature and one of an ultimate nature.The proximate explanation for the similarity in partner features is that it favours more stable, satisfying relationships. It avoids unnecessary stress and friction that may arise from differences in appearance, character, temperament, interests, and attitudes. More stable relations, moreover, result in higher fertility, and also enhance inclusive fitness, as such (cf. Thiessen and Gregg, 1980; Mascie-Taylor, 1988).

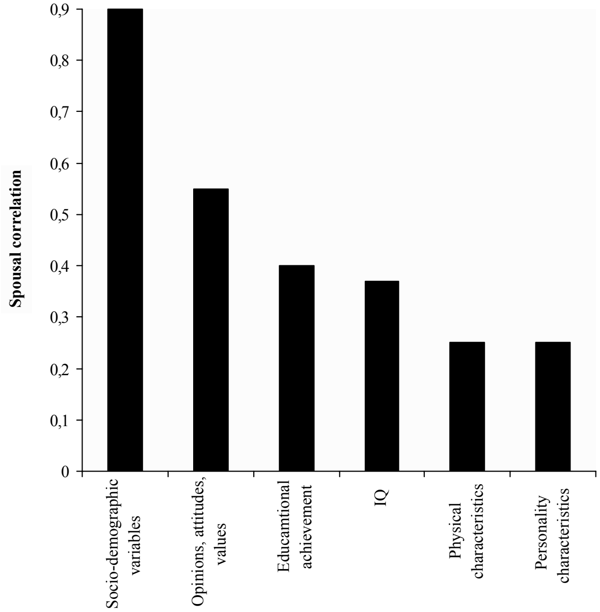

Figure 5.3. Spousal resemblance on a variety of characteristics. Source: Susanne, 1967; Spuhler, 1968; Roberts, 1977; Thiessen and Gregg, 1980; Mascie-Taylor, 1988; Rushton and Nicholson, 1988.

The ultimate explanation has to do with the individual's promotion of his or her own genes. Offspring bearing slightly more than one half of each parent's genes by common descent can be expected to provide a fractional boost of fitness (Epstein and Guttman, 1984). Rushton *et al.* (1984) have developed this view in their 'genetic similarity theory', stating that a gene ensures its own survival by acting so as to bring about the reproduction of any organism in which copies of itself are to be found.

The genetic effects of homogamy and heterogamy are intuitively easy to understand: the first case results in homozygote genotypes, the second one in heterozygote genotypes. Positive assortative mating changes the Hardy-Weinberg-equilibrium from the oth to the nth generation (Spuhler, 1968) from

$$p^2_{AA} + 2pq_{Aa} + q^2_{aa} = 1$$

to

$$\{p^2_{(AA)_0} + (\frac{1}{2} - \frac{1}{2^n})2pq_{(Aa)_0}\} + \{\frac{1}{2^n}(2pq_{(Aa)_0}\} + \{q^2_{(aa)_0} + (\frac{1}{2} - \frac{1}{2^n})2pq_{(Aa)_0}\} = 1$$

Homogamy does not produce the unfavourable side effects of inbreeding. Whereas inbreeding influences the genotypes of all genes in a population, assortative mating has an effect only on the proportions of the genotypes of the features involved in the partner choice.

Homogamy increases the variance in the population and can, in cases where the differential mate choice is accompanied with differential reproduction, indirectly contribute to the change of the genetic composition of the population.

Types of partnership

In modern society, the presence (or absence) of an intimate emotional relationship seems to be the quintessence of partnership. Whilst such a relationship may be limited to a feeling of infatuation, it may or may not include sexual intercourse, it may be combined with a living arrangement, and in most cases it is legally or religiously consecrated in the form of a marriage.

The variation in forms of partnership is a phenomenon that can be classified according to various criteria or considered from different angles. It is, however, difficult to elaborate a classification in which all of the relevant components are included. In the biosocially relevant literature the following issues appear to be the most commonly discussed: celibacy, monogamy, divorce, serial monogamy, polygamy, adultery, promiscuity, prostitution, rape, and homosexuality.

Dealing with these issues from a biosocial interactive point of view, in which both genetic and ontogenetic determinants and consequences can be addressed, the following underlying and interrelated dimensions, each one of which is characterised by two or more variants, may be distinguished:

- Time: simultaneity versus sequentiality
- Number of partners: none, one, several, many
- Living arrangement: same or different household
- Legal status: e.g. marital vs. non-marital partnership
- Sexual orientation: heterosexual, homosexual, bisexual

Most partnership variation is reducible to the interrelationship between the number of partners and the time dimension as defined above: simultaneity and sequentiality. The combination between the number of partners and the temporal (dis)simultaneousness of the partnership identifies most partnership variants:

celibacy, life-long monogamy, current monogamy, successive monogamy, polygamy, adultery, promiscuity, rape. Living arrangement distinguishes various types of household situations. Legal status of the partnership further refines the picture and allows distinguishing non-married, marital unions and divorcees. Finally, further variants of partnership can be distinguished on the basis of sexual orientation.

Vital statistics or survey data provide estimations of the range of prevalence of partnership variants in a population. Obviously a certain between-population variation may be expected, either because of real cultural differences, or because of differences in transitional phases (cultural lags).

Let us now have a look at the combinations between the number of partners and the temporal (dis)simultaneousness of the partnership, thus distinguishing between forms of single and multiple partnerships. Variation in other aspects of partnership such as living arrangements, legal status, and sexual orientation were discussed earlier.

Single partnership

The prevalence of monogamy depends on the definition used, the population chosen, and the age cohort considered. In Western societies, the definition of monogamy in the Oxford dictionary – "the rule or custom to be married to only one person at a time" – does not account for much of the prevailing partnership variation. Monogamy is, as a matter of fact, the only type of formal partnership that is allowed by law. A relational type of definition such as the one of Wittenberger and Tilson (1980) – "a prolonged association and essentially exclusive mating relationship between one male and one female" – has more differentiating power.

Understood in a relational way, life-long monogamy appears to be a minority phenomenon. According to the American NHSLS (Laumann *et al.*, 1994) only one third of 50 to 54 year old respondents reported experiencing life-long monogamy. The younger age cohorts in this survey reported even lower figures (approximately 20 percent). These figures probably should be seen as minimal values due to the possibility of underreporting and because the NHSLS defined life-long monogamy as having had only one sex partner since age 18. In the French ACSF survey, 25 percent of men and 57 percent of women aged 50 to 54 years reported having only one sexual partner during the entire life course (Spira *et al.*, 1993). In the equivalent British survey, 31 percent of men and 58 percent of women aged 45 to 59 years old had only one sexual partner during their whole lifetime (Wellings *et al.*, 1994).

Current status monogamy, defined as a simultaneous exclusive partnership, in contrast, is the overwhelmingly dominant form of partnership. From the NHSLS data, it can be calculated that 92 percent of the respondents who were involved in partnered sex in the year preceding the survey had only one partner at a time during that year. In the French ACSF survey 94 percent of women and 86 percent of men of all ages (18–69) were monopartners in the preceding year (Spira *et al.*, 1993). In the British survey 92 percent of women and 85 percent of men (16–59) reported monogamous relationships over the last 5 years.

Such figures obviously decrease when sequential or serial monogamy over the entire life course is considered. As was already explained above, in recent decades partnerships have shown a tendency to split up after some time. The figures are quite large when both marriages and non-marital cohabitations are considered together. However, the break up of cohabitations and marriages is in the large majority of cases, especially amongst people of reproductive age, followed by a new relation.

Although modern culture technology and living conditions allow people to escape many of the costs of multiple partnerships (Buss, 1994), the large majority continues to live in a single partnership relationship. The modern partnership pattern corresponds quite well to the picture that we know from cross-cultural research which shows that in spite of the fact that an overwhelming majority of human cultures condone polygyny, most human individuals live in monogamy (Shepher en Reisman, 1985).

Multiple partnerships

Multiple partnerships, defined as having more than one partner at a time, appears as only a minority phenomenon when it is considered as current status behaviour. In the American NHSLS (Laumann *et al.*, 1994) only eight percent of the respondents who had partnered sex during the year preceding the survey, reported having had several partners concurrently. In the French ACSF (Spira *et al.*, 1993) 14 percent of men and six percent of women aged 18 to 69 had more than one partner during the year preceding the survey. In the British NSSAL (Wellings *et al.*, 1994), 16 percent of heterosexual men and eight percent of women, aged 16 to 59, had more than one partner during the last year. These low figures correspond quite well with the low prevalence of multiple marriages in polygamic cultures where only five to ten percent of unions are polygynic (Fisher, 1992).

Considered over the entire life course, the experience of simultaneous multiple partnerships appears to be somewhat more common. Its prevalence can be estimated from reported data on extra-marital relations or adultery. This phenomenon is usually defined as the occurrence of sexual intercourse between a married man or woman and someone who is not at that time their spouse (Lawson, 1988). However, people consciously opting for an open marriage will certainly not consider themselves as adulterous. On the other hand, marriage is becoming too narrow a category for assessing partnership, since more and more people experience unmarried cohabitation. However, even in unmarried cohabitation partnerships, most people expect sexual fidelity from their partner. Therefore adultery should be defined as the occurrence of extramarital or extra-cohabitational affairs, namely sexual relations with other people without the consent of one's own partner or spouse, thereby breaching the sexual exclusivity rule of marriage or consensual union (Gangestad and Thornhill, 1997).

During the full length of their marriages, less than ten percent of women and less than 20 percent of men in the NHSLS reported extramarital relations. Among the NHSLS cohabitants, these figures are somewhat higher: 15 percent among women and 25 percent among men. In the British survey, 15 percent of men and eight percent of women, aged 16–59, reported concurrent relationships over the last five years.

Obviously the frequency of respondents having had more than one (sexual) partner over the entire life course, either concurrently or subsequently, is much higher. The NHSLS results show that, overall, 76 percent of 18 to 59 year old respondents had experienced partnered sex with more than one person after age 18. Amongst women, the proportion is 70 percent, and amongst men 83 percent (Laumann *et al.*, 1994). The French ACSF reveals that amongst 18 to 69 year old respondents, the number is 54 percent of women and 78 percent of men (Spira *et al.*, 1993). In Britain, 58 percent of heterosexual women and 78 percent of men aged 16 to 59 have had more than one sexual partner throughout their whole lifetime (Wellings *et al.*, 1994). It can be deduced from these figures that most of this behaviour is of a subsequent nature. The behavioural survey data corroborate findings from preference surveys which show systematically that men report preferring more sex partners than do women (cf. Buss and Schmitt, 1993; McBurney *et al.*, 2005).

Whatever statistic is considered, polygyny systematically appears to be somewhat more prevalent than polyandry, but not to that degree that it can be concluded that males are predominantly polygynous and females monandrous (Greenlees and McGrew, 1994). In particular, men with resources and status may be better able to attract multiple partners, but also young and attractive women may be freer to discriminate (Feingold, 1990). Males may be more promiscuous than females, but both sexes must compromise with the strategy of the opposite sex (Walsh, 2002). We should be careful with statements generalising about men's inclination towards promiscuity and women's monogamous nature. Moreover, according to some authors, the differences in reported number of lifetime sexual partners by men and women are not to be completely trusted

(Einon, 1994). On the basis of several recent probability surveys, the reported number of lifetime sexual partners appears to be somewhat more than ten for men and somewhat more than three for women – an average difference of seven partners. This difference should logically be accounted for by an excessive number of hypersexual women and/or by prostitution. The frequency distributions of sexual activity, however, show that there are somewhat fewer hypersexual women than men, and Einon's analysis of prostitution rates suggests that this phenomenon cannot account completely for the discrepancy. Hence, we are facing here a tenacious paradox: more than women, men systematically report that they desire more sexual partners, and also that they have (had) higher numbers of sexual partners, whereas neither the number of hypersexual women nor the practice of prostitution seems to be able to account for the difference. Einon (1994) hypotheses that, based on their evolutionarily developed gender specific mating and reproductive strategies, women may have an interest in hiding their promiscuity because they want to reinforce the paternity confidence of their partners, whereas men may have an interest in exaggerating their sexual potency because of perceived links between sex and social status. Hence, he concludes that no one tells the truth and that the real figure is probably somewhere in the middle.

Polygynandry or group marriage in which there is or must be free sex, is a phenomenon that is extremely rare and never lasts a long time. Wherever it was tried, it soon failed either because of abuse by some dominating males, or because people tend to pair up (Fisher, 1992).

Promiscuity, defined by Laumann *et al.* (1994) as having had at least five partners within the last year or more than 20 over a lifetime, is reported in the NHSLS to occur at a frequency of 5.1 percent, respectively 16.6 percent amongst males, and 1.7 percent, respectively 3.2 percent amongst females. In the French ASCF survey (Spira *et al.*, 1993) four percent of women and 23 percent of men of all ages (18–69) report having had at least 15 partners over their entire life course. Only a minority of people, particularly young men, opts (temporarily?) for variable, non-durable relations (Corijn, 1996; Laumann *et al.*, 1994).

Dynamics of partnership

The important changes in family structures observed in recent decades are partly the result, but also partly the cause of changes in relational contents, dynamics and processes (Deven, 1996). Both partner relations and parent-child relations have been affected by several changes in values in power and decision-making equilibria, and in the emotional content of relationships. The experience of partnership has shown a shift from complementarity toward egalitarianism, from normative action toward individual choice behaviour, and from a commanding toward a negotiating housekeeping. Similarly, parent-child relations have undergone changes including a shift from paternal power to parental authority, from submission to self-development, from obedience toward exploration, and from a unilateral toward a bilateral transmission of values and knowledge. All in all, both partnership and parent-child relations are subject to much higher cognitive and emotional requirements. Family relations have, consequently become more vulnerable, less stable, but also more satisfying.

Causes and consequences

On the basis of the human evolutionary heritage, sociobiologists have characterised our species as "designed for a system of monogamy plagued by adultery" (Ridley, 1993), as "mildly polygamous" (Alexander *et al.*, 1979), or as "primarily monogamous with polygamy as a secondary opportunistic reproductive strategy" (Fisher, 1992). Wherever social monogamy is imposed, various forms of adultery may be expected. On average, males show or at least report higher levels of promiscuity than females. The most important biologically based prediction, however, concerns the fact that most people will strive for enduring relationships or at least expect such behaviour from their partner (cf. Van den Berghe, 1979; Mellen, 1981; Fisher, 1992). It is understandable that women in particular highly value long-term relationships and seek long-term commitment (Landolt *et al.*, 1995).

The picture which emerges from the data and observations about partnership behaviour in modern culture corresponds very well with the evolutionary predictions. It differs from the doomsday scenarios which have been advanced on the basis of changes in some formal indicators of partnership have undergone in recent decades (such as the decrease in nuptiality rates). It also differs from the profiles resulting from non-probability samples such as the Kinsey (1948; 1953) and the Hite (1976; 1987) reports. It is, however, not without ambiguity. Humankind's evolutionary heritage includes several tendencies: the major one tends towards long-term relationships, but other preferences and tactics in mate choice may compete with or complement the inclination toward this type of partnership.

The strong drive toward the establishment of enduring relationships in the human species is ultimately explained by the need to care for and socialise offspring who mature slowly and over a long time period. Staying together had, and still has, clearly an evolutionary advantage (Buss, 1994; Fisher, 2004). Recent neurological and genetic research has even given the first clues about the evolutionary adaptation of the human brain to monogamic behaviour (cf. Insel and Carter, 1995; Young and Wang, 2004; Edwards and Self, 2006).

As a long-term mating strategy, monogamy has several evolutionary advantages: children in a monogamous family have a higher coefficient of relationships than in any other social unit (Melotti, 1980); women can garner far more resources for their children through a single spouse than through several temporary sex partners (Buss, 1999); monogamy increases paternal certainty; children's survival and later reproductive success is more likely through higher paternal investment (Buss, 1999); monogamy is the expected outcome of K-selection processes in which parental investment is equalised between the sexes (MacDonald, 1990); and monogamy contributes to the establishment of democracy and the harmonious functioning of larger societies in which sexual competition between males is reduced (Holcomb, 1993; Ridley, 1993; Voland, 1993). Egalitarianism in sexual and social relationships is believed to be highly consistent with the principle of self-interest and the other central tendencies of human behaviour predicted by evolutionary theory, which predicts that humans will not only attempt to maximise their own reproductive success but also attempt to minimise the negative differential between their own success and that of others (Liesen, 1995).

It is also noteworthy that in modern culture, where mortality control depends less on the survival of the family, but where quality of life criteria have become so much more significant for social and intergenerational success, long-lasting relationships remain important.

Monogamy might, of course, also have some negative effects, particularly for dominant males: monogamy restricts the number of their sexual relations and consequently limits their inclusive fitness. In some respects this might have some dysgenic effects (Ridley, 1993). In contrast, monogamy favours the reproductive fitness of non-elite men (Wright, 1994).

Although the break-up of partnerships involves considerable costs – emotional, material, and even reproductive – for at least some of the family members (cf. Mellen, 1981; Fisher, 1992; Buss, 1994), it can resolve – again at least for some family members – existing problems of partnership incompatibility and conflict and may even enhance the reproductive fitness for those who succeed in establishing a new, more successful relationship. In some circumstances, serial monogamy may induce adaptive advantages at least for some individuals (Fisher, 1992; 2004; Liesen, 1995).

Multiple partnerships, both as a long-term (polygamy) and as a short-term (adultery, promiscuity) mating strategy, can be adaptive for those practicing it (Fisher, 1992). Multiple partnerships without contraception seem to be more advantageous for men than for women: ultimately, it enhances the male opportunity for spreading their genes over multiple women and thus enhances their inclusive fitness. There are several physiological and psychological indicators for the male short-term mating strategy: testicle size, variation in sperm insemination, different sperm morphs, phantasies about sexual access to a variety of partners, greater desire for casual sex and a variety of partners, more extra-marital relations, more prostitution, faster transition to intercourse, and lower standards in mate selection (Buss, 1999).

Whereas polygamy has proximate and ultimate advantages for those men who succeed in partnering with several women, and it might have some proximate advantages for the first wife in a harem, it definitely has ultimate disadvantages for the concubines since the number of children per woman decreases with increasing harem size (Borgerhoff Mulder, 1990).

A short-term mating strategy might also have some advantages for women: it might provide her with extra resources; it might initiate mate-switching in case of existing unsatisfactory relations (Fisher, 1992), and it might enhance her fertility, upgrade the genetic fitness of her offspring, and increase the variation of her offspring (Smith, 1984). Signs of the existence of female short-term mating strategy include: extramarital affairs, and the coincidence of extra-marital copulations with ovulation period (Baker and Bellis, 1995).

However, short-term mating strategies have also negative effects. For men they may involve: increased risk of sexually transmitted diseases, lower chances of establishing a long-term relationship, lower survival rates of children due to lack of paternal investment or protection, the provoking violence of other men, and costly divorce. Women, even more than men, are susceptible to sexually transmitted diseases, may suffer greater risk of physical and sexual abuse, may impair their desirability as a long-term mate, and have a higher risk of producing offspring without paternal investment (Buss, 1999).

On the whole the advantages of multiple partnerships do not offset the benefits of an enduring single partnership, both at the individual and the societal levels. Nevertheless, wherever the latter – single partnership – fails or proves to be inadequate, the alternative solution – multiple partnerships – may be applied as a secondary strategy.

In modern culture the old-fashioned sexual differences in partnership strategies can still be observed, but there are clear signs of a convergence in sexual behaviour between the two sexes: changes of a socio-biological (mortality and fertility control), socio-economic (the shift from a family-based to a broader societal production system) and socio-cultural (the shift from a beliefs-based to a knowledge-based value system) nature allowed women to change most. In fact, men are losing their dominant position in partnership matters, illustrated by phenomena such as a decrease in socially or family-arranged partner choice, increasing initiation of divorce procedures by women, a sexually more equal division of occupational, household and child-rearing tasks, and increasing societal pressure to ban the sexual abuse of women (e.g. genital mutilation, female seclusion, sexual harassment at work, battered women, incest, paedophilia, exploitation of prostitution, and rape).

A revolutionary, but insufficiently acknowledged, change in male-female relations has resulted from the invention and spreading of modern contraceptive methods. The fact that women can now efficiently control their fertility has freed them from the psychological pressures and physical burden of unwanted or untimed pregnancy, resulting in decreasing numbers of unwanted adolescent births, premature marriages, forced marriages, and excess fertility. Perhaps efficient contraception has also facilitated multiple partnership and extra-marital relations. However, for promiscuous males, modern contraceptive methods are a disaster: the gene-spreading effect of their behavioural pattern is strongly reduced, if not completely eliminated. In the long run, modern contraception will erase the genetic effect of the machismo of philandering males since extramarital affairs will no longer have reproductive effects. As a matter of fact, modern birth control practices have completely changed the rules of the game. Whereas in earlier times, sexual promiscuity and extramarital sex might have increased the reproductive fitness of philanderers, in the modern contraceptive society, women can effectively protect themselves against the unexpected or undesired side-effects of adultery, namely against births which would not be fathered by their spouses. The same holds for aggressive males who in earlier times, particularly in wartime, succeeded by means of rape or slavery to increase their inclusive fitness, but in modern society have no such advantages. When parenthood tends to concentrate amongst couples that establish enduring relations, this personality type will, genetically as well as culturally, have the advantage. The long-term Darwinian effect of differential reproduction should not be underestimated (Cliquet and Avramov, 1998).

Modern birth control might also give women also better opportunities to choose the father(s) of their children. On the other hand, modern paternity identification methods will decrease the risks of cuckoldry. Males who suspect that their partner was fertilised by another man are, thanks to modern paternity identification techniques, now able to have certainty about their genetic fatherhood.

THE FUTURE OF THE FAMILY

Family households in Western countries are becoming smaller in size, but show an increasing diversity and complexity in structure and dynamics. The unlinking of sexuality, marriage and reproduction further continues, resulting in a deinstitutionalisation, de-standardisation and de-chronologisation of relational and reproductive behaviour. Individuals experience more complex family-related life courses with a limited number of successive unions.

The multiplication of family forms in recent years constitutes the basis for the majority of hypotheses regarding the future of the family. In recent literature (e.g. Cornish, 1979; Roussel, 1989b; Duvold, 1995; Moynihan *et al.*, 2005) we find that mainstream 'visions of the future' can be grouped into the following three major types of scenarios: (1) disappearance of the family; (2) restoration of the traditional family; (3) persistence or further increase of family variation.

Disappearance of the family

Recent trends of various demographic indicators of family life may, at first sight, seem to confirm that the family is about to vanish: nuptiality and fertility are decreasing, whilst consensual unions, LAT-relations, union disruptions, single person households are increasing.

Whilst it may be argued that the significant decline in nuptiality rates is indicative of the loss of appeal of a certain type of legally regulated partnership, it does not necessarily foreshadow the disappearance of the family. The lower propensity to conclude matrimony or postponement of formal marriage is (more than) compensated for by other types of partnership such as non-marital cohabitation and LAT-relationships. Evidence from a variety of sources shows that most people establish an enduring relationship and many eventually marry. Investigations have shown that cohabiting couples strongly resemble married couples in many ways (e.g. Brown and Booth, 1996). Furthermore, in many countries equal rights and responsibilities for married and un-married couples are supported by legislation, blurring thus any significant social differentiation between married and cohabiting couples.

The need for an enduring partnership combined with some other sexually or reproductively related personality features (e.g. jealousy, nepotism) implies that communes as types of partnership disappeared in modern culture as quickly as they arose (Behnam, 1990).

An increase in the divorce rate may be interpreted as a threat to a certain model of the family. It may be argued that present levels of divorce reflect differences in gender expectations with respect to partnership, rather than rejection of enduring relationships. In particular, many men seem to be unable to adapt to an emancipated female partner. However, research also shows that most divorced people want to and do establish new, enduring relationships.

The decline in fertility has been remarkable. But, recent fertility surveys in many countries (e.g. Klijzing and Corijn, 2002) as well as demographic registration data (Sardon, 2002; Council of Europe, 2006) point to a trend toward stabilisation of fertility, although at a low level. Fertility surveys also show that the vast majority of married and unmarried couples want to have children. In fact, they affirm that they want more children than they currently have or expect to have (cf. Höhn *et al.*, 2008).

Some authors have recently tried to explore the limits of low fertility. Both on the basis of a biosocial approach, based on analysis of the biological predisposition toward nurturing behaviour (Foster, 2000) and demographic analysis (Golini, 1999), it is concluded that most women will choose to have at least one child and that, consequently, in the absence of extreme environmental pressures against having children, the limits to low fertility are very probably in sight.

A nuanced analysis of demographic data reveals the shallowness of 'the death of the family' scenario based on a quick reading of statistics. But, even stronger arguments against the disappearance scenario are found in the human biogram. After all, humans have been selected – for reproductive ends – to form enduring, though not necessarily lifelong, sexual bonds. Indeed, there is ample evidence that in modern culture, where a wider range of relational options has become available, the vast majority of the population continue to want to develop enduring relationships in which romantic love is seen as a buttress (cf. Sternberg and Barnes, 1988; Laumann *et al.*, 1994). The same holds for bearing and rearing children. For a large majority, parents want to have children and want to raise their children themselves.

Moreover, sociobiology offers another argument against the disappearance thesis. This argument is concerned with the effect of Darwinian selection, namely of the differential reproduction of carriers of various genes or ideas. The potency of this evolutionary mechanism is generally underestimated, either because knowledge about evolution is still insufficiently disseminated or because it meets with ideological opposition. Another reason may be that the selection mechanism only shows results in the long term and such a perspective is currently not much in vogue.

Sociobiology shows that not only genes but also ideas are under the pressure of Darwinian selection. Indeed, ideas may be regarded as the genes of cultural development (cf. Dawkins, 1976; Lumsden and Wilson, 1981). From an evolutionary point of view, culture can be considered as an exosomatic system that facilitates adaptation. Consequently, adaptation-promoting cultural innovations will have a positive effect on reproductive fitness. However, not all cultural innovations promote fitness. Just as with genes, there are favourable, neutral and unfavourable cultural variants. A substantial difference between genes and ideas is that ideas can be passed on both vertically and horizontally, whereas genes, as yet, are only vertically inherited – namely passed from parents to children (Alexander, 1979b).

In conclusion, the emancipatory opportunities associated with technological and cultural modernisation are reshaping human relations. Modern humans may be facing an inconsistency between growing opportunities and rising individual aspirations on the one hand, and present-day societal structures not yet well adapted to the new environment, on the other hand. From a broad evolutionary and historical perspective, modernisation is in fact a revolutionary innovation, totally different from the Environment of Evolutionary Adaptedness EEA (Bowlby, 1951; Symons, 1979) in which the human emerged and evolved. Modernity is a cultural mutation, a sudden change requiring adaptation in many respects, either by genetic or by cultural means.

The diagnosis about the multiplication of family forms, and increased frequency of transitions between different of these forms provides no justification for the 'vanishing of the family' prediction. From a sociobiological point of view, as well as on the basis of available empirical data on relational and reproductive behavioural changes in modern culture, 'the death of the family' scenario is most improbable. Care of child(ren) and enduring (though not necessarily lifelong) relationships persist as two basic family functions in modern culture.

Back to the traditional family?

Some people look upon the modern family transition with sorrow and nostalgically hope family life will return to what they perceive as its traditional structures and functions. They are mainly found in ideologically, religiously and politically conservative quarters, if not in extreme right wing circles (Abbott and Wallace 1992; Gilbert, 1999).

What should be understood, however, by the idea of the 'traditional family'? Is it the traditional biological family, as it existed under conditions of high mortality and high fertility that produced high frequencies of one-parent families and stepfamilies as a result of the death of a spouse? Is it the traditional economic family with the father as the sole breadwinner and the mother as homemaker? Or is it simply the traditional ideological family in which sexuality, nuptiality and reproduction are expected to be inseparable? Is it the model of a family which excludes contraception, abortion, premarital sex, unmarried cohabitation, divorce and that starts with heterosexual matrimony and produces (many?) children in a lifelong monogamy as for instance Caton (1985) suggested in his conservative discourse on feminism and the family?

We can be brief concerning the biological traditional family. It is difficult to imagine that anybody would want to re-introduce a generalised high mortality, implying the necessity of a compensating high fertility. The traditional economic family model, however, with its clear-cut gender-segregated role and task division, is not yet completely unknown in modern society. Some ideologycally conservative pressure groups continue to advocate this model, and many a would-be patriarch is filled with nostalgia for the times gone by. However, the aspirations of recent generations of women show that this model can be dismissed. All recent surveys show that the overwhelming majority of young women want to join the labour force, to earn money or to develop a career (cf. Van Dongen *et al.*, 1995; Gornick and Meyers, 2003; Van Dongen, 2009). Thus, female career and family aspirations rule out asymmetrical partner roles.

What are the chances of a revival of the traditional ideological family? The development of a social counter-movement can never be excluded completely, as may be evidenced by the appearance of new religious movements (cf. Bromley *et al.*, 1981). However, these movements manifestly affect only a minority of the population, at least as yet. A generalised return to the ideological family, however, must be regarded as unlikely because the biological, economic and cultural bases for such a return simply no longer exist. Mortality and fertility control and new insights about man and society have eroded the functional basis of traditional ideologies.

All this does not mean that some of the current tendencies in the development of family formation might not lead to a partial countermove. A sustained very low fertility rate resulting from a generalisation the one-child family would produce unfavourable social effects in the long run, for instance as regards intergenerational continuity and intergenerational transfers. Therefore, it is quite possible that subsequent generations will draw lessons from the reproductive behaviour of former generations and spontaneously increase their fertility. It is even more likely that the state will try to prevent a sustained very low fertility and will implement a wide range of family supporting measures (Roussel, 1991). But, the two- or three-child family obviously does not imply a return to the traditional family.

Modern family variation

The family demography of modern society shows an increasing variation in household types and more complex family life courses in recent decades

(Sobotka and Toulemon, 2008). Family and household variation is, however, not a completely new phenomenon. In pre-Victorian societies, some family and households types – e.g. celibacy, mono-parental families, and reconstituted families – were as common if not more common than today, but the causes of their prevalence – mortality levels, economic constraints, and ideological choices – were different from the current ones (Laslett, 1965). The modern ideological attitude toward family variation is also different. With modernisation, society clearly evolved from a uniform ideal toward the tolerant acceptance of a pluriform variation that is the outcome of individual choice.

The existence of social security networks and the abundant recreational opportunities offered by modern culture, together with the ideologies of equality and the liberty of pluralist democracy, promote individualisation. These conditions combined with the variability in personality features and reproductive strategies of both genders (Batten, 1994), suggest that the expanding diversity of family and household types, especially with regard to partnership, will continue or even increase (cf. Hoffmann-Nowotny, 1987; Roussel, 1989a; Höpflinger, 1990).

By reason of the specificity of human bio-psychic needs, it may be argued that most people will continue to strive after enduring relationships, even though they will not necessarily be of a lifelong nature. Moreover, surveys corroborated that most people want to develop enduring relationships and even want to marry (cf. Kiernan and Wicks, 1990; Corijn and Klijzing, 2001). All this leads us to expect that both individual biographies and family formations will become even more complex and differentiated than they are today.

Since external pressures – familial, religious or general social influences – together with internal pressures – economic dependence, a large family – have weakened, if not totally undermined, the value of ‘legalised’ partnership, intimate relationships will become more and more dependent on individual personality features and decisions. In addition, demands made upon intimate relationships will become greater and greater. It follows that families will become much more vulnerable and may, to a considerable extent, end in separation or divorce. At the same time, the shift from a social to a more personal choice of partner and relational continuity, including the possibility of splitting up and establishing a new relationship, results in more gratifying relationships and increased marital or relational happiness.

The continued rise in divorce rates may result in a further increase in the frequency of one-parent families. Some authors (e.g. Rivera, 1994) even predict that the one-parent family headed by a mother will become the most common future family pattern or, at least, one of the most frequent family types. This would mean that the pre-hominid mother-child bond would become again the basic unit of society. It is legitimate, however, to question whether we are not confusing one-parent households with one-parent families. Co-residence is not necessarily a good enough indicator of the functional roles of parents. Joint or shared custody may become more prevalent. Modern working conditions tend to leave more time for working fathers to enjoy their role as caregivers than they did in the past. Men may not wish to abdicate as fathers, even when they cease to function as husbands.

Rising separation and divorce rates do not necessarily have to result for long in one-parent or single-person families. Most divorced people, with or without children, build up a new relationship or even remarry. Now that divorce is becoming a quite frequent phenomenon, we may expect the values and standards relating to divorce and parenthood held by divorced or separated persons to change as well. We may expect that divorced or separated people will adopt a more supportive attitude toward their relationships with former family members (e.g., partner and children), and society may develop more effective means to prevent children from being used as bargaining chips between former partners. However, considerable effort will be needed to neutralise or balance innate drives such as dominance, possessiveness, jealousy and nepotism, which are deeply embedded in the human biogram (cf. Alexander, 1979a; Betzig, 1997).

It is to be expected that the frequency of one-parent families, at least as a transitional family stage in the life course, will increase or remain high. This type of family will remain in the near future a vulnerable social group, given the facts that today most one-parent families are headed by women, that women's social position is still relatively weaker than that of men and that women, more than men, must cope with the existing incompatibilities between gainful employment and family life, especially child care (Avramov, 2003).

The combination of the drive to develop enduring relationships and the increasing vulnerability of relationships, often resulting in divorce, may lead to the maintenance, or even a rise in the frequency, of reconstituted families by way of remarriage or cohabitation.

For many people, the modern bio-cultural context is leading to the re-emergence or reinforcement of the practice of successive monogamous relationships. An important innovation in this respect is the considerable increase in life expectancy in modern culture, which allows or forces lifelong monogamous partners to have a continuous partnership of more than half a century. The long life expectancy is a novelty to which the human species is perhaps not well adapted, especially now that the traditional biological, cultural and economic constraints promoting family bonding have been loosened. Successive monogamy may be a better adapted system to the new conditions, although it is probably not free from particular constraints, such as the demands placed on relations between stepparents and stepchildren in the presence of surviving biological parents, and the gender differences in reproductive clocks and ageing patterns.

Unmarried cohabitation, especially as a premarital phase, may continue to increase. In some demographically more advanced countries cohabitation is already a generalised stage in the life course (Prinz, 1995). Nevertheless, we may expect that, in the end, most people will continue to marry for a variety or combination of reasons such as the emotional need for an enduring affectional relationship, certainty of fathering for the male, guaranteed paternal investment for the female, legal advantages, social status, pressure of the parental families, social advantages, ideological grounds and the magic effect of rituals. Furthermore, the removal of the traditional impediments to divorce may decrease the growing reluctance to marry or the current trends of delaying marriage.

Several aspects of modernisation, mainly the increased career opportunities for women and improved geographical mobility**,** also offer the possibility of or, as the case may be, necessitate developing a LAT-relationship (“Living-Apart-Together”). This choice presumably concerns a very heterogeneous category that is opted for as a result of a variety of factors and circumstances (such as personality type, employment conditions and location, mobility requirements, family phase, financial position, etc.). Given the economic and psychological burden that, in many cases, weighs on this type of partnership, we may suppose that LAT-relationships will remain a minority or constitute a transitional stage in a person’s life course. It may become more important in later life stages, for instance after a divorce or in the case of widowhood (Villeneuve-Gokalp, 1997; Trost, 1998).

It may be expected that some people will, at least during some stages in their life course, opt for free and variable relationships. Recent surveys showed that this category of people, consisting especially of young males, is expanding (e.g. Laumann *et al.*, 1994; Corijn and Klijzing, 2001). Given the multiplicity and diversity of human needs and drives, it is not surprising that, in the absence of stringent life- or welfare-threatening environmental pressures, a larger variation in behavioural choices manifests itself. It is also not surprising that this is more prominent for the human male, given his still relatively lower interest in parental investment and less restricted reproductive biological clock.

As they become less stigmatised, same sex relationships may be expected to increase or, at least, become more visible to the general public. As more evidence corroborates that homosexuality is largely determined by biological factors, we may expect that the social acceptance of homosexual households and families may increase. In our modern multi-million member societies, such relationships do not constitute a threat to the reproductive continuity of society. Both evolutionary insights and sexological surveys reveal that homosexual relations are quite rare.

In pre-modern culture, celibacy was not uncommon for various economic, biological and ideological reasons. Several features of modern culture, such as the higher standard of living, the improved state of health, the ideology of equality and secularisation, are causing this phenomenon to wane. Nevertheless, celibacy may be expected to persist, not only because a number of people will not succeed in being singled out for appropriate partnership, but also through the fact that some consciously choose celibacy as a lifestyle. Surveys have clearly found that such a choice is made only by a minority of the population (cf. Corijn and Klijzing, 2001).

All forms of forced partnership or sexual exploitation, such as enforced or arranged marriages, paedophilia, incest, rape, and constrained prostitution, may be expected to become more rare, not because their biological basis has disappeared, but because living conditions in modern culture promote the existence of emancipatory ideologies, particularly for children and women. Forced partnership or sexual abuse is incompatible with modern cultural values.

Fertility surveys (e.g. Abma *et al.*, 1997; Wu, 1999; Klijzing and Corijn, 2002) repeatedly and amply show that we may expect that most people will continue to want children, but – given the current social, economic and cultural conditions – in restricted quantities, not more than one or two per couple. Factoring in the unavoidable occurrence of wanted and unwanted childlessness and one-child families, this will lead to the perpetuation of below-replacement fertility (Frejka and Sobotka, 2008). Population categories with above-replacement fertility may become to predominate in society on account of their differential reproduction.

Because of social security and the individual's wider range of emancipatory opportunities in the sphere of employment and recreation, the one-child family and even childlessness may in certain economic or cultural conditions increase considerably. However, it should be stressed that new forms of childlessness may result from a postponement strategy, as a consequence of role incompatibilities, rather than a conscious and final choice not to have children. The still-persistent partial incompatibility between family duties and employment, especially for women (e.g. Van Dongen *et al.*, 1995; Höhn *et al.*, 2008; Van Dongen, 2009) constitutes a well-known obstacle to reproduction experienced by many individuals.

The introduction of social security and other social protection systems and processes, which in modern culture ensure survival and well being largely independent of family structures, have complemented and even replaced individual parental investment in one's own offspring. They have also changed the nature of intergenerational transfers of resources, and to a lesser degree provision of support services between adult children and aged parents. In the last few decades, all this has led to an erosion of some functional aspects of the family. In the 1990s, there was an increase in instances of intentional lone motherhood (Miller, 1992) and a general decrease in fathers' interest and investment in the offspring from their former relationship(s) (Roussel, 1991). Institutional solidarity, which has replaced direct family transfers, is a part of the modernisation process that has made possible substantial changes in family relations and family structures.

Despite the weakening of several traditional social and economic functions of the family, it seems inevitable that, due to the nature of the human biogram, families will (have to) continue to fulfil their fundamental role in the procreation and primary socialisation of offspring. This includes fulfilling related functions, such as assisting in children's physical and emotional development, and the creation and maintenance of enduring intimate partner relationships. In the process of hominisation, both genders have developed, perhaps to somewhat different degrees, emotions that promote enduring relationships as well as care for one's own offspring. Moreover, success in modern culture requires, despite the existence of supportive social structures, high individual parental investment in offspring, an effort most parents want to continue to make. Nepotism is a particularly strong driving force in this regard (Alexander, 1979a). Consequently, it may be expected that most of the population will continue to consider the family the most important unit for physical care and emotional security, both for children and adults. Experiments entrusting other institutions with family duties relating to primary socialisation of children, or promoting alternatives to enduring partner relationships have failed miserably either because of their poor results (Prigent, 1955), their high economic cost, or the resulting emotional dissatisfaction of participants (Bowlby, 1951; Montagu, 1957).

What about the more distant future?

The 'future of the family' scenarios described in recent sociological literature (e.g. Cornish, 1979; Hoffman-Nowotny, 1987; Roussel, 1989b; Duvold, 1995) all look at family changes from a relatively short-term perspective. A sociobiological or evolutionary approach, however, always considers a longer-term perspective. Hence, one may raise the question how recent changes in relational and reproductive behaviour might evolve in the more distant future?

The evolutionary approach explains the past based on insights into the evolutionary mechanism and the reconstruction of the Environment of Evolutionary Adaptedness (EEA). These insights add to the knowledge we have about our present novel environment, but it is much more difficult, on the basis of our present level of knowledge, to foresee what the future evolutionary environment will be and consequently to make a long-term evolutionary forecast.

What can be said is that, if the present trajectory of cultural progress continues, the future environment, and individual lives within it, will increasingly be shaped and steered by human intervention. This intervention will likely be directed toward the improvement of the quality of life, even at the expense of quantitative goals which were so important in the past (Cliquet and Thienpont, 2005).

Efforts to promote quality of life, however, may take different directions. For instance, they could concentrate uni-directionally on individual need satisfaction and promoting individualism (if not solipsism to the utmost), or they could also pay attention to social relations at the meso and macro levels. The future of humanity and its most basic sociobiological institution – the family – will in other words also depend upon the future value system that is chosen and the developmental goals we set for ourselves.

As far as family life is concerned – particularly with regard to its two basic functions, care of slowly maturing offspring and the building of enduring adult partnerships – we should not harbour unrealistic illusions. Unless we succeed in fundamentally changing the human genome’s influence on these functions, it will not be easy to liberate ourselves from our evolutionary past. Indeed, without genetic change it may be that some of the past trends in human evolution – for instance, the increasing maturation time of offspring and the need for enduring and profound affection – will even be re-enforced in the future. Last but not least, it may well be that we would not want to eliminate such deeply embedded emotional needs, which result from millions of years of evolution.

There can be little doubt that, from an ontogenetic point of view, future family life will be increasingly influenced by scientific insights into family functions and relations. Psychological counselling and psychotherapy in family relations will increasingly contribute to the management of family processes and conflicts (cf. Nichols and Schwartz, 2007). The availability and further development of pharmacological inventions that stimulate or attenuate those processes, such as means of birth control (cf. Sitruk-Ware, 2006), hormone-replacement therapies, drugs that address sexual and reproductive dysfunctions, affective disorders or disruptive behavioural disorders (cf. Booth *et al.*, 2000), will certainly also be found in the family management toolkit.

However, in the long run, the most important determinant of the future of the family will be Darwinian selective processes that result from the changing mating and reproductive behavioural patterns of modern culture. To the extent that genetic factors are involved in the development of partnership and parenthood practices, the virtually universal availability and use of modern methods of contraception and abortion will change behavioural predispositions in the direction of couple formation as well as desire for children and childbearing, due to the fact that behavioural predispositions toward alternative forms of relational and reproductive behaviour will be outselected. Obviously, behavioural patterns such as voluntary celibacy will be selected against, as it was in the past. But, as already argued above, other mating patterns which are not conducive to long term paternal investment, such as extra-marital sex, machismo, and rape, will also be outselected.

Contrary to Baker (2000), who argued that

> *"The demise of the nuclear family is an*
> *inevitable step in social evolution."*

we are inclined to predict that modern society, with its 'quality children' value system and its contraceptive revolution, will strengthen the nuclear family.

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CHAPTER 6

REPRODUCTIVE VARIATION AND PRO/ANTI-NATALISM

INTRODUCTION

Reproduction is one of the most basic drives in human behaviour, programmed by millions of years of biological evolution. At the same time, it is one of the human biosocial features that have been most strongly changed by modernisation. This change has provoked – and in some countries or quarters, still provokes – profound ideological conflicts, and has fundamentally influenced gender relations and family structure. In the short term, the quantitative growth of modern populations has halted, and in the long term we can expect several population genetic effects from these changes.

THE EVOLUTIONARY BACKGROUND OF HUMAN REPRODUCTIVE BEHAVIOUR

In earlier chapters, we discussed some specific features of human reproduction that are directly or indirectly related to the long maturation process and neediness of the human child, including: premature birth, late puberty, sexual characteristics facilitating the creation of enduring partnerships such as hidden ovulation, the development of large breasts, female orgasm, menopause, and the neuro-hormonal control system focussed on cooperation.

General evolutionary trends with respect to reproduction

In a paper reviewing research on evolution and human reproduction, Rhodes (1962) drew attention to some general evolutionary trends, showing that human reproductive characteristics are often related to the prolongation of general phylogenetic trends, such as:

- The shift from a quantitative to a qualitative reproductive strategy (r/K evolution);
- The increasing probability of fertilisation, delayed timing in the onset of reproduction;
- The expansion of the infant and juvenile periods of the lifespan;
- The intensifying protection of offspring, prenatally through improvement of the anatomical and physiological organisation of the reproductive apparatus (in the evolution of the primates, among others, this was

characterised by the transformation from a double to a single uterus chamber and the shift from multiple to single gestation), and postnatally through the progressive development of social protection mechanisms such as the family and society.

Human reproductive physiology is specialised toward the production of high-quality, large-brained offspring. To this end, during pregnancy human females have decreased metabolic rates and store fat (Ellison, 2001). The human male reproductive strategy is characterised by pre-insemination mate guarding rather than post-insemination sperm competition, which has played a relatively minor role in human evolution (Campbell, 2003; Dixson, 1998).

Humans are unique in raising multiple dependent offspring of different ages and caring for (feeding) their offspring during the juvenile period of life. These developments were only made possible thanks to the establishment of long-lasting pairbonding through which extensive paternal investment in offspring, mainly via material support, cumulated in the further increase and prolongation of the period of maternal care (e.g. Short, 1976; Lancaster and Lancaster, 1987).

Both human females and males show physiological and behavioural adaptations that are consistent with an evolutionary history involving extensive male parental investment and provisioning (e.g. Kaplan *et al.*, 2000).

Both men and women had derived benefits from linking their economic and reproductive lives over the long run. The large majority of foragers live in monogamous relations, and even continue to do so after women's menopause (e.g. Binford, 2001).

Maximisation of inclusive fitness

In recent decades, the development of sociobiological theory has, among things, resulted in the formulation of the 'maximisation of inclusive fitness' principle (Hamilton, 1964; Trivers, 1971; 1985; Alexander 1975; Wilson, 1975; 1978; Durham, 1979; Irons, 1979; Dawkins, 1982; Lopreato, 1984). This theorem asserts that humans, like other organisms, developed through natural selection evolved behavioural tendencies to maximise their genetic representation in future generations in the context of constraints set by the environment and their phylogenetic past (cf. Irons, 1979; Turke and Betzig, 1985; Lopreato and Yu, 1988; Turke, 1989). Such optimal reproductive success, achieved through the production and survival of descendents and nondescendent relatives, results in evolutionary adaptiveness.

Sexually reproducing organisms with multiple dependent and long-maturing offspring are characterised by three major trade-offs in their life history (Kaplan and Lancaster, 2002):

1) Between present and future reproduction: natural selection will tend to maximise total allocations of energy to reproduction over the life course.
2) Between quantity and quality of offspring: natural selection will tend to maximise the long-term production of descendents; in the evolution of the hominids this implies a shift from the quantity to the quality of children.
3) Between mating and parental effort: natural selection acts on the mating and parenting activity of males and females so that individual fitness tends to maximise in a competitive equilibrium.

The paradox between maximisation of inclusive fitness and the demographic transition

One of the most important characteristics of modernisation is the demographic transition – the shift from high to low mortality and fertility levels (Landry, 1934; Notestein, 1945; Chesnais, 1986) (Figure 6.1). This transition began in the eighteenth century in northwestern Europe and the United States with a gradual decrease in mortality, which in most cases was followed, approximately one century later, by an incremental but rapid decrease in fertility by means of parity-specific birth control interventions.

Whereas the pre-transition phase was characterised by high mortality, high fertility and moderate population growth, the beginning of the demographic transition was characterised by mortality control and continued high fertility, resulting in explosive population growth. The end of the demographic transition was conceptualised as a state of low mortality and fertility levels, with population growth expected to fluctuate somewhat above the population replacement level. This model would have resulted in moderate population growth.

In contrast to the theory, industrialised countries have not yet reached the final stage of the demographic transition, but appear to have leaped into a new phase, that of persistent below-replacement fertility. Lesthaeghe and Van de Kaa (1986) (see also van de Kaa, 1987; Lesthaeghe, 1995) have labelled the recent changes in relational and reproductive behaviour, together with other factors leading to a more or less below-replacement fertility level, as the so-called ‘second demographic transition’. Others (e.g. Roussel, 1989; Cliquet, 1991; Coleman, 2004) consider the recent changes to be merely an acceleration and generalisation of the changes which started with the industrial revolution. Indeed, unlike the demographic transition at the turn of the twentieth century, the so-called second demographic transition does not appear to be a ‘punctuated equilibrium' (Coleman, 1986) in human demographic history, but rather an acceleration of the new demographic regime that emerged with modernisation.[1]

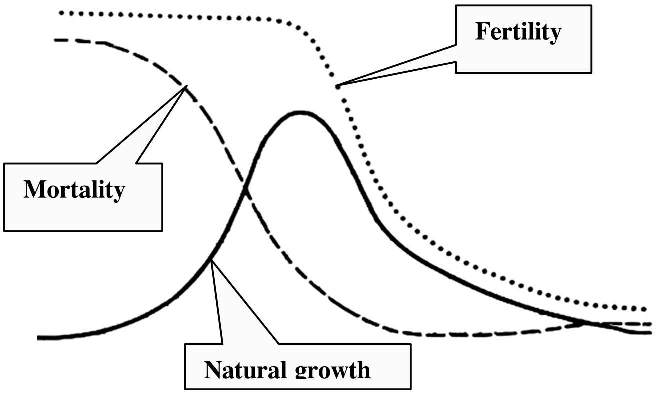

Figure 6.1. The demographic transition. Source: Chesnais, 1986.

One of the major characteristics of the present demographic situation in (post)industrial countries is the widespread application of fertility limitation techniques, the effectiveness and universality of which surpasses everything that was observed in former times. Currently, fertility levels lay considerably below the biological reproductive potential in modern welfare states. Most individuals in modern populations limit their fertility, even to below replacement levels, whereas current knowledge of human behavioural ecology suggests that, in traditional and historical populations, people by and large strive for achieving a maximum possible personal share in the genetic reproduction of their population, following the biological imperative of fitness maximisation.

No wonder evolutionary biologists are puzzled by the apparent contrast between the reproductive behaviour in modern societies and the maximisation of

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[1] Some authors distinguish several 'demographic transitions' in the broader history of humankind. For example, Muhsam (1979) distinguishes two major demographic transitions before the current modern transition, namely the transition that occurred in the Early Paleolithic, 30,000 years ago, and the transition that was associated with the agrarian revolution, 10,000 years ago. So, in Muhsam's numeration, the modern demographic transition is the third one, whereas the so-called 'second demographic transition' of Lesthaeghe and Van de Kaa (1986) would be the fourth one.

inclusive fitness principle. In his paper on 'The Search for an Evolutionary Philosophy of Man', Alexander (1971, 111) states: "Never in the enormously long and complex history of life has it been advantageous to restrict one's reproduction." In their book on 'Sex, Evolution and Behaviour', Daly and Wilson (1978, 287) argue that wilfully refraining from reproduction in modern society "seems to contradict the suggestion that human nature is in any sense a product of evolution by natural selection, that process of the competitive ascendancy of whatever traits help some individuals outproduce others." In his 'Human Family System', Van den Berghe (1979, 173) raises the question whether declining fertility in industrial societies does or does not contradict the postulate of fitness maximisation that underlies natural selection theory. In a paper on the evolutionary aspects of the demographic transition, Barkow and Burley (1980, 63) underline the paradoxical nature of present demographic trends: "Increased food supply and lowered mortality rate lead to population growth in most species. For human beings, rising standards of living are often associated with a fall in the rate of population increase. This paradox makes no ready biological sense." Shepher (1983, 18), in his discussion on the evolution of reproductive behaviour, also concludes: "The separation of sex and procreation undermines my argument." In their book on 'Culture and the Evolutionary Process', Boyd and Richerson (1985, 194) write: "From a sociobiological perspective the demographic history of industrialisation is a puzzle." Vining (1986) and Pérusse (1993) address the same problem, however, on the basis of the differences between social and reproductive success within industrial populations.

Explanations for the paradox

In recent decades several hypotheses have been suggested to explain reduced fertility in modern industrialised populations from an evolutionary perspective. Many of these explanations are not mutually incompatible; they only show how many factors are involved in the reproductive decision-making process and how modern culture has a multifactorial impact on it. The hypotheses include:

- *Maladaptive strategy hypothesis*: reduced fertility is a maladaptive strategy resulting from the novel environment of modernity (Hill, 1984; Vining, 1986; Borgerhoff Mulder, 1998);
- *Shortage of time hypothesis*: the decline in fertility associated with the demographic transition has so far taken place over a mere six generations which is not enough time for the adaptation to be disrupted by mutation and drift, or perhaps altered by directional selection (Irons, 1979);
- *Fertility control hypothesis*: fertility control is an evolved reproductive strategy. Throughout human evolutionary history, individuals have been

able to conceive more children than they can successfully rear. As a result, individuals have evolved to limit births and to strive to acquire as many resources as possible (Turke, 1989);

- *Breakdown-of-kinship-network hypothesis*: modern culture has cause a breakdown of extended kinship networks. Since children are resource consuming, humans have been selected to strive for social and economic success. In traditional societies extended kinship networks disperse the costs of childrearing. In modernising societies the pursuit of social and economic success, via competition within reference groups, leads to the breakdown of these kinship networks, concentrating childrearing costs on parents and inciting them to limit their number of children (Turke, 1989; 1990; Newson *et al.*, 2007);
- *Relaxed fertility-selection hypothesis*: in modern countries where personal wealth is relatively secure due to legal protections and political stability, and offspring have access to resources that are largely uncontested by the offspring of other parents, low fertility can become more common (Aarssen, 2005);
- *Evolved two-child family hypothesis*: in pre-industrial times little more than two out of many children per family survived to reproductive age. This suggests the possibility that human psychology has been evolving toward a reproductive strategy that adjusts optimal genetic benefit to minimal cost and that the hypothesised tendency toward the two-child family of modern societies is ultimately the result of this evolution (Lopreato and Yu, 1988);
- *Cultural evolutionary hypothesis*: lowered rates of fertility are the result of non-genetic but Darwinian, mechanisms of inheritance. Traits, such as low fertility, associated with successful individuals can spread through a population as a result of imitation (Boyd and Richerson, 1985);
- *Transmission competition hypothesis*: the desire to "leave something of oneself" for the future is a by-product of natural selection for behaviours that promote gene transmission in the domain of sex and mating. In modern culture this evolved desire can be achieved through actions other than the production of biological offspring, namely through what Dawkins (1976) referred to as 'meme' transmission. This involves investment in career development, accumulation of wealth and status, etc., possibly even at the expense of childbearing and childrearing efforts (Aarssen and Altman, 2006);

- *Evolved strategies to maximise long-term fitness*: this hypothesis is expressed in two variants. First; the *quality of children hypothesis* states that evolution in general is characterised by a shift from an r (quantitative) toward a K (qualitative) reproductive strategy. In modern culture this shift is accelerated by the increased competitive nature of the economy (Harpending and Rogers, 1990; Rogers, 1990; 1995; Kaplan 1996; Voland, 1998). Second, the *social status/competition hypothesis* argues that in highly competitive contexts individuals will, when faced with a trade-off between investing resources into more status versus more offspring, prefer more status because high status acquisition is an important factor determining the probability of lineage survival in calamities. Lowering fertility is thereby explained as part of an evolved strategy to maximise long-term fitness in the face of relatively infrequent but severe calamities that result in significant demographic crashes (Boone and Kessler 1999: Mace, 2000). Johansson (1987) is of the view that fertility reduction in the early stages of the demographic transition was the outcome of high levels of 'status anxiety' among elites. Mueller and Short (1983) also emphasise the relation between wealth, status and reproduction. A number of authors are of the view that within-population competitiveness in modern society has gone so far as to become suboptimal from a reproductive point of view (e.g. Pérusse, 1993; 1994; Borgerhoff Mulder, 1998; Low, Simon and Anderson, 2002);
- *Economic benefit hypothesis*: at the proximate level, humans often value economic opportunities higher than reproductive opportunities. During the Pleistocene, in which the availability of resources was always limited and uncertain, psychological mechanisms were selected that attributed a higher priority to the accumulation of resources than to generative benefits. Whereas the psychological mechanisms pursuing economic opportunities in premodern living circumstances favoured reproductive fitness, they are not adapted to modern conditions of life and can lead to genetically dysfunctional results (Voland, 1998).

Changed relations between phenotypic and genotypic fitness in modernisation

A way to explain the 'maximisation of inclusive fitness-demographic transition paradox' in modern society is to consider the changing relations between phenotypic fitness and genotypic fitness. This includes confronting explanations of the demographic transition in the socio-demographic literature with the biological ontogenetic determinants of human reproductive behaviour (Cliquet, 1987; 1998).

Many mutually interactive and cumulative features of modernisation have been advanced as partially contributing factors to the modern fertility transition, particularly with regard to the remarkable and unexpected fact that, in recent decades, fertility declined to below-replacement levels (cf. Caldwell, 1982; Schmid, 1984; Lesthaeghe and Van de Kaa, 1986; Davis *et al.*, 1987; Hoffmann-Nowotny, 1987; Roussel, 1989; Romaniuc, 1990; Becker, 1991).

The general determinants of the fertility transition can be classified into two broad groups of interacting factors, namely (1) changing living conditions such as a shift from (extended) kin to non-kin dependence, mortality control, enhanced opportunities and requirements of individual development, birth control, and changing gender relations, and (2) changing value orientations such as secularisation, democratisation, and individuation (Cliquet, 1991).

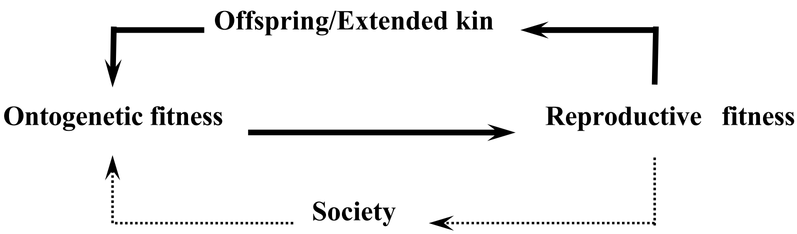
From an evolutionary perspective, below-replacement fertility in modern culture might be considered a result of the disruption of previously existing biosocial adaptations concerning procreation. Modern man has not had enough time to develop newly adapted biological features and/or cultural values and social structures in response to the 'novel environment' of modernity, with its fundamentally changed sociobiological interdependencies between the individual, his kin members, and society at large.

In pre-industrial society the maximisation of inclusive fitness was largely associated with the degree to which phenotypic fitness was maximised (Retherford, 1986; Winkler and Kirchengast, 1994). The strong differentials in phenotypic success that existed in those days, resulting from differences in the largely uncontrollable opportunity to avoid morbidity and early mortality, induced differential genetic success almost automatically. Phenotypic success was and still is, moreover, driven to a large extent by genetic endowment, thus closing the vicious circle.

However, in pre-modern times the production of a large number of children was an advantage to the parents – it not only compensated for high infant mortality, but it also strengthened the kin network, enlarged the familial production system, particularly in agrarian cultures, and, last but not least, it constituted an insurance policy against traumatic events or vulnerable phases in life, especially old age.

In modern culture, living conditions leading to phenotypic fitness have changed so thoroughly that reproductive fitness no longer coincides automatically with phenotypic fitness. The direct inter-dependency between parents and their own children, and between kin in general, that existed in pre-modern society, has been disrupted unilaterally in modern culture. Societal protection mechanisms have taken over the earlier survival functions of (extended) kin networks, particularly those related to one's own offspring. The fundamental cause of this modified relationship between phenotypic and reproductive fitness during modernisation lies in the fact that phenotypic fitness is a condition for, but not a cause of genotypic fitness. Low fertility has become possible, since the phenotypic fitness of adults no longer depends on their kinship relations, especially the quantity of offspring they produce themselves (Figure 6.2).

Intergenerational interdependency between adults and their offspring in pre-modern societies:



Intergenerational interdependency between adults and their offspring in modern societies:

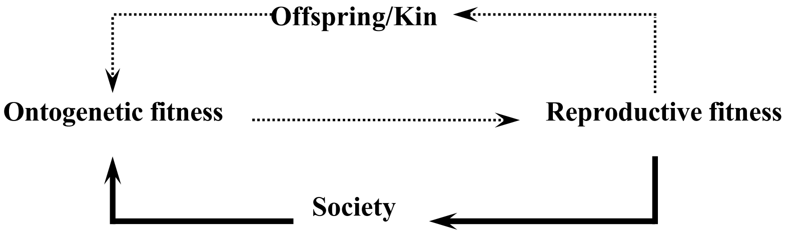


Figure 6.2. Changed relations between ontogenetic fitness and reproductive fitness in modern culture.

Several theories have developed to explain the exact mechanism that changed intergenerational kinship relations: wealth flow reversal between parents and children (Caldwell, 1982; Cain, 1982; Handwerker, 1986), protection (Becker, 1991), survival (Jones, 1977), the shift from an r- to a K-reproductive strategy – from quantity to quality of children – (Alexander, 1974), quality of life (Schultz, 1974; Willis, 1982), need-satisfaction in general (Deven, 1982; Schmid, 1984), breakdown of extended kinship networks

(Turke, 1989), and ideological shifts (from patrilineal to individualistic freedom and development; from intragenerational to intergenerational welfare and wellbeing concerns) (Ariés 1960; Lesthaeghe, 1983; LeVine and White, 1987).

THE IMPACT OF MODERNISATION ON HUMAN REPRODUCTION

Each stage in the ontogenetic reproductive process can be influenced by a number of biological and cultural factors (Table 6.1). Within each of these proximate and ultimate determinants can be distinguished (Bongaarts, 1978; Mosley, 1979). Amongst the biological factors influencing reproductive ontogeny and behaviour, both genetic and environmental determinants, such as nutrition and disease, should be distinguished. Socio-cultural determinants include values and norms, social relations, economic living conditions, and technology.

In recent years renewed interest has been shown in the genetic determinants of reproductive processes and behaviour. The attention is based on the one hand on the progress made in unravelling the genetic code, and on the other hand on investigations in which reproduction-related life course events are analysed in relation to the degree of genetic relatedness (cf. Kohler and Christensen, 2000; Rodgers *et al.*, 2001). Almost all reproductive components – morphological, physiological and socio-psychological – appear to be partially influenced by genetic dispositions, a fact which has not always been sufficiently appreciated in sociological theories of fertility.

An interesting phenomenon is that the increase in opportunities for making lifestyle choices in modern society, due either to technology or changing values, seems to increase the variation in genetically mediated reproductive behaviour and fertility outcomes, just as is the case in other domains of human life (Kohler and Rodgers, 2003).

In the following sections we examine the impact of modernisation on the stages of the ontogenetic reproductive process, as presented in the middle column of Table 6.1.

Sexual maturation

Modernisation is characterised by a decrease in the age of sexual maturation. This has been demonstrated most convincingly based on secular changes of the age at menarche. In developed countries, the age at menarche falls, on average, between 12 and 13 years while in developing countries it is commonly still above

Table 6.1. Flow chart of the major components of the reproductive process and their proximate and ultimate biological and cultural determinants

Biological determinants		**Reproductive process**	**Cultural determinants**	
Ultimate	**Proximate**		**Proximate**	**Ultimate**
		Sexual maturation		
		↓		
Genes	Pair bonding drive	Pair bonding	Nuptiality Separation	Values and norms
		↓		
	Childbearing motivation	Desired fertility	Child wish	
		↓		
Nutrition	Sexual drive	Coital frequency	Contraception	Social relations
		↓		
	Ovulation Insemination Fertilisation	Fecundity	Medically assisted fertility	
		↓		
	Intra-uterine mortality	Pregnancy	Induced abortion	
Disease		↓		Social-economic determinants
	Stillbirth	Delivery/birth	Medically assisted delivery (birth management)	
		↓		
	Post-partum amenorrhoea	Birth interval	Infanticide Lactation duration	
Lifestyle		↓		
	Sterility	Menopause	Sterilisation	Technology
		↓		
		Fertility		
		↓		
	Parental drives	Parenting	Parental education	

15 years. In the nineteenth century, the age at menarche in some European countries was even above age 16 years, probably due to the worsening of the material living conditions among the lower socio-economic classes in the early phases of capitalism (Léridon, 1973; Gray, 1979). The decreasing age at menarche is part of the so-called secular growth acceleration associated with modernisation (see Chapter 3).

The biological growth acceleration trend contrasts with the expanding amount of time youngsters need in modern culture for learning and socialisation. The increasing time gap between biological development and social maturation is a typical example of asynchrony in modern culture resulting from the fact that biological-evolutionary adaptation cannot keep pace with rapid cultural change.

Pair bonding

Pair bonding is a strong drive in the human species. On the basis of animal studies, it can be hypothesised that several brain centres and neurotransmitters play a role in human pair bonding behaviour. It can also be hypothesised that genetic variation and interaction with environmental factors produces individual differences in pair bonding initiation and maintenance behaviour (Insel and Carter, 1995; Young and Wang, 2004).

In Chapter 5 on Family variation, it was shown that modern culture is characterised by a strong increase in rates of union dissolution, i.e. separation or divorce (though in countries where the rates started accelerating decades ago, a slowdown, stabilisation or even a slight decrease has recently been observed). This increase can be explained by a variety of factors such as the growing psychological emancipation and economic independence of women, and the heightened dependence of pair bonding on personality features (Deven and Cliquet, 1986).

In light of the increasing vulnerability and instability of pair bonds, it is remarkable that the overwhelming majority of individuals continue to strive for and engage in long lasting relations. When a union dissolves, each ex-partner typically hurries to enter into a new (long-lasting) relationship.

Desired fertility / Childbearing motivation

Notwithstanding the presence of neural substrates underlying succorant, affiliative and nurturant systems contributing to positive and negative childbearing motivations (cf. Anthony and Benedek, 1970; Krasnegor and Bridges, 1990; Miller and Pasta, 1995; Panksepp, 1998), the genetically programmed motivation for childbearing appears to be rather weak. Compared to other basic urges, such as the drive toward self-preservation and sexual behaviour, a conscious desire to conceive children, though present, is relatively weak. Conception is motivated primarily by a taste for copulation (Turke, 1989). Childbearing motivations are strongly supported by the sexual drive and the impulse for caretaking behaviour (after birth), but there is no component that might be said to specifically represent a reproductive drive (Miller, 1992). This may come as a surprise, at first sight. However, evolutionary outcomes – *in casu* the maximisation of inclusive fitness – can be realised via different mechanisms. Under the conditions of the 'Environment of Evolutionary Adaptedness' (EEA), a combination of the sexual urge, the nurturing drive and intergenerational interdependencies apparently sufficed to guarantee intergenerational replacement and even expansion; but in the novel environment of modern culture, it doesn't.

Indirect evidence that the genetic programming for childbearing motivation is weak can be seen in the fact that all premodern cultures appeared to be very normative with respect to fertility and parenthood (Reynolds *et al.*, 1983). Indeed, if there were a strong biological drive for reproduction, one would instead expect to find restrictive norms and taboos just as with sexuality, food consumption, and possessive and aggressive behaviour. Apparently, a strong cultural super-structure is needed to bolster and even compensate for the rather weak genetically programmed urge, as demonstrated by all 'in-group' oriented ideologies – such as religions and nationalisms – that are often strongly focused on demographic expansion.

As far as the desire for a particular number of offspring is concerned, features such as high fecundity and strong sexual urge have undoubtedly contributed to the intuitive notion that humans are also endowed with a strong urge to produce a large number of offspring. But this view is unjustified. High fecundity in humans is probably best explained as a biologically selected safety valve, allowing for the realisation of high fertility when required by factors like increased mortality. The strong sexual urge is not related to the production of a large number of children, but instead is a feature now considered to have a functional significance with respect to the maintenance of an enduring relationship, which is, in turn, a function of the human child's prolonged helplessness (Beach, 1978). Consequently, the genetic basis for the urge toward a large number of offspring seems to be even weaker than the parental drive as such; again, this view is supported by the reproductive behaviour of humans in circumstances in which strong pressures – of any kind – are absent (Deven, 1982). Moreover, one should keep in mind that it is not impossible that, as Robinson *et al.* (1980) have hypothesised, the realisation of a small number of children has a negative feedback effect on the biological stimulation system concerning parenthood, because the desire to bear and rear children is, in part, a function of specific experiences with infants and young children during biologically sensitive periods. So, it is not surprising that most couples desire a low number of children in modern societies, where economic and cultural (mainly religious) pressures in favour of large families are experienced or perceived as no longer necessary or valid.

Recently, Foster (2000) raised the question of how low fertility can go. Based on her biosocial analysis of the genetic predispositions for nurturing behaviour, she concludes that most people, in particular women, would like at least one child. In their analysis of low fertility in Europe, Morgan (2003) and Morgan and King (2001) conclude that having few children and investing in them heavily fits well with our evolutionary inheritance and the neural wiring in our brains.

Coital behaviour

Sexological investigations have shown that, under ‘normal’ living conditions (namely in absence of illness, acute starvation, abstinence-stimulating behavioural rules, etc.), the human shows a quite high coital frequency on average, but with significant inter-individual and age variation. Evil tongues even dare to claim that the human is one of those oversexed species – but human coital behaviour makes sense from an evolutionary point of view.

The first large-scale investigations in this domain were the renowned, though statistically non-representative surveys of Kinsey and associates (1948; 1953). Since then, more information has become available, including from representative surveys (cf. Laumann *et al.*, 1994; Spira *et al.*, 1993; Wellings *et al.*, 1994), which has largely confirmed and refined the Kinsey findings.

Notwithstanding the striking uniformity in sexual outlet observed between populations, several environmental factors may influence the frequency and timing of sexual intercourse. In the cultural domain the best-known factor is the regulation of sexual behaviour through the institution of marriage. In most pre-modern cultures, sexual intercourse starts – and often also ends – with marriage. In modern culture this pattern changed radically during the course of the twentieth century, particularly since the 1960s when the start of sexual activity has been increasingly dissociated from marriage, as was shown in the preceding chapter (Figure 6.3).

On the whole, it can be said that coital behaviour has changed dramatically with modernisation as living conditions improved in many domains, ranging from nutrition to health and housing. Thanks to the improvement of biosocial living conditions in modern culture, attitudes and beliefs could also change. In particular modern people could free themselves from the many earlier cultural/religious taboos on sexual behaviour, which were often, though not always, biological functional.

Fecundity

Human potential fertility – also referred to a 'fecundity' in English language demographic and sociological literature – is a theoretical concept for which no observations are available. It refers to the number of live-born children that could be realised without the limiting effects of sexual taboos, late marriage, lactational amenorrhea, contraception and induced abortion (Bongaarts and Potter, 1983).

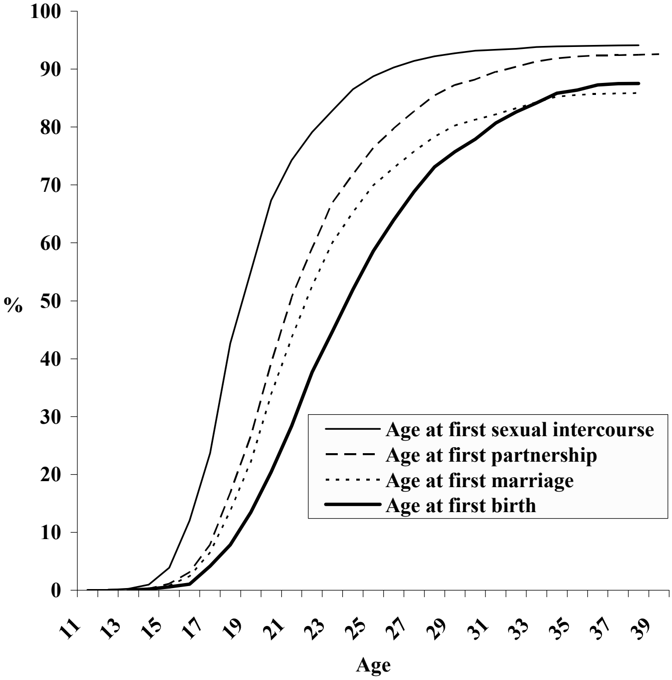


Figure 6.3. Age at first sexual intercourse, first partnership, first marriage and first birth for women aged 35 to 39, pooled data for Belgium, France, Italy, Portugal, and Spain. Source: Fertility and Family Survey database (UN/ECE-Population Activities Unit, Geneva).

On the basis of a number of empirical observations of populations in different stages of cultural development and by means of different methodologies, the average total potential fertility in human populations has been estimated to be 15.3 live-born children, with a between-population range of 13 to 17. The within-population (inter-individual) variability in fecundity in populations with an average of 15.3 and a standard deviation of 5.09 has been calculated to lie between 0 and 26 live births (Bongaarts, 1978; Bongaarts and Potter, 1983).

From a modern point of view, the reproductive potential of the human is extremely high. From an evolutionary point of view, however, this high human fecundity doesn't come as a surprise at all. The high potential fertility is clearly an adaptation to the high mortality rate that prevailed in pre-modern living conditions which not only required a high realised fertility to compensate for ordinary losses of children, but also had to serve as a safety valve in case of extraordinary catastrophes.

The term fecundability refers to female ability to conceive, specifically the probability of conception within one month for a fertile woman having sexual intercourse without contraception. Fecundability can be influenced proximally by several cultural-technological interventions, either to increase or to decrease the probability of conception. With regard to the latter, the term contraception is well-known; for the former, Miller (1983) devised the term 'proceptive behaviour', as a counterpoint to 'contraceptive behaviour'.

Proceptive behaviour

Considered in its broadest sense, medically assisted fertility is a phenomenon that developed gradually with modernisation and involves a broad range of medical techniques ranging from general medical and genetic counselling to specific technical interventions which facilitate or replace natural conception. Such techniques may include donor insemination, ovum donation, in vitro fertilisation, gamete and zygote intrafallopian transfer, and embryo transplantation, as well as methods aimed at maintaining the pregnancy and inducing or facilitating delivery. In recent decades, the concept of medically assisted fertility has been understood more and more in the narrow sense of methods which facilitate or replace natural conception (cf. Bentley and Mascie-Taylor, 2001; de Jonge and Barratt, 2002).

Whereas medical interventions related to the whole process of childbearing are quite widespread, conception-related interventions are, at the population level, still quite rare. Nevertheless, it can be observed that increasing numbers of couples that experience difficulties in getting pregnant, are turning to these techniques to fulfil their family-building desires (cf. Delmotte and Cliquet, 1983; Lodewijckx and Schoenmaeckers, 1994; Schieve *et al.*, 2002; Sobotka *et al.*, 2008). In recent years, concern has grown about the possible long-term effects of proceptive interventions on foetal birth weight and malformations (cf. Cetin *et al.*, 2003; Dulitzki *et al.*, 1998; Kozinszky *et al.*, 2003). Prudence is also called for the application of proceptive medical techniques at ever-higher ages for proceptive mothers, because of increased foetal morbidity risks at those ages (e.g. Salihu *et al.*, 2003).

A proceptive-related issue is the question of sex selection of children for non-medical reasons, also called social or elective sex selection, through sperm separation by means of flow cytometry (FC) or preimplantation genetic diagnosis (PGD) (cf. Savulescu, 1999). Social sex selection is legally banned in many countries and ethical views on this issue are strongly divided. Scientifically, there are still matters to be further clarified (cf. Dahl *et al.*, 2006; Michelmann *et al.*, 2006; Grant, 2006).

Contraceptive behaviour

Contraceptive behaviour concerns efforts to reduce the natural fecundability f_n to a residual fecundability f_r corresponding to the number of children desired. The standard measure of the use effectiveness *e* of a contraceptive method among fecundable women gives the proportional decrease of the monthly conception probability (Tietze, 1959):

$$e = 1 - \frac{f_r}{f_n}$$

With a perfect contraceptive method the residual fecundability $f_r = 0$ and the effectiveness $e = 1$; with a total failure of a method $f_r = f_n$, and $e = 0$. Avoiding conception over an extended time period requires extremely high levels of contraceptive effectiveness (cf. Lodewijckx *et al.*, 1988).

The contraceptive transitions in modern culture

Birth control practices are not exclusively limited to modern culture. Hunter/gatherers and agrarian populations usually kept their fertility substantially below the biological potential. Historical studies of birth control, such as those of Himes (1936), McLaren (1990), and Riddle (1992), as well as demographic investigations show that fertility control was very widespread, though also varied according to socio-economic and ecological living conditions, cultural attitudes and policy objectives in pre-modern times.

In the early stages of the demographic transition, Western societies underwent a revolutionary transition in fertility control, namely the general dissemination of parity-specific birth control practices – contraception and induced abortion. This transition is sometimes called the Neo-Malthusian transition, as opposed to the Malthusian transition that was characterised by late marriage and a high prevalence of celibacy which spread in particular in Western Europe between the sixteenth and eighteenth century (Hajnal, 1965). The Neo-Malthusian transition involved not only a shift in the means of birth control and the percentage of the population exercising such control, but also a change in the mode of regulation, namely a shift from spacing births to stopping fertility at an earlier age. This first contraceptive transition coincided with and, in fact, formed the proximate cause of the initial fertility decline of the modern demographic transition.

The demographic transition was not caused by a major technological innovation in fertility limitation, although appliance methods such as the condom gradually became available but were initially not widely used. The major methods applied were *coitus interruptus* as well as several other traditionally known methods such as abstinence, extended nursing, and late marriage. In the later stages of the demographic transition (the first decades of the twentieth century) induced abortion and – at least in some countries – mechanical barrier methods (such as the condom, pessaria, douche, and spermacides) increased in importance (cf. Dawson *et al.*, 1980).

In the second half of the twentieth century, Western countries experienced – with significant differences in pattern and pace – a second contraceptive transition, this time characterised by the development and dissemination of technological innovations: hormonal contraceptives, intra-uterine devices and (somewhat later) more advanced medical techniques for female and male sterilisation (Westoff and Ryder, 1977; Cliquet and Lodewijckx, 1986; Léridon *et al.*, 1987; Benagiano *et al.*, 2007). The new contraceptive technology was, moreover, paralleled by new surgical and pharmaco-chemical abortion procedures (cf. Cliquet and Thiery, 1972; Baird *et al.*, 1995). A striking feature of this second contraceptive transition (or the modernisation of contraceptive practice) is that contraceptive behaviour as such shows no clear increase in or around the 1960s, only the types of contraceptive methods used changed (Figure 6.4).

The contraceptive profile in advanced countries continues to modernise (cf. Frejka, 2008). In most Anglo-Saxon countries and several Western European countries (e.g. Flanders, the Netherlands, Norway and Switzerland), the most recent changes concern a notable increase in rates of female and male sterilisation. In most of those countries sterilisation has already become the most common method after people have reached their desired family size (cf. Ross, 1992; Lodewijckx, 2000).

A remarkable feature of both the first and the second contraceptive transitions is that they occurred not only without much support from public or religious authorities, but even against the opposition of various powerful groups of the establishment, such as governments, legal authorities, churches, political parties, and the medical profession. Despite its revolutionary character, the dissemination of birth control at the turn of the century took place in silence, if not in secrecy. Neo-Malthusian groups were fought or boycotted from all sides (cf. Stengers, 1971; Van Praag, 1979). It is, hence, not surprising that so many older surveys revealed that people were reluctant to admit the practice of contraception and that, consequently contraceptive practice or the use of particular methods was largely underreported and underestimated. A well-documented example has to do with the withdrawal method, which respondents very often did not considered a contraceptive method, particularly amongst those in social subgroups where taboos on sex itself, or talking about it, were very strong (e.g. Cliquet, 1972).

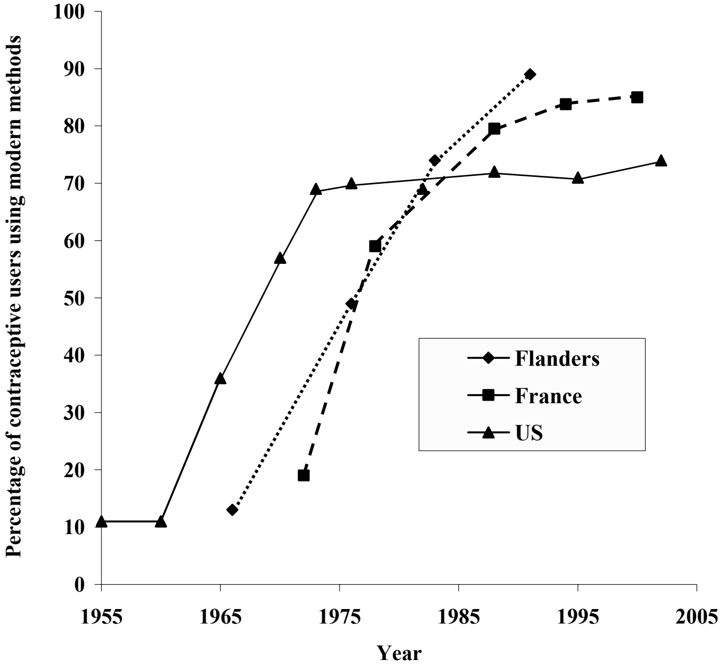


Figure 6.4. The second contraceptive transition in Flanders, France, and the United States. Sources: Freedman et al., 1959; Whelpton et al., 1966; Westoff and Ryder, 1977; Ford, 1979; Mosher and Westoff, 1982; Cliquet and Lodewijckx, 1986; Mosher and Bachrach, 1988; Cliquet and Callens, 1993; De Guibert-Lantoine and Léridon, 1998; Bensyl et al., 2005; Trussell and Wynn, 2008; Fertility and Family Survey in the ECE Region; www.ined.fr/2009.

Due to the weakness, or even absence of educational policies with regard to sexuality and reproduction at the time of the demographic and contraceptive transitions, those periods were characterised by the emergence of significant social differences in attitudes toward and practices regarding what is nowadays euphemistically known as 'sexual and reproductive health' (United Nations, 1994). The shifts toward smaller families occurred first among the better-educated and well-to-do segments of society, whilst large families remained concentrated amongst the less educated and the poor (cf. Wrong, 1958). Similarly, the second contraceptive transition was characterised by striking social differences in the use of modern, effective methods: the pill, IUD, and sterilisation as well as medical abortion first spread among the better educated, whereas less educated, poor people as well as people with weak cognitive or emotional personality characteristics tended to continue to use the withdrawal method, or resorted to non-medical abortive practices (cf. Cliquet and Balcaen, 1983). Another feature of the demographic and contraceptive transitions was that different ideological groups adopted the new reproductive behaviours at different times. Free-thinking and non-religious people limited their family size earlier than practicing church-goers (cf. Cliquet and Maelstaf, 1977). But in recent decades, the original social differentials in contraceptive and reproductive behaviour have levelled off or even disappeared completely. Vulnerable groups, however, remain in populations where sexual and reproductive education is still insufficiently embedded in the educational systems and mass media, or where medical and welfare care services do not yet fulfil their tasks properly. In the countries that developed first, present-day population subgroups with unmet family planning needs are those that have inadequate knowledge to control their fertility, such as adolescents and people with weak cognitive abilities, and people who are still under strong in-group cultural pressures, such as socially non-integrated immigrants from developing countries (cf. Jones *et al.*, 1986; Bajos *et al.*, 2002; Guldi, 2008).

The present array of contraceptives is still not yet satisfactory in all respects by being safe, effective, acceptable and sexually convenient. Although new variants of the hormonal and intra-uterine devices are becoming available (cf. Upadhyay, 2005), no real innovation has occurred since the contraceptive revolution of the 1960s (cf. Nass and Strauss, 2004).

Effects of the second contraceptive transition

Many divergent views have been expressed on the possible effects of the dissemination of modern contraceptives on a broad array of issues such as fertility, health, sexual life, gender relations, family dynamics, morality, and population growth. In some cases, the assessment of the presumed effects was evaluated positively, but in many cases negative or harmful consequences were predicted: modern contraception was responsible for below-replacement fertility and therefore for population decline and ageing, some contraceptives were harmful for women's health, and effective birth control would favour promiscuity and extramarital affairs, and impair gender relations and family life.

Scientifically, it is not in all cases easy to confirm or deny some of the hypothesised effects of modern contraceptives. Their spread occurred in a period when several other important technological, economic and cultural changes were taking place: increasing wealth, improving educational levels, especially of women, increasing labour participation, again mainly of women, the spread of several innovative technologies such as telephones, TVs, CDs, household gadgets, cars and jets, and international travelling, etc. People had not only new opportunities, but also new ideas about how to organise their life, their work, and also their sexual and reproductive behaviour. It will probably never be possible to disentangle the precise effect of each of these simultaneous social and technological changes, some of which have been interacting in complex ways.

The general spread of parity-specific birth control practices, starting at the end of the nineteenth and the beginning of the twentieth century, obviously had a strong effect on fertility: it formed the proximate cause of the fertility decline of the demographic transition. The question was raised whether modern contraceptives (and medical abortion methods) in the second half of the twentieth century were also the cause of the resumption of the fertility decline observed since the mid 1960s, after the baby boom of the post-war decades. The 'Pillenknick', as it was called in Germany, was undoubtedly one of the popular explanations for the rather steep dive fertility took in the last third of the twentieth century, before stabilizing at unprecedented below-replacement levels in some countries.

There is considerable misinterpretation of the supposed causative relationship between the spread of efficient contraceptives – the pill, I.U.D. and sterilisation – and the onset of the recent fertility decline that, indeed, remarkably coincided in time. What is often overlooked is that in earlier periods – in the 1930s and even earlier – some populations succeeded by means of inefficient methods (mainly withdrawal, and by induced abortion) in reducing their fertility to below replacement levels. Successive fertility surveys – before and after the second contraceptive transition of the 1960s – have shown that the desired family size decreased only slightly in recent decades (cf. Cliquet, 1985). Moreover, desired family size appeared and still appears to be largely independent of the number of children actually produced: before the second contraceptive transition, families, irrespective of completed family size, large and small, did not differ substantially in their (original) desired number of children. What happened when the pill and other modern method became available, was that the unplanned or undesired large families (largely) disappeared. Subsequent fertility surveys that paid sufficiently attention to the phenomenon of excess fertility (cf. Cliquet and Balcaen, 1983; Lodewijckx *et al.*, 1988) have shown that untimed and undesired births are increasingly averted by means of effective methods. So, there can be no doubt that efficient birth control methods help women or couples to achieve a better and more conscious control of the family building process. The avoidance of unplanned, and especially unwanted pregnancies does have an influence on completed fertility (Calot, 1990). Less apparent, though perhaps more important, is the indirect attitudinal effect of the availability of modern birth-control methods on planned parenthood. The existence of such methods, and the knowledge that fertility can be mastered rationally and efficiently, may influence individual attitudes and motivations with respect to conscious decision-making about parenthood. Moreover, familiarity with efficient control over fertility permitted or favoured several other family-related processes: premarital sex became less risky; marriage could be postponed or temporarily replaced by other types of union formation. Perhaps it also facilitated multiple partnership and extra-marital relations.

Whether modern contraception has substantially contributed to the emergence or advancement of the so-called sexual revolution is difficult to evaluate with precision, but its effect is probably largely overestimated. Antibiotic drugs may have had a more important influence in this respect, as Sipe (1990) has suggested. Effective contraceptives may have furthered premarital sex, they may have contributed to the spreading of consensual unions, they may have facilitated extra-marital relations and the formation of new partnering, but sexological research shows that the arrival of modern contraception was not associated with a considerable increase of sexual promiscuity.

One of the longer-term evolutionary effects of modern contraceptives might be that their use will gradually change the composition of the male population. As suggested in the previous chapter, for promiscuous males, modern contraceptive methods are an ‘evolutionary dead-end’ as the gene-spreading effect of such behavioural pattern is strongly reduced, if not completely annihilated. Modern contraception undermines, and perhaps erases, the effect of male dominance and macho behaviour, because extramarital affairs as well as various kinds of forced sex will no longer have reproductive and, hence, genetic effects.

Pregnancy

Pregnancy is the period in a woman’s life when she carries a fertilised ovum. Pregnancy duration and result are crucial issues for the study of the effects of interventions in this stage of the reproductive process.

Effects of medical interventions

Medical interventions aimed at maintaining a pregnancy are quite frequent in developed countries. The frequency increases quite substantially after age 35 (cf. Dulitzki *et al.*, 1988; Salihu *et al.*, 2003). Significant differences are also observed according to the number of pregnancies and pregnancy order – a negative relation with pregnancy number, a positive one with pregnancy order. Women with a pregnancy intervention at a particular rank have a substantial higher risk of interventions at higher ranks (Léridon, 1973; Delmotte and Cliquet, 1983).

In recent decades further advancements in medical technology and improvements in prenatal care use have adversely affected prematurity rates. Low and even very low birth weight and preterm birth rates have dramatically increased (cf. Alberman and Botting, 1991; Amini *et al.*, 1994; Greg and Slay, 2002).

It is well known that infants born prematurely have an increased risk of death in the first year of life, have a higher morbidity and a higher likelihood of having emotional and behavioral problems, and lower social and academic competences. They place considerable demands on families and public health and educational services and families (cf. Lorenz *et al.*, 1998; Stevenson *et al.*, 1999; Dahl *et al.*, 2006; Moster *et al.*, 2008; Verrips *et al.*, 2008). Hence, the question arises about the ethical aspects of medical advancements pushing ever further towards the survival of children with ever lower birth weight and higher degrees of prematurity.

A recent phenomenon related to pregnancy intervention concerns individuals or couples who encounter unavoidable problems with the maintenance of pregnancy, and seek out a willing surrogate. They appeal for the assistance of a woman who provides the womb to develop a child, either with the gametes of the donor mother and father, or with the donor mother's ovum being impregnated by artificial insemination (AID), or by means of an implanted embryo (IVF). In most respects surrogacy is comparable to adoption, even though the genetic relationship between the child and the surrogate mother can be larger than in the case of a simple adoption (cf. Cook *et al.*, 2003).

A next step in the practice of surrogacy might be the development of a completely artificial womb. Though for the moment such a notion remains completely in the realm of science fiction, it may become a realistic possibility in the remote future.

Spontaneous and induced abortion

It has been estimated that some 30 percent of conceptions are eliminated before implantation and another 30 percent are spontaneously aborted after nidation but before the next menstruation. These statistics are based on the seminal investigation by Hertig *et al.* (1959) on the prevalence of abnormal embryos in the first two weeks of pregnancy, more recent hormonal studies on the detection of early pregnancies by means of the hCG-factor[2] (Wilcox *et al.,* 1988), the 'early pregnancy factor' secreted by preimplantation embryos into maternal serum 12–16 hours after fertilisation (Morton *et al.*, 1977), and new cytogenetic techniques (Macklon *et al.*, 2002). Taking into account all prenatal losses (early losses, clinically recognisable spontaneous abortions and stillbirths), it is estimated that more than two thirds of conceptions end in intra-uterine mortality (Hertig, 1967; Léridon, 1973; Macklon *et al.*, 2002). This means that three fertilised ova are needed to obtain one live-born child. The biological causes of intra-uterine mortality are diverse, but it seems that the large majority is due to genetic malformations (cf. Boué *et al.*, 1975; Rubio *et al.*, 2003). Pregnancy is a period of extremely intense natural selection.

Induced abortion is still quite frequent, albeit with strongly differentiating statistics according to the stage of the demographic transition, the contraceptive profile of the population, and prevailing attitudes, values, norms and legislation (Tietze, 1981; Ketting and Van Praag, 1983; Henshaw *et al.*, 1999; Alan Guttmacher Institute, 2000).

In general, it can be said that modernisation is characterised by an increasing acceptance and legalisation of induced abortion, a shift from non-medical (criminalised abortion) to medical forms of induced abortion (*abortus arte provocatu*s), and a decrease in both non-medical and medical pregnancy interruptions – the latter being subject to a good contraceptive policy (Cliquet and Thiery, 1972; 1985; Ketting and Van Praag, 1983; Faúndes and Barzelatto, 2006).

From a statistical perspective, indications for induced abortion are mainly of a social nature: age (too young, too old), marital status (unmarried, divorced), family size (excess fertility), financial constraints, and failed contraception in general. Medical indications are less common: maternal indications have become an exceptional phenomenon whilst relatively rare foetal indications can result in selective abortion (cf. Alan Guttmacher Institute, 2000; Bajos *et al.*, 2002).

The availability of selective abortion (cf. Bromage, 2006), due to improving diagnostic identification of prenatal genetic impairments, may have two distinct

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[2] hCG-factor = human chorion gonadotrophin, a hormone that is produced in the trophoblast of the human embryo.

effects on the genetic composition of the population. First, it allows families who have a substantial risk of genetically impaired children to avoid having seriously handicapped offspring. Selective abortion not only avoids births of children with severe genetic impairments, but it may also contribute to decreasing voluntary infertility of couples who know that they have high risks. Such couples may find it easier to decide to build up a family knowing that they will bring to term only healthy children (cf. Evers-Kiebooms, 1994; Conway *et al.*, 2008). Second, for recessive and perhaps also for polygenetic features, reproductive compensation resulting from replacement of defective offspring by healthy children increases the relative frequency of carriers of the genetic condition in heterozygote individuals who may transmit the defective allele to future generations and contribute to the increase of the allele frequency in the population. However, it may be expected that more refined future genetic screening techniques will prevent such an increase, reducing thus parental requests for selective abortion.

Delivery and birth

After nidation, birth is the most dangerous threshold a new human being has to cross (Ellison, 2001). The hominisation process, in particular the emergence of *Homo sapiens sapiens*, was characterised by an increasingly difficult delivery compared with other mammals and even other primates. The cause of this increasingly difficult parturition is well-known: in the course of human evolution the head of the human foetus increased out of proportion to the size of the female pelvis. The reason for this disproportional relationship is because the pelvis evolved under opposite selective pressures for two different functions: delivery and upright walking.

A remarkable consequence of this evolution is that, whilst non-human primate birth is a private event, in all human cultures birth is normally a social event, with other humans attending and assisting the woman with labour and parturition. Social support during labour and delivery not only has a favourable effect on the survival of mother and infant, it seems also to favourably influence the social interaction of the mother with her baby (cf. Chalmers and Wolman, 1993). Ellison (2001) considers it particularly ironic and appalling that earlier in modern society, medical workers did not permit family or friends to be with women during childbirth in the unfamiliar hospital setting probably for hygienic and/or professional reasons. In recent years, this practice has been on the way out thus restoring to childbirth a crucial aspect of the intimate social experience which probably developed in the course of our evolution.

Given the difficulties of human delivery it comes as no surprise that medically assisted delivery (birth management) has become a sophisticated and distinct field of modern medicine. Through a broad variety of medical interventions, difficult deliveries are now often successful, preserving the life and health of the mother and decreasing instances of perinatal and maternal morbidity and mortality.

However, some investigations show that, at least in some countries or regions, medical interventions such as episiotomy, epidural anaesthesia, induction of labour, and caesarian section, are increasingly being applied even in non-high-risk deliveries (cf. MacDorman *et al.*, 2002). The recent expansion in the use of some obstetric procedures, moreover, seems not to be accompanied by a comparable decrease in perinatal mortality or morbidity (Rossi, 1987). Conversely, the practice of painless delivery techniques – more time consuming but technologically less intrusive – has not increased to the same degree (Lothian and DeVries, 2005).

Birth interval

The length of the time interval between two births can be influenced by several factors: a short infecund period immediately following birth in the absence of breastfeeding (post-partum amenorrhoea *sensu stricto*, lasting on average 1.5 months from birth to the next menstruation); an additional infecund period due to breastfeeding (each month of breastfeeding extends the period of post-partum amenorrhoea by somewhat less than one month, up to a maximum duration of two years in cases of unlimited breastfeeding); a variable period of sexual abstinence or contraceptive use; and the duration of the next pregnancy (Bongaarts and Potter, 1983).

Modern culture was initially characterised by a decline both in the practice and duration of breastfeeding. Several factors are believed to have contributed to these decreases: the development of breast milk substitutes, the demise of wet nursing, the annexation of obstetrics and postnatal care from midwifery by male physicians, and expansion of women's work outside the home (Ellison, 2001).

Breastfeeding provides not only essential nutrients (calories, proteins, fats, vitamins, minerals) but protects against infection by external pathogens and contains immunologically active substances (including lactoferin and antibodies from the mother) that help defend the infant's gastrointestinal tract from pathogens. It is not surprising, therefore, that public health policies recommend that newborns be breastfed at birth and exclusively breastfed for at least four months (cf. Dubois and Girard, 2003).

Closely spaced births have a cumulative negative effect on the mother's ability to invest physiologically in her current and subsequent offspring. Even in developed countries, the close spacing of births has a negative effect on rates of low birth weight and prematurity (Hartmann *et al.*, 1984).

In many developed countries a resurgence of breastfeeding has been observed in the past few decades (cf. Wright and Schanler, 2001; Ryan *et al.*, 2002). But the officially recommended frequencies and durations have not yet been achieved. Women least likely to breastfeed are those who are young, have low income, belong to an ethnic minority, are unsupported, are employed full-time, have negative attitudes toward breastfeeding, or have low confidence in their ability to breastfeed (Dennis, 2002).

Although further progress in breastfeeding practices can be expected, provided that educational and public health campaigns are continued or intensified, it might be an illusion to hope that the originally universal practice will be restored. If for a variety of reasons, ranging from difficulties for working mothers to breastfeed to the desire to maintain youthful looking breasts, a substantial majority of women, over generations, stops breastfeeding, the evolutionary effects of reduced or discontinued breastfeeding must inevitably, in the long run, lead to a weakening of the lactation function in the human female, since babies will be able to survive thanks to bottle feeding. This regressive evolution, of course, might be avoided or counterbalanced if, in the future, genetic engineering were able to replace genes for deficient lactation.

It is ironic that, despite a waning of the lactation function in the human species, which might be expected in the remote future, it is possible to imagine the maintenance or even the improvement of female breast morphology. Via plastic surgery or genetic engineering, breast enhancement based on the aesthetic ideals that evolved for their reproductive value may become more widespread.

Menopause

From an evolutionary point of view, menopause is a paradoxical feature. How can natural selection produce a trait that doesn't reproduce itself? And why are humans characterised by such a strong sexual dimorphism in this respect? In women, menopause appears around age 50 whilst men maintain their reproductive potential, although diminished, until very old age (Figure 6.5).

The menopause paradox was originally explained by the so called 'grandmother hypothesis' (Williams, 1957; Hawkes, 2004; Hawkes *et al.*, 1998). The benefits and costs of one's own reproduction were weighed against the provision of childcare assistance for one's kin. Since female reproductive risks increase with age, it might have been more advantageous to exchange the mother role for the grandmother role (Mayer, 1982). With her 'altriciality-lifespan hypothesis' (ALH), Peccei (1995; 2001) referred to an earlier theory explaining menopause as an adaptation to the need for increased maternal investment such that the reproductive efforts of the female hominid are not endangered or decreased by high risk pregnancies at higher age (see also Pavard *et al.*, 2008).

Although mothers and grandmothers continue to invest in children and grandchildren and consequently contribute to their own fitness (cf. Hawkes *et al.*, 1989; Gibson and Mace, 2005), doubts have been expressed as to whether this contribution outweighs the advantages of extended reproduction. Ellison (2001) hypothesised that menopause in humans is related to restricted oocyte production in combination with a long lifespan. Limited oocyte production is an ancient phenomenon that evolved as a correlate of increased maternal investment in the foetus, which the early hominids acquired as part of their phylogenetic heritage. In Ellison's (2001) view, the evolutionary extension of the human lifespan is related to the long-term maturation requirements of the human infant and decreased fecundity. As the human lifespan extended, menopause became a phenotypic expression of ovarian depletion.

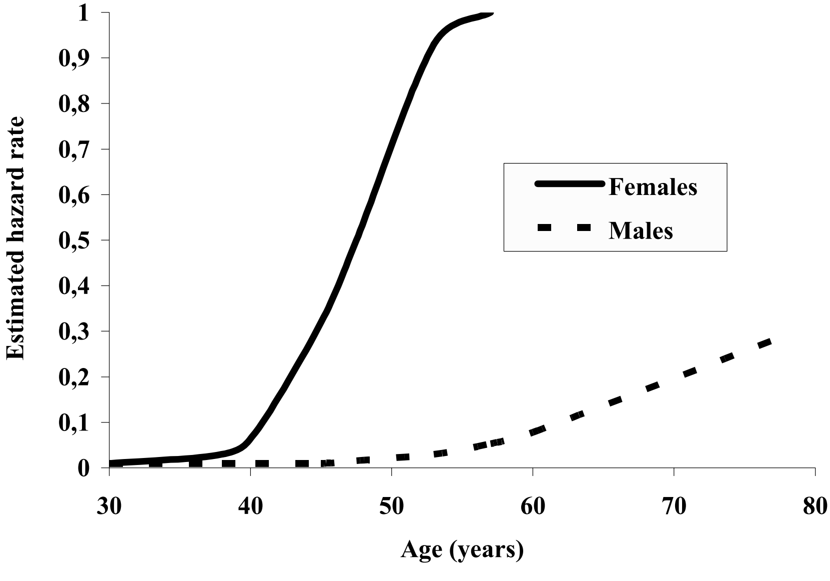


Figure 6.5. Estimated hazard rate of the end of reproductive life phase amongst men and women in the United States. Source: Kinsey et al., 1948; Treolar, 1974.

Whereas the reproductive life stage of women ends for most women around age 45 (Bongaarts and Potter, 1983; Gray, 1979), male fecundity diminishes only at a much higher age and is also less abrupt (Figure 6.5). This difference is usually explained as a consequence of the difference in parental investment that, although decreasing throughout hominid evolution, still exists and which makes, from a Darwinian perspective, reproductive senescence in the male unnecessary, from a Darwinian perspective (Peccei, 1995).

Under the influence of modernisation, menopause seems to have evolved in the same way as menarche, but in the opposite direction: in developed countries it appears, on average, around 50–51 years, whereas in developing countries it often still occurs below age 45.

Sterility

Sterility is defined as the physiological inability to produce a live-born child. Usually two forms of sterility are distinguished: primary and secondary sterility. Primary sterility refers to total infecundity because of the biological inability to have a live-born child in the fecund life phase. Secondary sterility is the inability to produce more children, after having had one or more live-born children. On the basis of investigations on populations that do not use contraception, the prevalence of primary sterility among young married couples who reach the end of their fecund phase, is estimated to be three percent. Both primary and secondary sterility increase with age, particularly after 35 years of age. The sum of the age-specific primary and secondary sterility figures gives the frequency of age-specific definitive infecundity (Figure 6.6).

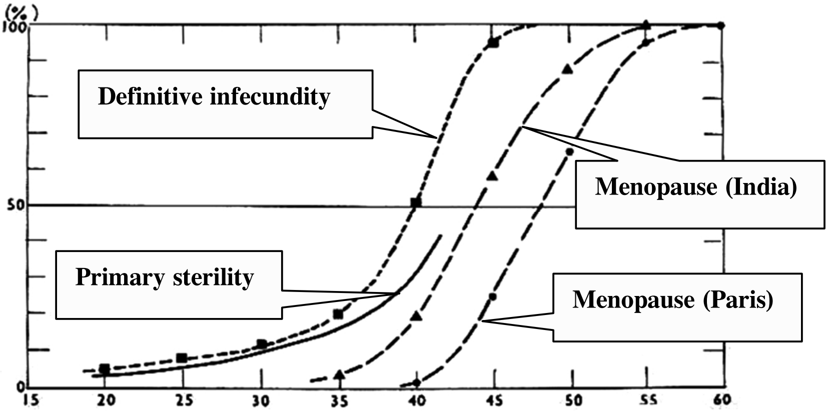


Figure 6.6. Primary and secondary sterility and menopause. Source: Léridon, 1973.

In modern culture, medical treatments are believed to have diminished the occurrence of sterility, either by preventing or curing sterility-inducing infections or by treating congenital subfecundity conditions. Recently, however, medical workers in industrial countries have been alarmed by reports of a substantial decline in sperm quality during the past 50 years (1940–1990). A significant decrease in mean sperm count as well as a significant decrease in mean seminal volume, indicating an even more pronounced decrease in total sperm count have been found amongst men without a history of infertility. This trend has occurred simultaneously with an increase in the incidence of some genitourinary abnormalities such as testicular cancer, cryptorchidism and hypospadias (Carlsen *et al.*, 1992). Some studies have also found a time-related decrease in sperm motility and the proportion of spermatozoa with normal morphology (cf. Van Waeleghem *et al.*, 1996). In recent years the deterioration seems to have slowed down or may even have stopped since the early 1990s. Since male fertility is to some extent correlated with sperm quality, it is concluded that these trends may reflect an overall reduction in male fecundity. Whether this has already influenced actual fertility is difficult to ascertain, since fertility levels lay considerably below the biological potential. The second half of the former century was, moreover, also characterised by important behavioural changes in reproductive performance. As far as concerns the possible causes of the recent sperm deterioration, researchers believe that the changes observed over a relatively short period of time cannot be due to genetic factors. Also changes in lifestyle can hardly be held fully responsible; in particular the consumption of tobacco and alcohol seems to have decreased in recent decades. Hence, it is suspected that environmental pollution may have been responsible for the sperm deterioration, either via the introduction of abnormally large amounts of estrogen or estrogen-mimicking chemicals or via the spreading of detrimental industrial chemicals in the environment.

Fertility

In demography the term fertility refers to the number of live-born children actually born to a woman. Completed fertility or completed family size is the fertility a woman has realised by the end of her fecund life phase. Proximately, fertility is the result of the combined effects of sexual intercourse, contraception, abortion and lactation on fecundity. Ultimately, fertility is influenced by the level of desired family size – which is itself subject to influences from biological drives, cultural values and socio-economic living conditions.

Investigations that have tried to estimate the degree to which fertility variation within populations is due to genetic factors and to environmental factors, usually find that fertility shows low to moderate heritability, meaning that both genetic, but mainly non-genetic factors influence human fertility variation. For instance, Kohler and Rodgers (2003) found, on the basis of their Danish twin omnibus survey of 1994, that 35 percent of the variance in fertility is related to genetic factors.

On the basis of Fisher's Fundamental Theorem of Natural Selection (FTNS) (Fisher, 1930), it has often been thought that fitness components have little or no additive genetic variance, because such traits are under strong natural selection pressures that erode genetic variation very quickly. But there are several evolutionary forces than can maintain variation. Amongst them, mutation is the most important: a very large proportion of within-population variation is due to mutation.

Genetic variation in fertility outcomes may become more relevant in societies where there is a wide range of life course options that affect fertility. Genetic factors may play a strengthening rather than a weakening role in the intergenerational transmission of fertility in contemporary societies (Udry, 1996; Rodgers *et al.*, 2001). Social practices such as the use of contraception and abortion, marriage patterns, family size norms, and the medical treatment of infertility may reintroduce genetic variance that had been eroded by natural selection. Some recent empirical findings seem, indeed, to point in that direction (Kirk *et al.*, 2001; Kohler *et al.*, 2002).

From this discussion it is obvious that reproductive fitness in humans depends largely on socio-cultural determinants, and that – consequently – it is potentially subject to a large variability. However, not only may the result (reproductive fitness) vary, but the biological and cultural means to achieve the result may also show considerable variation, both in their relative importance and in their interaction and feedback relations. The culturally mediated potential for variation in the expression of particular needs applies to reproductive behaviour and other needs, such as self-development, sexual expression, and property acquisition, most of which are mutually competitive. For individuals, material conditions of life as well as ideological convictions may favour the realisation of some of these needs and may result in the neglect or suppression of others.

Fertility at the family level

Most (married) couples in developed countries want and beget children, but produce only a low number of offspring (Figure 6.7).

Whilst a few decades ago women preferred a somewhat lower number of children than they actually realised, the average number of children that women desire today lies slightly above the number achieved (cf. van Peer, 2002; 2008; Avramov and Cliquet, 2008). When people say that they want or have wanted more children than they actually have, the obvious hypothesis is that individuals encounter obstacles during the family building phase which prevent them from having more children. This discrepancy between the wish for more children and the realisation of small families is influenced by socio-economic factors, notably prolonged education and partial incompatibility between paid work and family life, relational factors such as higher ages at marriage as well as couple dissolution, and biological-reproductive factors such as genetic risks, health problems, and sub-fecundity after years of prolonged education and pursuit of a firm footing in the labour market (Table 6.2) (Cliquet, 1998). Whereas in former decades inefficient methods of birth control resulted in considerable rates of excess fertility, the contraceptive transition from inefficient to efficient methods has strongly reduced this phenomenon and has brought achieved fertility levels closer to, or even lower than desired rates (cf. Lodewijckx *et al.*, 1988).

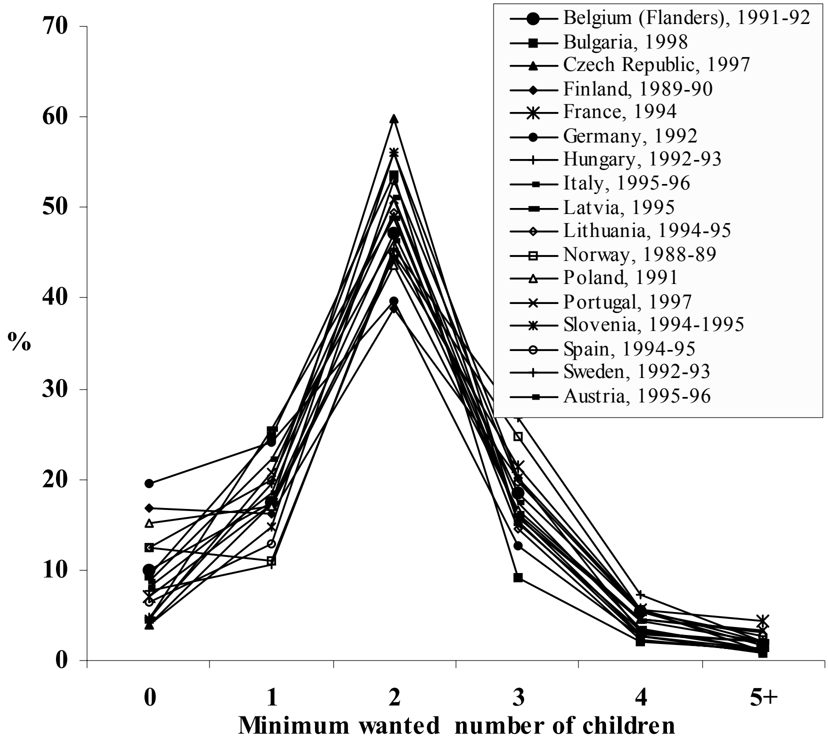


Figure 6.7. Frequency distribution of the minimum desired number of children in selected European countries (1988–1997). Source: Fertility and Family Survey database (United Nations-Economic Commission for Europe-Population Activities Unit, Geneva).

In the cluster of socio-biological factors, age is often the primary reason for not having more children. Since women as young as 35 frequently consider themselves to be too old to have a child, it is social rather than biological ageing that is an issue. One of the major socio-economic reasons for the current discrepancy between the desired and realised number of children is the perceived incompatibility between work and family life, particularly with regard to the unequal contribution of women and men in family matters – a fact that led McDonald (2000) to conclude that if men do not change their role within families, many may end up without descendents.

Table 6.2. Percentage deficit fertility (desired fertility > realised fertility) and reasons for deficit fertility amongst married couples in Flanders. Source: NEGO-V (1992), Population and Family Study Centre (CBGS) (Cliquet and Callens, 1993).

	1992
Percent deficit fertility	12
Reasons given for the deficit fertility (100 %)	
• *Socio-biological*	46
• *Relational*	22
• *Socio-economic*	20
• *Other*	12

Fertility at the population level

The unprecedented use of birth control in modern culture obviously has a limiting effect on population growth. Birth control, however, not only has quantitative effects at the population level, but may also influence the qualitative structure and composition of modern(ising) populations.

Below-replacement fertility

The first contraceptive transition in modern times, lasting from the end of the nineteenth century into the early twentieth century, formed one of the pillars of the demographic transition. After a temporary post-World War II baby boom in the middle of the twentieth century, fertility resumed its decline – in some countries in the 1960s and 1970s, and in others as late as the 1980s. By the end of the century, fertility – measured by the total fertility rate (TFR), the average number of children that could be born alive to a woman during her lifetime, calculated on the basis of the age-specific fertility rates of a given year – reached unprecedented low levels, notably in southern and eastern European countries (cf. Kohler *et al.*, 2002). By the turn of the century the total fertility rate seems to have stabilised at more or less below-replacement levels. This stabilisation was already apparent in North America and in most northern and western European countries in the 1980s, but is now also observed in Southern Europe and Ireland (Bongaarts, 2002). Yet fertility levels still show considerable between-country variation. In Europe, fertility is highest in the northern countries and in France, whilst in most of southern Europe fertility is almost 50 percent below long-term replacement (Figure 6.8). In most eastern European countries fertility took a steep plunge after the collapse of communism and it is unclear what the stabilisation level will be (Population Division, 1997; Council of Europe, 2006; Sardon, 2006).

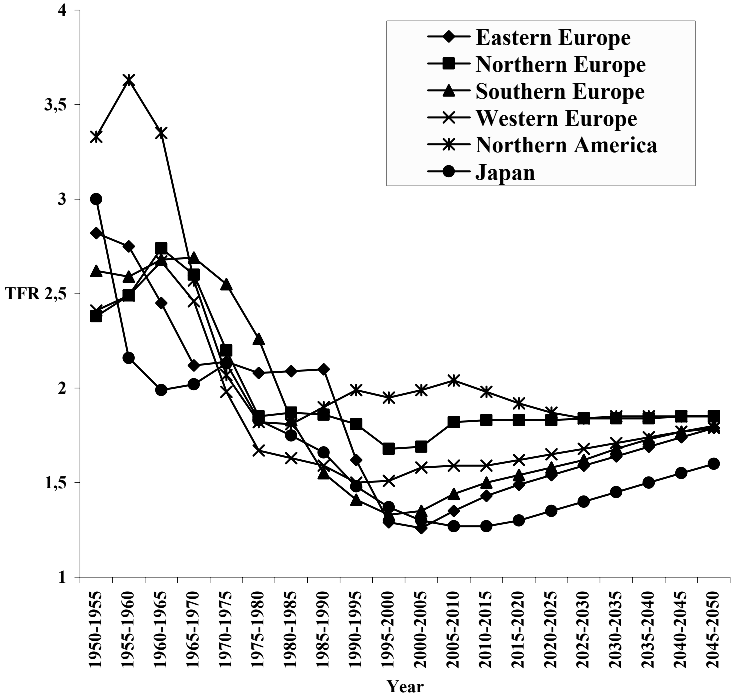


Figure 6.8. Total fertility rate in Europe, North America and Japan, 1950–2050. Source: United Nations, 2008.

The United States has a total fertility rate close to replacement level (TFR = 2.03). However, substantial differences exist between states, with relatively high levels in the southern states and relatively low levels in the northeast coastal states. The birth rate in Utah is twice as high as the rate in Vermont.

Appreciable differences also exist between ethnic and racial groups. The population of Hispanic origin has a TFR of 2.7 (Ventura *et al.*, 2003) and the Black Non-Hispanic population has a TFR of 2.1, whereas the total fertility rate of the US White (Non-Hispanic) population (TFR = 1.8) is similar to the one found in some northern European countries and France. Canada (TFR = 1.5) falls within the middle of the range of the western European levels.

A recent, statistically important novelty in some countries with very low fertility levels is the substantial increase in childless couples (Bosveld, 1996) (Figure 6.9). In the western territories of Germany, Dorbritz and Schwarz (1996) expect that almost one third of the women and men born after 1960 will remain childless. Childlessness is particularly high among more educated women in many countries (Beets, 1998; Kemkes-Grottenthaler, 2003; Koropeckyj-Cox and Pendell, 2007).

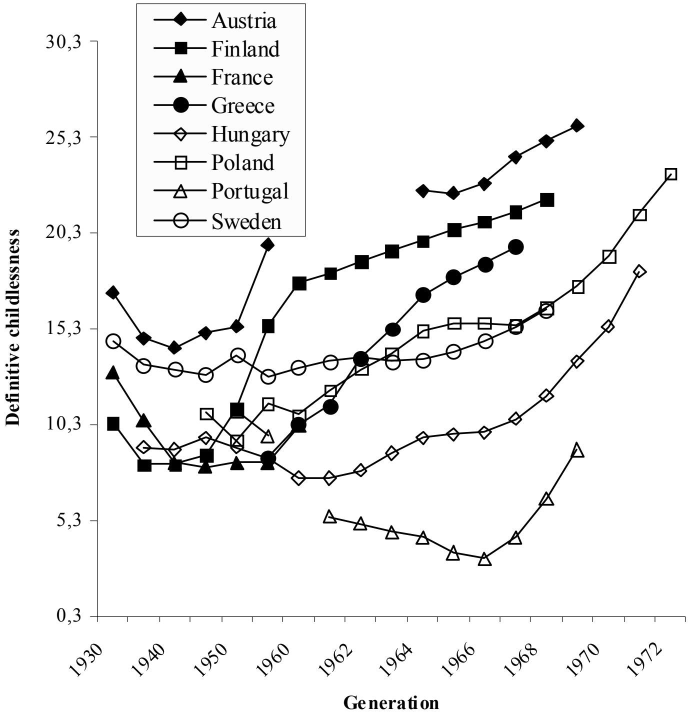


Figure 6.9. Definitive childlessness of female generations (percent of childless women). Source: Sardon, 2002.

Concerning the timing of births, we observe that since the mid 1970s, both the mean age at first birth and the average age at childbearing increased continuously. In most countries, the age at first birth now lies between 25 and 29 years, but most couples have their last child before 35 years of age (Council of Europe, 2006). The lower averages in the United States are striking, although here again ethnic and socio-economic differentials are important: amongst Blacks and some Hispanic groups, maternal age at first birth is 22 years, whilst amongst the White Non-Hispanic population it is 26 years; in Mississippi it is 23 years whereas in Massachusetts it is almost 28 years.

Postponement of births is one of the reasons for declining or low fertility. This is because there is insufficient recuperation at higher ages, either because of increasing subfecundity or because postponement easily leads to a decision not to bear children once a particular lifestyle without children or with a small number of children has been adopted (Lesthaeghe, 2001; Sobotka, 2004). The recently decreasing TFR values probably underestimate somewhat the final descendence because some postponed births will be recuperated at higher ages. Nevertheless, it is unlikely that the expected recuperation will bring fertility up to a replacement level (Bongaarts, 2002).

Table 6.3. Fertility variation necessary to maintain long-term generational replacement. Source: Cliquet and Balcaen, 1983.

	Alternative models	
Number of children	**% women**	**% women**
0	10	15
1	10	20
2	45	10
3	30	50
4	5	5
Average: 2,1	100	100

At the population level, long-term intergenerational replacement necessitates a considerable family size variation in order to compensating childlessness and one-child families. Various ‘numbers games’ can be used to illustrate the importance of family size variation in a population. Current mortality and sex ratio figures show that about 210 children per 100 women are needed to ensure long-term population replacement. On the basis of present trends in domestic partnership, desired family size distribution, sub-fecundity and other life course events, it may be expected that at least ten percent of the female population will remain childless and ten percent will have only one child. Only about five percent of women will have four children and statistically insignificant number will have five children or more. To ensure generational replacement and compensate for childless and one-child families, 45 percent of families would need to have two-children and 30 percent would need to have three children. If even higher proportions of women remain childless or have only one child, the required proportion of women having three children will need to increase even more while the proportion of women with two children must decrease. With fifteen percent of women childless and 20 percent with one child, 50 percent women would need to have three children and only ten percent two children. If the level of childlessness were to rise further, reaching 20 to 25 percent, even the number of four-child families would have to increase (Table 6.3). This would require a set of norms that would enhance the desire of a considerable part of the population for more children. Thus, modern culture is confronted with a fundamental clash of interests between the individual's life course perspective and a long-term intergenerational societal perspective.

The demographic consequences of the prevailing below-replacement fertility rate include on the one hand, population ageing due to population dejuvenation, and, on the other hand, population decline.

Population dejuvenation

The combination of persistent below-replacement fertility levels (dejuvenation) and the continued increase in longevity (greying) will result in further population ageing in the coming decades. A higher proportion of aged people is a normal outcome of the demographic transition, but a substantially below-replacement fertility rate obviously produces more ageing, adding to the normal population ageing caused by greying (Figure 6.10). This bottom-up ageing process – called population dejuvenation – intensifies the social, economic, cultural and political consequences of the overall ageing process.

The changing age composition of the population raises a variety of ethical and political concerns. A 'doomsday scenario' has been prophesised by those who believe that modern demographic regimes will lead to a societal catastrophe and the disappearance of some populations (cf. Wattenberg, 1989; Buchanan, 2002). Others are confident that technological innovation, economic growth, managerial skills, entrepreneurial initiatives, employment policies, cultural change and adequate governance will allow modern societies to adapt to the new demographic regime. Still others highlight the long-term advantages of a stationary population model as a desirable societal goal. This model, which implies zero population growth, would be the easiest demographic regime to manage socially because of its stable age structure. Striving toward the stationary population model implies limiting fertility up to or around the intergenerational replacement level. In the short run, this process would increase the total dependency load of the aged on society, but in the long run, it would somewhat relieve the ageing load.

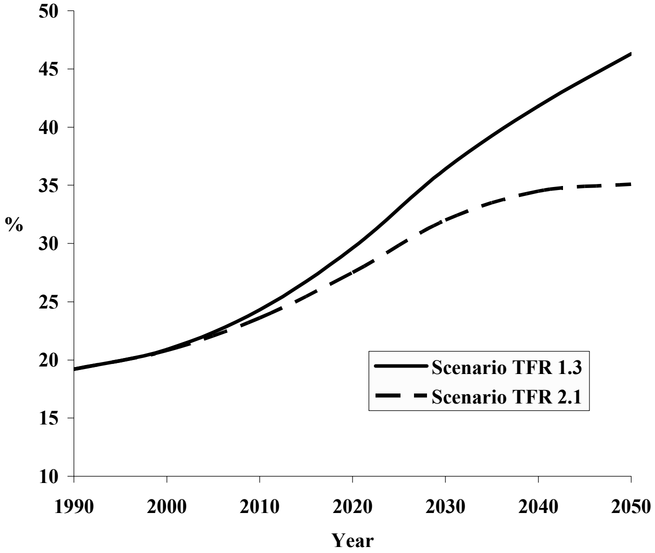


Figure 6.10. Future population ageing scenarios based on very low fertility and replacement fertility levels (all member states of the Council of Europe, except Turkey, having a population of more than one million in 1993). Source: Prinz and Lutz 1993.
Scenario TFR = 1.3, Longevity = 90♂/95♀ ; Net immigration = 0
Scenario TFR = 2.1, Longevity = 90♂/95♀ ; Net immigration = 0

Population decline

All recent population projection scenarios show that Europe's population is at the verge of a continuous, more or less intense decline if the recent below-replacement fertility levels persist and are not compensated for by substantial increases in immigration and life expectancy (cf. Prinz and Lutz, 1993; de Beer and van Wissen, 1999; Population Division, 2001; Demeny, 2003; Giannakouris, 2008) (Figure 6.11).

The prospect of a substantial European population decline elicits a diversity of opinions and policy positions. Two main types of reactions can be distinguished.

The first is mainly inspired by ecological and/or global considerations and sees no harm in population decline. Some would even welcome such a development, especially in highly densely populated regions (cf. Ehrlich and Ehrlich, 1990; 2008). Even if in some countries or regions a population decline were ecologically favourable, and hence socially advantageous in several respects, the decline could obviously not be sustained indefinitely. At some point in time, when population size and density are brought down to ecologically acceptable levels, population stationarity would have to be established in order to avoid the gradual disappearance of the population's identity (Bourgeois-Pichat, 1988).

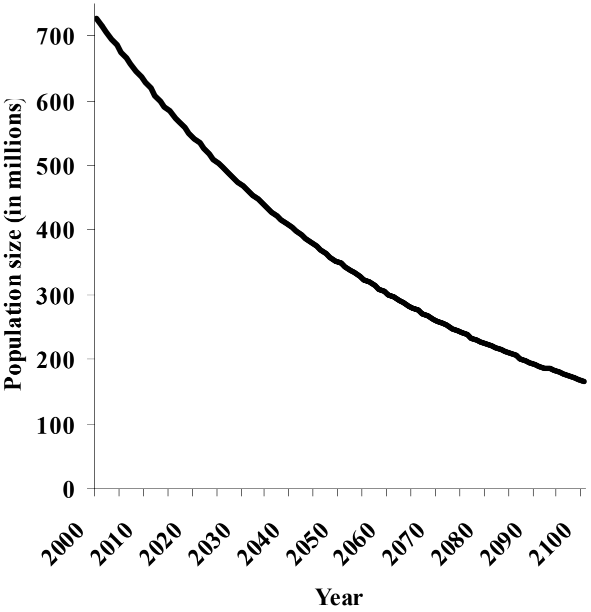


Figure 6.11. Population decrease in Europe (including the Russian Federation) from 2000 to 2100, on the hypothesis that Europe's 2000 fertility and mortality rates remain constant and assuming no in- or out-migration. Source: Demeny, 2003.

In contrast, many fear continuous population decline (cf. Teitelbaum and Winter, 1985; Chesnais, 1995). Sometimes this apprehension is related to the expected economic, cultural and especially political effects of a quantitative reduction. Although absolute numbers of inhabitants are less seen as decision for political, military and economic success in modern societies, demographic differentials are still seen as relevant with regard to North-South competition (e.g. Chaunu, 1975; Van Mechelen, 1987; Tönz, 2005).

The possible negative effects of a population decline need to be viewed in a broader context, however, particularly in relation to the issue of population ageing, with which it is often correlated. The combined effects of continuous population decline and population ageing, which can take the form of a negative exponential (Chesnais, 1985), are thought to lower society's competitiveness and adaptability (cf. Krosnick and Alwin, 1989; Chesnais, 1990), to diminish the renewal of human resources (cf. Chaunu, 1975; Sauvy, 2001), and to decrease society's ability to provide high standards of social security and health care, and other social benefits (cf. Johanet *et al.*, 1990).

Discussions about the desirability of maintaining a stationary population invariably ends up having to address the issue of below-replacement fertility, and brings us back to issues of gender equity and the quality of life for women and men. Today all research points to the conclusion that a spontaneous fertility recovery, as suggested in Figure 6.8, is highly unlikely, though recently some birth rates have risen slightly. Thus, policies and measures by which fertility could be stabilised at or around the replacement level pop up again and again in the debate about the demographic future (Harbison and Robinson, 2002; Höhn *et al.*, 2008).

Qualitative effects of the new fertility regime

The demographic transition is characterised by profound changes both in the timing and intensity of fertility. As far as timing is concerned, births are no longer spread throughout the fecund period of life. With respect to fertility intensity, both the average rate and the variance decreased. Last but not least, the transition from a high to a low fertility regime has, in many cases, been associated with significant social biological differentials in reproductive behaviour.

In demographically post-transitional societies, births are avoided at younger ages, in particular during adolescence, and after 35. The latter phenomenon, avoiding births at higher age, is generally considered to have a eugenic effect, because the rates of several genetic impairments increase with parental age and/or birth order and, hence, can be avoided by controlling fertility at higher ages or parity (cf. Matsunaga, 1966).

In recent decades, however, the postponement of births has been pushed further up in the life course. In some countries like the Netherlands, the average age at first birth now lies close to 30 (cf. Beets *et al.*, 1994), which means that most women will have their children in their thirties instead of their twenties.

In addition to increased risk of fecundity problems (since primary and secondary sterility start to increase substantially after age 30) (Billari *et al.*, 2007), relatively older parents also risk higher frequencies of particular genetic disorders. This is partially offset as more and more genetic impairments can be detected prenatally and eliminated by selective abortion, if so desired.

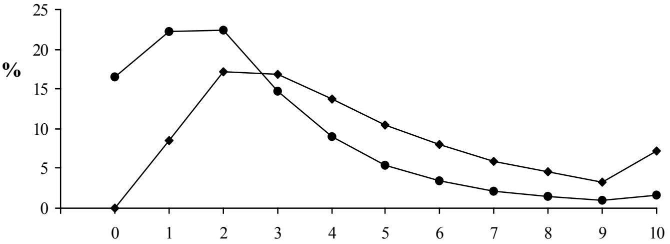
Fertility regulation, resulting in a lower parity combined with an earlier timing, may have some other, but perhaps less important genetic effects, such as changes in the frequency of dizygotic twins, the sex ratio, and the formation of consanguineous unions. In fact, all genetic phenomena that are differentially related to maternal or paternal age may be supposed to be influenced by fertility regulation (see e.g. Fuhrmann, 1969; Chandrasekar *et al.*, 1993).

The decreases in average fertility and variance in the modern world have to be considered together, because the opportunity for selection depends, according to Crow's Index of Total Selection, on the ratio of the variance (V_w) to the square of the mean (w^2) of the number of first generation descendants per individual (Crow, 1958). Data from different countries seem to suggest that, at least in the initial stages of the demographic transition, the fertility component of the Index of Total Selection (I_f) increased slightly, whereas in later stages it decreased (Adams and Smouse, 1985).

Although in the field of reproductive behaviour the demographic transition is mainly characterised by a decrease in fertility, modernisation has also increased, in absolute or in relative terms, the fertility of particular population categories. Modern healthcare and social welfare policies, particularly therapeutic replacement, have not only postponed mortality, but also relieved morbidity, in some cases allowing individuals or couples, whose reproductive fitness would have been strongly reduced in earlier times, to have (more) children. For cases in which genetic factors are involved in the aetiology of diseases, health care and therapeutic replacement result in selection relaxation. For instance, medical treatment for several mental or physical conditions is known to have a positive effect on reproductive fitness. Schizophrenic patients traditionally had (and still have) a lower reproductive fitness than other people, due to lower marriage rates, higher divorce rates and lower fertility rates (cf. Erlenmeyer-Kimling *et al.*, 1969; Ritsner *et al.*, 1991). In recent decades, however, thanks to medical treatment allowing deinstitutionalisation and improved medication, the fertility rate of schizophrenic patients has shown a slight upward trend (cf. Bodmer, 1968; Ödegaard, 1980). The same phenomenon has been observed for diabetes (cf. Aschner and Post, 1956/57; Jonasson *et al.*, 2007).

Selection relaxation may also act against subfecundity. More and more medical interventions are aimed at treating subfecundity. Moreover, fertility limitation profoundly changes the parity frequency distribution in favour of the lower parity numbers (Figure 6.12). Although fertility seems to have a low heritability (Philippe and Yelle, 1978), the combined effects of replacement therapies and the changed parity distribution might, in the long run, also decrease fecundity, or at least increase the proportion of people facing subfecundity problems (cf. Graham, 1972; Medawar, 1974).

Family size and offspring number in a demographically pre-transitional regime (France, birth cohort 1881)



Family size and offspring number in a demographically post-transitional regime (Flanders, birth cohorts 1950–1954)

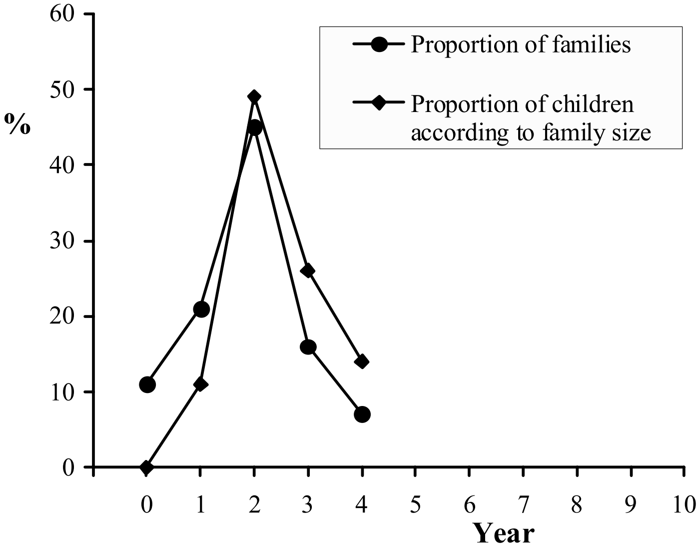


Figure 6.12. Distribution of family size and number of offspring. Source: Callens and Schoenmaeckers, 1993; Vincent, 1946.

Overall, fertility changes associated with the modern demographic transition seem to have contributed, as with the changes in partnership behaviour, to the increase in the variance of several biological characteristics.

In pre-industrial cultures, fertility was largely uncontrolled, resulting in high fertility levels and in a large fertility variance. The fertility variation was largely due to individual fecundity and life course events with respect to morbidity and mortality, all factors which were quite independent of personal choice or control. In modern culture, in contrast, low fertility levels are largely due to choice and control. To the extent that childbearing motivations and desired and intended family size are partially genetically influenced (cf. Miller and Pasta, 2000; Rodgers and Doughty, 2000), it can be expected that these factors will become subject to selection and consequently may change the gene pool. This could influence reproductive fitness and change the distribution of some of the psychological determinants of fertility. In the future, people will not only be selected on the basis of their physiological potentialities (as was the case in the past), but also, and more than in pre-modern cultural stages, on the basis of psychological predispositions with respect to childbearing motivation and desired fertility. In the long run, couples and individuals with below-replacement fertility rates would, thus, be outselected, leaving room for individuals and couples with more children, thus allowing fertility to increase again to near replacement levels (Cliquet and Avramov, 1998; Udry, 2000).

Parenting

Evolutionary background: increased parental investment

In response to, and interaction with, the growing brain size of the hominids and the significantly increasing maturation period of the human child, the need for parental care and investment must have vastly increased from the very beginning of the evolution of our species. Moreover, as was already pointed out earlier, one of the distinctive traits of the human species is the combination of slowly maturing offspring with a long childrearing process, necessitating a greatly expanded commitment to parenthood. During the extended period of growth and development of children, adults typically must care for and feed multiple offspring through adolescence. This level of investment was made possible through increased and longer maternal care with the cooperation of the male. Through paternal investment, human females became able to rear not only a nursing infant but also one or more additional, nutritionally dependent juveniles at the same time. Thanks to male investment, humans were able to successfully raise one out of every two born children into adulthood, whilst among other primates and group-hunting carnivores only 10 to 30 percent of offspring reach reproductive maturity (Lancaster and Lancaster, 1983; 1987).

The evolution-based increase of paternal investment in children does not necessarily mean that fathers started providing their children with the same kind of care as women. The specificity of the nature of paternal investment consisted probably more in provisioning and protecting women and children than in direct father-child interaction as many investigations in various cultural settings show (Geary, 2000).

Parenthood in modern culture

The increase in parental investment in offspring in the course of human evolution has not only continued into the modern era, but even shows a notable acceleration. This acceleration is quite a recent phenomenon, occurring to a large extent during the transition from the agricultural to the industrial era, and largely coinciding with the demographic transition (cf. Gauthier *et al.*, 2004).

Changing economic living conditions and new ideological beliefs, combined in a variety of ways resulted in a reproductive shift in human parenthood from quantity to quality. This marked the transition from an agrarian societal and family model, characterised by domestic food production involving child labour, a patrilineal kinship ideology, a large quantity of children with low investment per child and little schooling, filial reciprocity in care and support, and high birth and death rates to the modern family model in an industrial society with its system of wage labour, high investment in children and advanced education, unilateral wealth flow from parents to children, and low birth rates and death rates. Whereas in agrarian culture the number of children was maximised because they contributed more than they cost, in industrial society the number of offspring is minimised because they cost more than they contribute and have excellent chances of survival and economic opportunities (LeVine and White, 1987).

In the later stages of the agricultural era of human history parents started to limit their fertility and ensure their children access to scarce resources to support their own reproduction. The perception and treatment of children, as well as the nature of parent-child interactions, changed substantially during the last 300–400 years, characterised by increased parental attachment and involvement (Vinovskis, 2005). Nevertheless, modernisation was accompanied by – and partly also further evolved due to – a critical transformation in parental strategy from an emphasis on child quantity to child quality in the late eighteenth and early nineteenth centuries (Ariés, 1962). This transformation has been explained as a function not only of changes in socio-economic and technological conditions, but also of innovative ideological views on individual freedom and development emanating from the Enlightenment and the French Revolution (Lesthaeghe, 1980; 1983). Rossi (1987) called it “a change from lineage to a child-centred value orientation in western societies”.

Modern culture is characterised not only by a continued and accelerating increase in parental investment, but also, particularly in recent decades, by a change in the nature of fatherhood. Traditional paternal investment mainly consisted of provisioning, and direct involvement in childcare was of secondary (if any) importance. But due to the changing role of women in modern society, as well as evolving attitudes and values concerning gender relations and parent-child interactions, fathers have gradually taken up paternal caring tasks, though at a varying pace and frequency within as well as between countries and cultures (Lamb *et al.*, 1987). Although some authors perceive a ‘shrinking fatherhood’ in modern culture (cf. Jensen, 2000), most now refer to the emergence of ‘the new fathers’ (e.g. Lamb, 1987; Tamis-LeMonda and Cabrera, 2002; Day and Lamb, 2004).

PRO- AND ANTI-NATALISM

Pronatalism is an ideology that advocates childbearing. Historically, it has mainly been supported by ‘in-group’ and expansionist ideologies. Two major types can be distinguished: patriarchal religions in which women’s roles are restricted to procreative activities as a glorification of God, and expansionist nationalist groups, regimes or countries that try, through demographic growth, to increase their economic, military and political power and influence. Moreover, religious and nationalist forms of pronatalism are often strongly linked (cf. Hastings, 1997; O’Brien, 1999).

Antinatalism is the view that it is bad to (abundantly) procreate, either for philosophical reasons (cf. Schopenhauer, 1851; Benatar, 2006), or for pragmatic reasons, which may include economic or ecological considerations (cf. Ehrlich and Ehrlich, 1990; 2008), or feminist positions (cf. Giminez, 1980).

The pronatalist position can obviously get a strong boost in times of decreasing fertility or population decline due to war or other catastrophic losses. Significant ethnic or racial differentials in fertility may also promote pronatalism for fear of changes in in-group/out-group relations, economic prosperity or political power.

However, the concerns currently expressed by many population scientists about the possible negative effects of below-replacement fertility in many developed countries cannot be equated with old-fashioned pronatalism. The effort to stabilise fertility around replacement levels is a fundamentally different policy goal than the earlier pronatalist objectives. Whereas pronatalism was ideologically focussed on ‘in-group’ expansion, the current concerns about subreplacement fertility are – at least publicly – motivated not at all by demographic growth ideals, but rather by concern over demographic problems such as excessive population dejuvenation or rapid population decline (cf. Avramov and Cliquet, 2005; Grant and Hoorens, 2006).

Most present-day population scientists are well aware of the pressing societal problems resulting from overpopulation, economic underdevelopment, environmental pollution, resource depletion, deforestation, species extinction, and climate change. Due to the increasing awareness about the unfavourable effects of high population density and strong population growth, the second half of the twentieth century was characterised by a gradual shift from a population growth ideology toward a population stationary ideology, in both scientific and policy quarters. Even at the global level, a broad political consensus has been reached on this matter, thanks mainly to the strenuous efforts of the United Nations Committee on Population and Development, as can be seen from the Bucharest ‘World Population Plan of Action’ (United Nations, 1974), the ‘Mexico Declaration’ (United Nations, 1984), and especially the Cairo ‘ICPD Action Programme’ (United Nations, 1994). Advocates of the population growth ideology have become an insignificant, though still noisy, minority. Advocates of a population decrease are not yet very numerous, although this may change in the coming decades or centuries if environmental problems or population growth are not adequately addressed.

In the same way a clear distinction has to be made between the ideology of antinatalism and those who advocate family planning and birth control, although most pro-life activists indiscriminately sweep these issues into the same heap.

Supporters of family planning or birth control goals are not at all oriented against births, but rather seek to promote conscious parenthood, quantitatively and qualitatively, in the best interests of parents, children, and society overall (cf. World Health Organisation and John Hopkins Bloomberg School of Public Health, 2007; International Planned Parenthood Federation, 2008). In most cases, this implies the quantitative limitation of the huge potential of human fecundity; in a minority of cases it implies the application of medically assisted reproduction to facilitate childbearing, or the use of genetic counselling services to avoid genetic impairments or to favour the birth of healthy children.

In modern culture, both pro- and antinatalist ideologies are inadequate approaches to human reproduction. In a knowledge-based culture that wants to perpetuate itself intergenerationally, in harmonious coexistence between neighbouring societies, its environment, and available or potential resources, only conscious fertility control (both quantitative and qualitative) is a well-adapted strategy that should be promoted.

From an evolutionary perspective, the principle of maximisation of inclusive fitness cannot be looked at only from an individual point of view or dissociated from the novel environment modernity produced. The modern demographic transition resulted in a population growth and density which, together with the quality-of-life requirements of modern culture, necessitates a considerable restraint in reproduction. Considered from a long-term perspective, the needed shift from quantitative to qualitative reproductive efforts in modernisation is completely in line with the evolutionary trends that resulted in the hominisation process. This matter will further be addressed in the penultimate Chapter on 'Intergenerational Variation and Dysgenism'.

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CHAPTER 7

SOCIAL CLASS VARIATION AND CLASSISM

INTRODUCTION

All known human societies are characterised by differences in the distribution of wealth, power or prestige. Sociologists have amply documented the phenomenon of social stratification in which people are ranked into a number of hierarchically differentiated layers.

Sorokin (1928, 11), for example, defines social stratification as

> *"the differentiation of a given population into hierarchically superposed classes. It is manifested in the existence of upper and lower social layers. Its basis and very essence consists in an unequal distribution of rights and privileges, duties and responsibilities, social values and privations, social power and influences among the members of a society."*

Societies are, however, not only structurally stratified. The different positions and functions of its members are also differentially evaluated. Barber (1957, 1–2), for instance, formulated this in a concise way:

> *"Human societies are not only differentiated structures, but they are also dynamic systems in which differentiated activities and roles are valued in different degrees... But men in society are valuing animals, who develop patterns of preference with respect to their social, physical and biological worlds. They rate one another as higher and lower, they treat one another as better and worse; in other words they value one another on various scales."*

Depending on the stage of a society's cultural development – for instance, pre-industrial, industrial, post-industrial – the allocation of differentially rewarded social positions may be made on the basis of different criteria and a different weighting of those criteria, for instance descent, wealth, military, political or religious status, economic and financial status, education, personal qualities, and prestige (cf. Barber, 1957; Grusky, 1994).

In modern culture, the hierarchy of functionally necessary social activities increasingly is determined by the degree of people's knowledge and responsibility (Barber, 1957). These factors require a particular biological endowment and equipment of the individual (physical as well as mental).

As was explained in Chapter 2 on ‘Individual Variation and Individualism’, individuals within populations differ in their biological characteristics on the basis of their genetic endowment, environmental influences and the interplay between the two.

The central question in this chapter is whether individual biological variation and social differences within populations are interrelated, and if so, in what direction are their causal relations oriented?

BIOLOGICAL VARIATION ⟷ SOCIAL DIFFERENTIATION

Related questions include: How do biological differences between individuals contribute to the establishment of social differences and social stratification systems? What is the impact of genetic and environmental biological factors on those differences and systems? How and to what degree do social stratification systems influence the genetic assortment and/or phenotypic development of individuals belonging to different social strata?

Social biology is interested in both directions of those biosocial interrelations, and involves the study of how different biological mechanisms (genetic, environmental) and biological features (maturation, physiological drives, morphological appearance, health, cognitive ability and emotional personality characteristics) influence social differences and/or are influenced by social differences. These questions are particularly important in modern or modernising societies. With its egalitarian ideology, its rising living standards and increased opportunities for individual development, the modernisation process entails a clear shift toward the growing importance of the ‘human factor’ in the allocation of individual social positions (cf. Crook *et al.*, 1992; Esping-Andersen, 1993; Marshall *et al.*, 1997). It has been argued that human and cultural capital is replacing economic capital as the principal stratifying force in advanced industrial societies. As Bell (1973, 409) states:

> *“The post-industrial society, in its initial logic, is a meritocracy. Differential status and differential income are based on technical skills and higher education. Without those achievements one cannot fulfil the requirements of the new social division of labour which is a feature of that society.”*

In modern society, with its world-wide ethic of equality in rights and social equity, social differences are often perceived as social inequalities and inequities. In particular, biosocial relations are commonly perceived as manifestations of an unjust natural order and/or an unfair social construct. The study of biosocial interrelations in matters of social stratification and social mobility can contribute to the establishment of a morally and scientifically more coherent way of thinking and acting in which both the social importance of specific biological characteristics and processes as well as the realisation of social equality or at least social equity, are acknowledged for the continuation and further development of modernisation (Bereiter, 1987).

THE EVOLUTIONARY BACKGROUND OF WITHIN-POPULATION GROUP VARIATION

The existence of social status inequalities in human societies is consistent with dominance hierarchies that are generally found in social animal species (cf. Hinde, 1974; Wilson, 1975; Omark *et al.*, 1980; Trivers, 1985).

At the individual (or family) level, social hierarchies are the result of within-group competition for scarce resources, such as territory, food, and mates. The drives toward high status and priority access to resources are related to the principle of the maximisation of inclusive fitness (Hamilton, 1964; Williams, 1966; Alexander, 1979). Status and prestige are the markers of social success. Social success is the route to power, which, in turn, is the key to resource acquisition, a universal human desire (Betzig, 1986). High status is correlated with greater access to resources and mates, resulting in the production of a larger number of offspring, and this means, in the end, a higher likelihood of inter-generational transmission of genes.

In traditional societies, powerful individuals typically produce more offspring than their subordinates. Social and economic success enhances individual performances in achieving copulation and in rearing successful children. In hunting and gathering societies, high social status is generally positively associated with polygyny and/or a higher number of offspring (cf. MacCluer *et al.*, 1971; Turke and Betzig, 1985). In agrarian societies, there is a positive association between socio-economic status and the fertility behaviour of rural couples (cf. Stys, 1957; Notestein, 1963; Betzig, 1986). In modern contraceptive societies, as was shown in previous chapters, there may still be a positive association between status and number of mates, in the form of successive monogamy or extra-marital relations, but not necessarily between status and reproductive outcome.

At the group level, dominance relations may have several other advantages such as maintenance of group stability, facilitation of the transmission of communication (cf. Omark *et al.*, 1980) and, especially, success in inter-group conflict or competition for resources (cf. Van der Dennen, 1995; Sidanius and Pratto, 1999; Flinn *et al.*, 2005). Essentially, groups organised in hierarchies appear to be more efficient at combat than groups that are organised in other ways.

The evolutionary background of social status differences ultimately has to do, either via the individual or the group level of organisation, with differential reproductive fitness, in other words with Darwinian selection.

HISTORICAL THEORIES ABOUT BIOSOCIAL INEQUALITIES

The early development of social biology, in particular the study of the interrelations between biological variation and social differentiation during the second half of the nineteenth century, was characterised by a minimum of empirical research and an abundance of theoretical and speculative writings. Two important events explain this historical approach.

In the first place, Darwinism was the major catalyst, if not the direct cause, of the emergence of biosocial schools of thought within different disciplines of social studies. Whether one considers the anthropo-sociological approach of de Lapouge (1887; 1896; 1897; 1899) in France and Ammon (1890; 1893; 1895) in Germany, or the social Darwinism of Spencer (1864; 1874; 1895) and Sumner (1883) in the United States, or even Marxist biological doctrine (Marx, 1867; Engels, 1878), one always finds Darwin's theory at the root of substantiated or unsubstantiated applications on human behaviour and societal processes. The sixty submissions to a prize contest in Germany in response to the question "*Was lernen wir aus den Prinzipiën der Deszendenztheorie für die innerpolitische Entwicklung und Gezetzgebung der Staaten?*"[1] (Schallmayer, 1910) give an idea about the enormous boost that Darwin's revolutionary theory gave to the development of theoretical biosocial writings.

Secondly, the development of biosocial theory was stimulated by the emergence of Marxism. The confrontation of Darwinism with Marxist theory resulted not only in the production of numerous scientific and social-philosophical writings but gave also rise to the Marxist-biological school of thought, the content of which formed the antithesis of the propositions of the anthropo-sociological and social Darwinist theories (Woltmann, 1899; Venable, 1945; Hofstadter, 1955; Zirkle, 1959).

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[1] "What do we learn from the principles of evolutionary theory about the internal political development and legislation of states?"(author's translation)

The distinction between the anthropo-sociological school of thought and the social-Darwinist and Marxist-biological approaches, discussed below, is probably an oversimplified and not completely satisfactory classification of the early theories regarding the relations between biological variation and social differentiation. First of all, there is partial overlap between some of the approaches. Second, within each major school of thought there are important differences in viewpoint. Finally, the early biosocial theories involve much more than just the conceptualisation and study of the relations between biological processes and social classes. They often deal with much broader themes such as biological evolution (Darwinian or Lamarckian) and societal development, or concentrate on inter-population or international conflicts, in particular racial competition.

However, the strong but often speculative views contained within the nineteenth century theoretical approaches to biosocial interactions should not lead us to forget the important and unprejudiced empirical investigations that were made in several European countries on human physique, growth, and maturation based on socio-economic, socio-geographic or occupational status groups. Examples include the research of de Boismont (1842), Parchappe (1836) and Villermé (1829) in France, Livi (1898) and Niceforo (1905) in Italy, Hoesch-Ernst (1906) and Pfitzner (1899–1903) in Germany, and Ducpétiaux (1843) and Quételet (1835) in Belgium. Unfortunately, these empirical investigations had less social or political impact than the theoretical-philosophical publications.

The anthropo-sociological school of thought

The anthropo-sociologists, with George Vacher de Lapouge (1887; 1896; 1897; 1899) and Otto Ammon (1890; 1893; 1895) as their most important representatives (with Carlos C. Closson (1896) as their American disciple [cf. Maccabelli, 2008]), have gone down in history as ambivalent figures. On the one hand, they were precursors who conceptualised in a helpful way the biosocial challenges related to the interrelations between biological variation and social differentiation, and moreover did some empirical research in observing particular biological differences between various social status groups. On the other hand, today one is appalled by the way in which some of them, prejudiced by their own social position, ideological convictions, or limited scientific orientation, over-reached themselves in their lopsided hereditarian and racially deterministic conclusions and, hence, contributed to laying the foundations for later pseudo-scientifically based political doctrines (Cliquet, 1963; Tort, 1992; Hecht, 2000).

Social-Darwinism

In contrast to the anthropo-sociologists, the well-known representatives of the Social Darwinist school of thought, Herbert Spencer (1851) and William G. Sumner (1883), did not contribute to the empirical biosocial research of various social categories, but instead developed the notion that the principles of Darwinian evolutionary theory (Darwin, 1859) could be transferred and applied to the analysis of social order and social structure. Spencer and Sumner promoted individualism and economically laissez-faire politics, which they believed should maximise human and sociality potential. Misunderstood concepts such as 'struggle for existence' and 'survival of the fittest' became political metaphors used to legitimate particular political and social systems, and took on a life of their own. However, the connection between the Darwinian theory of evolution and the social Darwinism of Spencer and Sumner is extremely loose. In fact, social Darwinism is neither social nor Darwinian (cf. Hofstadter, 1944; Jones, 1980; Tarde, 1984; Tort, 1992; Truwant, 1997). Economic success was wrongfully equated with biological success, and those who didn't succeed in economic competition were – again mistakenly – considered the victims of natural selection.

The fundamental misunderstanding of Darwinian selection theory by the social Darwinists can best be illustrated by the following quotation from Sumner (1914, 90):

> *"The millionaires are the product of natural selection, acting on the whole body of men to pick out those who can meet the requirement of certain work to be done. ... It is because they are thus selected that wealth – both their own and that entrusted to them – aggregates under their hands. ... They may fairly be regarded as the naturally selected agents of society for certain work. They get high wages and live in luxury, but the bargain is a good one for society. There is the intensest competition for their place and occupations. This assures us that all who are competent for this function will be employed in it, so that the cost of it will be reduced to the lowest terms."*

The social Darwinists equated economic success with biological success, confused social assortment with social selection (see below), and misinterpreted natural selection, which, in present-day population genetic terminology, has to do with differential reproduction of carriers of different genes. Obviously, the acquisition of resources can facilitate the attraction of mates and enhance the reproductive outcome, as has clearly been shown for pre-modern societies (cf. Betzig, Borgerhoff Mulder, and Turke, 1988). But in the culture of modernity, particularly in contraceptive societies, there is not necessarily a correlation between resources and fertility.

With time, the social Darwinist discourse evolved from what is now considered traditional social Darwinism in the second half of the nineteenth century, in which ideas about individual economic competition were used to justify laissez-faire economic policies, to several variants of collective social Darwinism in the early decades of the twentieth century. These included a militarist or imperialist social Darwinism (cf. Fiske, 1874; Strong, 1885) and a racialist social Darwinism (cf. de Gobineau, 1853–1855; Haeckel, 1905; Chamberlain, 1911) that used natural selection as an argument for the superiority of particular nations or races (cf. Hofstadter, 1944; Jones, 1980; Truwant, 1997).

Since the 1960s the evolutionary approach to sociality has expanded with such intensity and to such a degree that some authors already speak about the ‘new social Darwinists’ (Thompson, 1982; Horgan, 1995). Contemporary social Darwinism, however, is cast in a different mould than the previous approaches, which Tort (1992) rightly characterised as a form of ‘pseudo-social Darwinism’. The new social Darwinists can rely on a better developed, more comprehensive evolutionary theory – the modern synthesis – and can also rely on the theoretical framework of the second Darwinian revolution. They also have a much more profound insight into evolutionary processes and their interaction and feedback with socio-cultural processes. The current wave of social Darwinism can, therefore, be expected to avoid the blunders the first wave committed in transposing evolutionary-biological principles onto societal and cultural processes, without a real understanding of the evolutionary framework (Thienpont, 2000–2001).

The term social Darwinism was first used in the 1880s in Europe – in all probability it was the Frenchman Gautier (1880) who invented the term and employed it in a pejorative sense to refer to theories that saw social laws as extensions of natural laws (Tort, 1992). Given this contentious history, it won’t come as a surprise that today the expression ‘social Darwinism’ is often misunderstood, misused and abused. For instance, the term is often used to discredit an adversary in scientific or ideological disputes. Hence, one should be prudent when using this term and always specify what one precisely means or wants to say by it.

Marxist biological doctrine

The Marxist biological school of thought rejected the view that genetic factors were the cause of the social order and the class struggle in capitalist society. According to this doctrine, the explanation for social differentiation, as well as any cultural development, can be reduced to differences in economic production. According to Woltmann (1899), the works of Karl Marx and Friedrich Engels do not include propositions about the role of natural selection in society. Nevertheless, they declare themselves openly in favour of the view that environmental factors cause social differentiation.

Marx and Engels were delighted with Darwin's work, mainly because it provided a materialistic, non-teleological explanation for change in the natural world. In a letter dated December 12, 1859, to Marx, Engels wrote (quoted in Zirkle, 1959, 85):

> *"Darwin, whom I am just now reading, is splendid."*

In a letter to Engels on December 19, 1860, Marx wrote about Darwin's book on natural selection (quoted in Zirkle, 1959, 86):

> *"Although it is developed in the crude English style, this is the book which contains the basis in natural history for our view."*

And a month later, on January 16, 1861, he wrote to Lassalle (quoted in Zirkle, 1959, 86):

> *"Darwin's book is very important and serves me as a basis in natural selection for the class struggle in history."*

However, Marx and Engels only partially supported Darwinism. They rejected population pressure as a selecting agent – Malthus' contribution to the theory of natural selection – and believed instead that adaptive modifications due to environmental effects were inherited (Zirkle, 1959). They were total environmentalists and believed in Lamarckism – the inheritance of acquired characteristics – not realising that this implies that the economically less advanced peoples and classes would have become inferior in their heredity (Muller, 1948, quoted in Zirkle, 1959). The environmentalist and Lamarckian beliefs of the Marxists became a dogma amongst their followers in the communist countries, in particular the Soviet Union, which in the first half of the twentieth century led to the rejection of modern (= Mendelian) genetic science, the elimination and even physical liquidation of many Russian geneticists, the most famous of whom was Nikolai Vavilov, and the disastrous Soviet agricultural policy. Modern genetics was exchanged for quack genetics, promoted by the fraudulent Lysenko who was remained in his post as director of the Institute of Genetics at the Academy of Sciences until 1964 (Medvedev, 1969; Joravsky, 1970; Soyfer, 1994).

In 1964, physicist Andrei Sakharov spoke out against Lysenko in the General Assembly of the Academy of Sciences (quoted by Joravsky, 1970):

> *"He is responsible for the shameful backwardness of Soviet biology and of genetics in particular, for the dissemination of pseudo-scientific views, for adventurism, for the degradation of*

> *learning, and for the defamation, firing, arrest, even death, of many genuine scientists."*

THE SOCIAL-BIOLOGICAL APPROACH TO BIOSOCIAL INTERACTIONS

In contrast to the major historical theories about biosocial interrelations, which were strongly biased by ideological prejudices, the modern social-biological approach to biosocial associations in within-population group variation conforms to the basic goal of social biology, namely the study of reciprocal relations between biological and social phenomena. Social biology today is empirical, it is bi-directionally oriented in its observation of associations between biological variation and social differentiation, and it considers both genetic and environmental mechanisms of biosocial interaction.

However, even in recent decades the biosocial approach to social differences and inequalities has not been completely free from ideological interference or scientific-methodological controversy, particularly with regard to the relative impact of environmental and genetic factors on social differentiation. One example is the ethically shameful and scientifically unjustified witch-hunt orchestrated against Arthur Jensen after the publication of his article entitled "How much can we boost IQ and scholastic achievement?" in the Harvard Educational Review in 1969 (cf. Jensen, 1972; Modgil and Modgil, 1987; Nyborg, 2003). Also, some negative reactions to the scientific analysis in Herrnstein and Murray's 'The Bell Curve' (1994) show that the ideologically biased, extreme environmentalism of the post-World War Two era hasn't died out completely or everywhere. At the same time, the policy conclusions of 'The Bell Curve' reflect just as much ideological prejudice as that found in the comments made by many of the book's critics as will be shown later in this chapter.

Social assortment and social selection

The idea that one's status within the community is in some way related to one's personal characteristics and capacities is a relatively old one that can be traced back to ancient Indian, Chinese, Greek, and Roman writers (Sorokin, 1927). This is not surprising: the observation that social and biological differences between people exist almost inevitably leads to the suggestion of one or another forms of causal relationship between the differences, in particular of an assortative association. Darwin explored the general idea at length in 'The Descent of Man' (1871). The ideal of a meritocratic allocation of social or economic status positions is a constant in philosophical, political and sociological classics (e.g. Ammon, 1893; De Lapouge, 1896; Niceforo, 1905; Schallmayer, 1903; Sorokin, 1927).

In Pitirim Sorokin's monumental study entitled 'Social Mobility' (1927), the association between sociological and biological differentiation is discussed in some detail, and the societal functionality of allocating social status according to individual ability is fully recognised. Sorokin extensively discussed the role played by biological variability in individual psychometric and personality traits, the social class gradients associated with biological characteristics, the role of differential fertility between social classes as a factor in the differential distribution, and the connections between biological variability and sociological differentiation in general, including social mobility.

The central concept in the study of biological variability and social variation is assortment. Scheidt (1925) provides one of the first explicit definitions of assortment (Thienpont, 2000–2001). Assortment is the non-random mobility of individuals between distinguishable social groups resulting in the subdivision of a population. This mobility is non-random with respect to particular individual characteristics. Although not all individuals go through this process, mobility is common enough for social groups to become identifiable in terms of general statistics. In its original meaning, then, assortment is about the distribution of variance amongst sociologically defined groups within a population. This does not mean that any randomly chosen individual from a particular group will distinguish himself from members of other groups in the same way and degree that each group as a whole differs from the others. Assorted groups show different mean values for the individual traits that are considered, but at the same time include substantial within-group variance.

Schwidetzky (1950) discussed social assortment in her social-biological classic '*Grundzüge der Völkerbiologie*', and introduced the distinction between spatial and social assortment. The first refers to the differential sifting of people with different biological characteristics into geographically different areas, for instance lowlands versus mountainous regions, or rural versus urban areas. The second refers to the differential distribution of people with different biological characteristics into various social groups, for instance, social classes, socio-occupational groups, educational levels, etc.

The terms 'assortment' and 'social assortment' both describe the process or result of between-group differentiation. Social assortment more explicitly refers to the sociological processes leading to between-group differences: social groups are sociologically distinguishable, and there are different positions in the social stratification hierarchy (Thienpont, 2000–2001). Geographical sorting of individuals has been shown to be associated with, though often subordinate to, sociological sorting (cf. Mascie-Taylor and Boldsen, 1985; Mascie-Taylor, 1990; 1998).

In his Ph.D. thesis on 'Social Assortment', Thienpont (2000–2001) gives special attention to the role of 'assortative mate choice' on the processes of social assortment. Assortative mating was mentioned in Chapter 2 on 'Individual Variation and Individualism' as one of the evolutionary forces that influence the genetic composition of the population and the genotypic (and phenotypic) features of individuals. This concept was also dealt with extensively in Chapter 5 on 'Family Variation and Familism', as one of the essential processes in partnership behaviour. Here, it is important to follow Garrison *et al.* (1968) who distinguish between assortative mating and assortative mate choice, the former being accompanied by the production of offspring whereas the latter is not. Assortative mate choice is important for the study of social assortment, especially in modern culture, since it was shown in Chapter 5 that modernisation is characterised by preferential mate choice increasingly based on personal traits and attributes, at the expense of the earlier emphasis of family and class endogamy (Eckland, 1968). In the modern world, assortative mate choice will lead to the same assortative effects as non-random social mobility.

Indeed, social assortment and individual mate choice have been shown to interact. Socially mobile individuals tend to marry in the direction of the class they are moving toward (Hazelrigg and Lopreato, 1972). Assortative mate choice can, therefore, be considered an amplifier to the assortative effect of non-random social mobility.

In addition to the concept of social assortment, the social-biological study of the interrelations between biological variation and social differentiation requires the use of another concept, namely social selection. As far as can be ascertained, this concept goes back to Broca (1872). He defined social selection as differential reproduction of carriers of different genetic traits under pressure from social living conditions. The term social selection was used in the same way by de Lapouge (1896) who wrote an extensive study titled '*Les selections sociales*'. In the English language literature, however, the concept social selection is often used either as synonym of social assortment, or as social selection *sensu stricto*, a situation which resulted in some vagueness and ambiguity in early social biological writings. For instance, from the content of Herskovits' (1929) paper on 'Social selection and the formation of human types' it can be deduced that the author does not have in mind differential reproduction of carriers of different genotypes, but rather an assortment of members of a society in different groups and subgroups. Also, Montagu's (1950, 331) use of the term social selection was actually a reference to social assortment, and even more specifically assortative mate choice:

> *"By social selection is meant the regulation of breeding by artificially instituted barriers between socially discriminated individuals or groups within a population, so that mating occurs between individuals preferred by such social standards, rather than at random."*

When speaking about the selection of individuals for a definite social position, Sorokin (1927, 182) drafted a clarifying footnote:

> *"From the text it is clear that the selection here means not a biological selection in the sense of a differential survival but a social sorting of individuals among the different strata or groups."*

Unfortunately, some present-day scholars continue to use the term social selection in the sense of non-random social mobility. For instance, Strickland and Shetty (1998, 8) do so in their description of the assortment of health related social-biological traits. They refer to assortment of these traits as a process of

> *"...natural or social selection: the phenomenon of within-generational social mobility being influenced by presumptively innate health status (physical strength, vigour or vitality)."*

It was German anthropologists/social biologists (cf. Schwidetzky, 1950) who made a clear conceptual distinction between social assortment (German = *soziale Siebung*) and social selection (German = *soziale Auslese*). Whereas social assortment merely subdivides the population into biologically assorted social groups without changing the gene frequencies in the total population (Figure 7.1), social selection is a particular form of natural selection, in which genetically assorted social groups in a population differentially reproduce under the influence of socio-cultural processes, with intergenerational change in the gene pool composition of the total population as a consequence (Figure 7.2).

The term 'selection' is a very ill-fitting label for describing assortative effects. Non-random social mobility has nothing to do with social selection which, in the orthodox Darwinian meaning of the word, refers to differentials in survival and reproduction probabilities between carriers of different genetic characteristics or variants of a particular trait. Social selection, as a form of natural selection, is evaluated on the basis of differences in average reproductive fitness values between social groups that differ in a number of genetic traits.

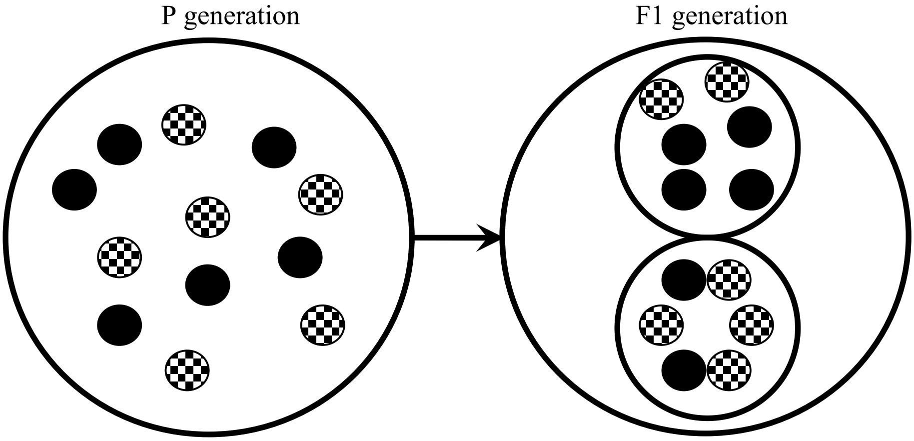
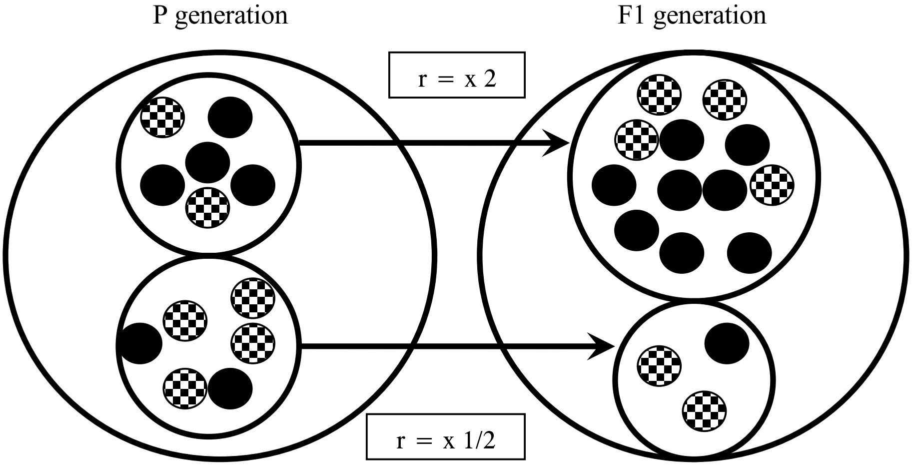


Figure 7.1. Social assortment of individuals within a population.



Proportion of 2 variants in the total population of the P generation: 1/1
Proportion of 2 variants in the total population of the F1 generation: 1.5/1

Figure 7.2. Social selection between two generations (an example of partial social assortment and differential reproduction between social groups).

However, social assortment processes and social selection can occur in conjunction: when socially assorted groups that differ in some of their gene frequencies start reproducing differentially, either via mate selection, fertility differentials, or mortality differentials, such differentials may lead to changes in the Hardy-Weinberg equilibrium, in the gene frequencies of the total population, according to Darwinian selection. This is a matter which will be discussed in Chapter 9 on ‘Intergenerational Variation and Dysgenism’.

The study of the social assortment of biological traits across different social categories, by means of social mobility, relates to the analysis of the effects of biological variation on social differentiation within populations:

BIOLOGICAL VARIATION → **SOCIAL DIFFERENTIATION**

Environmental influences

The social assortment literature in social biology usually deals with the redistribution of genotypes between different socially defined categories. Social selection obviously concerns changes in allele frequencies.

However, social assortment processes are usually analysed in terms of the differential distribution of phenotypes amongst the social categories under study. And most socially relevant biological characteristics in social assortment processes are traits which show a quantitative variability – health characteristics, morphological or physiological traits, measures of cognitive ability, or emotional personality characteristics – all features the phenotypic expression of which can be influenced by environmental factors. So, it is relevant to keep in mind that social assortment processes may only be applicable to phenotypic differences, and not necessarily also to genotypic differences. Observations about phenotypic assortment have to be carefully evaluated on the basis of the heritability of the characteristics involved.

But more generally, environmental factors may relate to the social categories individuals occupy or in which they grew up, and influence their phenotypic development during their life course. Many socially related environmental differences have been identified: maternal prenatal influences, nutritional factors, ecological influences, exposure to infections or other health-influencing conditions, education within the family and at school, influences linked to occupational activities, leisure activities and social relations (cf. Strickland and Shetty, 1998).

The study of the effects of socially linked environmental influences on the development of biological traits of people occupying different social categories involves analysis of the effects of social differentiation on the biological variability within populations:

BIOLOGICAL VARIATION ← SOCIAL DIFFERENTIATION

Genetic-environmental covariance

In the attempt to disentangle the aetiology of genetic and environmental factors in socially linked phenotypic differentiation, one should be aware that both genetic and environmental causes may co-vary. Genotypes have a tendency to create their own environment and, hence, produce biological differences that are due to both a genetic endowment and the specific environment that this endowment produced, resulting in the phenotypic reinforcement of an original drive or tendency. This phenomenon may even operate transgenerationally: parents may create a genotypically adapted specific environment for a child who appears to be exceptionally talented in a particular domain – such as athletic performance, musical creativity, or cognitive excellence – or may, due to their own genotype or life course experiences, suppress the normal development of the physical or intellectual abilities of their offspring.

The observation is, in other words, that environmentally linked biological differences may not necessarily be due to environmental causes. Intergenerational or intragenerational genetic factors may have contributed to create the specific social environment.

In general, one should beware of simplistic explanations of complex biosocial associations that, at first sight, appear to be straightforward. Biological (phenotypic) correlates to social origin, for instance, are not necessarily completely due to the effects of the environment of origin, but can be partly due to genetic assortment processes in prior generations. *Mutatis mutandis*, phenotypic differentials that arise from the contrast between one's social origin and one's aspired level of status are not necessarily (completely) explained by genetic assortment, but may also (partly) be due to the parental environment or to (cumulative) life course events one has experienced.

SOCIAL STRATIFICATION AND BIOLOGICAL VARIATION

Statistically significant associations of varying degrees have been found between socio-economic (e.g. occupation, income) or socio-cultural (e.g. education) background variables and various groups of biological characteristics such as maturation features, body build characteristics, health characteristics, and cognitive performance (cf. Mascie-Taylor, 1990; Macintyre, 1998).

For some characteristics, for instance stature, age at menarche, and intelligence, there exists not only a long history of empirical analysis, but information is also available for many countries or even from different stages of cultural development within countries.

In general, the indicators for individual biological development or performance – maturation, body size, health, longevity, cognitive performance – are positively and linearly related to indicators of social differentiation. In other words, stepwise gradients instead of threshold patterns are observed: the higher the level of one's position in the social stratification hierarchy, the earlier one matures, the taller he is, the healthier he grows up, the longer he lives, and the better he does on tests of cognitive performance. Nevertheless, the associations observed always show significant within-group variation, meaning that correlation coefficients are usually rather modest, except for intelligence tests where they range between 0.5 and 0.7 (Jensen, 1981a; 1998).

The degree of association between biological traits and social stratification criteria differs substantially according to the type of characteristic and over time. The magnitude of the differences varies also across countries, even when the comparison is limited to the industrial world (Fox, 1989; Kunst, 1997; Vallin *et al.*, 2001).

Body size and body build

Stature is undoubtedly the most studied physical trait among anthropometric measures. Universally, and independent of country or culture, a positive association is found with social class gradients: the higher the social status, the higher the averages in stature that are recorded, though with considerable within-group variation. This average positive association has been found for whatever social stratification indicator is used – socio-economic status (SES), income, occupation, or education. It is a phenomenon that has been observed in different stages of cultural development – among hunter-gatherers, agrarian populations, and industrial populations (cf. Niceforo, 1905; Schwidetzky, 1950; Mueller and Mazur, 2001). This positive association between stature and SES is readily found amongst children, classified by their socio-economic status or the educational level of their parents (cf. Walter, 1962; Goldstein, 1971; Kromeyer *et al.*, 1997).

Since body weight is relatively highly correlated with body stature (r = ± 0.50), identical social associations have been observed for this variable as for stature. However, in recent decades, relative measures of body mass (BMI), in particular of obesity, have shown a higher prevalence amongst lower than higher social classes (cf. Sobal *et al.*, 1989; Reidpath *et al.*, 2002). Obesity is inversely related to socioeconomic status and is associated both with downward social mobility and lower levels of socioeconomic achievement. The spread of affluence in society has evidently led to a concentration of unhealthy diets and lifestyles among less educated population groups.

Data on other body build characteristics – e.g. muscle-bone and fat components – or broader constitution types, reveal more mixed results. In some cases the muscle-bone component is positively and the fat component negatively related to social stratification indicators (cf. Garn and Clark, 1975; Clegg, 1982; Malina *et al.*, 1983), whilst other studies the opposite is found (cf. Cliquet, 1963). Many studies have also found a constitutionally more slim body build amongst higher social strata and in particular intellectuals, whereas several biometric breadth measures are more pronounced amongst lower socio-economic status groups (cf. Roth-Lutra, 1927; Garn and Gertler, 1950; Cliquet, 1963).

Growth and maturation

Various indicators of growth toward maturation – for instance, skeletal age, tooth eruption, and puberty measures, especially age at menarche – have often been shown to be related to socio-economic status differences. Children from higher social strata tend to have a higher growth tempo and mature earlier than children from lower strata (cf. Tanner, 1978; Bielicki, 1998; Bogin, 2008).

The concept of social gradients in growth refers to differences in body size or maturation rate observed within a society between groups that differ in some aspects of their socioeconomic situation, whereas intergenerational changes in growth are secular trends toward greater body size and increased tempo of maturation (Bielicki, 1986).

Health and longevity

As early as the nineteenth century, it was known that social stratification was positively associated with health stratification (Niceforo, 1910; Sorokin, 1927). This association has remained consistent throughout modernisation. Clear differences in health – both chronic and acute ill health – and health potential continue to exist between socio-economic status groups. Individuals with lower income, of lower socio-economic status, or lower educational attainment tend to report more chronic disease, more pain, or show a lower level of physical and mental well-being (cf. Power *et al.*, 1991; Strickland and Shetty, 1998; Leclerc *et al.*, 2000). The relations between ill health and social stratification are often disease-specific: the biggest differences are found for infectious, parasitic, and respiratory diseases, while there is less or no difference for cancers and circulatory diseases (cf. Davey Smith *et al.*, 1991).

Morbidity and mortality are differentially linked to social stratification in modern society. Both life expectancy and disability-free life expectancy are positively related to social status (cf. Cambois *et al.*, 2001). The relationship between mortality indicators and social stratification has been well documented for both the nineteenth and twentieth centuries (cf. Westergaard, 1901; Vallin *et al.*, 2001; Valkonen, 2002).

Notwithstanding the gradual and continuous decrease of mortality in the course of modernisation, important socially linked differentials persist up to this day: mortality risk (the probability of dying) is almost three times higher within the lowest stratum as compared to the highest stratum (cf. Desplanques, 1984; Fox *et al.*, 1985). Moreover the differences between the two extremes of the social stratification scale have increased in recent decades (cf. Hattersley, 1997; Kunst, 1997; Valkonen, 1999; 2002).

Measured intelligence

Measured intelligence is the psychometric characteristic most extensively studied in relation to social stratification variables. All investigations show a very significant positive relationship between average levels of measured intelligence and one's social status (cf. Eells *et al.*, 1951; Müller, 1956; Burt, 1961; Cliquet, 1963; Belmont and Marolla, 1973; Mascie-Taylor, 1984; Herrnstein and Murray, 1994; Nettle, 2003) and the social class one is born into (cf. Heuyer *et al.*, 1950; Gille *et al.*, 1954; Schwidetzky and Walter, 1958; Cliquet, 1963; Gibson, 1970; Gibson and Mascie-Taylor, 1973; Nettle, 2003). Mild forms of mental subnormality tend to concentrate in lower social strata, whereas severe mental deficiency due to brain damage or monogenetic or chromosomal defects occurs about equally in all social strata (Kushlick, 1966; Durkin and Stein, 1996).

Amongst all the investigated biological variables, measured intelligence shows the highest correlation coefficients with measures of social status. Jensen (1981a) mentions coefficients ranging from about 0.30 to 0.40 between children's IQ and the SES of their parents. However, he mentions much higher correlation coefficients, ranging from 0.50 to 0.70, between individuals' IQs and their own attained SES. Just as with the social differences which exist for physical characteristics, the correlation coefficients for measured intelligence demonstrate considerable between-class overlapping and within-class individual variation.

Social stratification variables usually covary with several other important social and demographic variables, such as urbanisation, family size, and birth order. Multivariate analyses, however, show that even after controlling for such covariates, the association between parental or one's own socio-economic status and measured intelligence remains largely consistent (Mascie-Taylor, 1984).

CAUSES OF INTERRELATIONS BETWEEN BIOLOGICAL VARIATION AND SOCIAL STRATIFICATION

As argued above, the observed relations between biological variation and social stratification within populations can be due to two different – not mutually exclusive, but often covarying – mechanisms. They can be due to environmental influences emanating from or associated with differences in socio-economic origin or status and/or they can result from social assortment between various social categories, i.e. social mobility.

Environmental influences linked to social status differences

The existence of environmental influences on biological differences between various social strata has been established based on different types of research about:

- Indicators of direct effects of particular environmental factors, for instance maternal prenatal environment, nutrition, exposure to infections or other environmental hazards, availability or use of medical care facilities, family environment, educational opportunities, differences in lifestyle (smoking, alcohol and drug abuse), etc.
- Secular trends in biological differences associated with social stratification that cannot be tied to changes in gene or genotype frequencies.

Environmental influences on the development of the adult phenome are uncountable, since they can have effects from the very beginning of embryonic development and continue throughout the maturation period of the life course. They can also cumulatively influence life functions and structures during adulthood and in senescence.

Several authors have tried to classify socially linked environmental differences, either in terms of deprivation (Eckland 1971) or in terms of social advantages/disadvantages (SAD) (Saunders, 1997), into the following broad, major categories:

- Biological factors, such as prenatal influences, nutrition, or birth order;
- Structural factors, such as differential access to institutional means for achieving prescribed goals;
- Cultural or behavioural factors related to various integrated sets of norms and values.

However, many elements of deprivation or opportunity enhancement consist of combinations of material, structural and cultural factors. Social differences in the intake of particular nutrients, for instance, can at the same time be due to the material absence or presence of those nutrients, availability or lack of knowledge about dietary needs, and culturally determined nutritional customs.

Socially linked differences in maternally transmitted deprivation (Townsend and Davidson, 1982), nutrition (cf. Boyd Orr, 1936; Miller and Korenman,1994; James *et al.*, 1997; De Irala-Estévez *et al.*, 2000), exposure to infections (cf. Feldberg, 1995) or other environmental hazards such as accidents (cf. Khlat *et al.,* 2008) or pollution (cf. Schell and Czerwinski, 1998), use of preventive or curative medical care facilities, family care, educational opportunities, social capital, and social differences in lifestyle options (smoking, alcohol or other drug abuse (cf. Barbeau *et al.*, 2004), and risk-taking behaviour in sports, traffic or following the law (cf. Thomas *et al.*, 2007) have all been documented to differentially influence the physical and/or mental characteristics or performances of individuals belonging to different social strata (cf. Jensen, 1973; Power *et al.*, 1991; Strickland and Shetty, 1998). Hence, it is not surprising that the proportion of variance in biological characteristics attributable to genes and environmental factors vary nonlinearly with SES, with lower SES families being much more influenced by environment-related factors and less by genetic factors, whereas in affluent families, the result is almost exactly the reverse (cf. Scarr, 1981; Rowe *et al.*, 1999; Turkheimer *et al.*, 2003).

Many of the socially linked hazards of physical or mental differentiation have emerged over time, especially in modern culture, because of improving (or occasionally degrading) living conditions and material standards of living, changing behavioural patterns and lifestyle options, enhanced environmental care, better educational and health policies, and the discovery of new knowledge or changing values.

Thus, secular trends in the decrease of socially linked differentials in maturation, general body size, health, and mental performance have been documented over time during the modernisation process. The best known changes concern the secular increase in stature (cf. Hoppe, 1954; Van Wieringen, 1978; Cernerud, 1993) and the spectacular decrease of height differences between social classes (cf. Cliquet, 1963; Silventoinen, 2003). The same trend has been observed for other indicators of physical maturation (cf. Tanner, 1968; Lindgren and Cernerud, 1992). However, a temporary halt or even decrease in the tempo of growth in European children was observed during the two world wars when environmental conditions deteriorated (cf. Markowitz, 1955). Another secular trend is the declining age of menarche in girls (cf. Berenberg, 1975; Bielicki *et al.*, 1986; Eveleth and Tanner, 1990), although in most advanced countries this trend slowed in the second half of the previous century (Roberts, 1994). Another well-known secular trend is the increase in IQ test results in the course of the twentieth century – the so-called Flynn effect (Flynn, 1984; 1987).

Important secular changes in health and disease indicators and their associated social changes have also been observed, but here the picture is somewhat more complicated, because the results may be disease-specific. In general, health and disease indicators improve with time, but the social differences decrease for some diseases and increase for others (cf. Valkonen, 1999), either because more highly educated groups make better use of the new knowledge about preventing or treating diseases (as has, for instance, been observed for cardio-vascular conditions), or because unhealthy lifestyle choices and behavioural patterns (such as smoking and overconsumption resulting obesity) spread more easily among less educated groups (cf. Rona and Morris, 1982; Pietinen *et al.*, 1996; Valkonen, 2002). Indeed, the so-called diseases of affluence tend to become the diseases of the poor in affluent societies (Wilkinson, 1998). A special case showing an increase in SES differences in morbidity and mortality has been observed in Eastern Europe in recent decades, either as a consequence of the crumbling of the communist system or the transition to neo-liberal market economy (cf. Bobak, 1999).

An important finding is that the most significant reduction in health inequalities is found in industrial countries where social solidarity is stronger, understood in terms of a narrower societal income distributions, and the existence of other social stress-relieving living conditions (Wilkinson, 1996; 1998).

Social assortment: social mobility and biological variation

Empirical findings about the relationship between social mobility and biological variation

The effects of social assortment can be seen when comparing the biological characteristics of individuals according to their social origin and their SES. The correlations between the characteristics of children and the SES of their parents are usually smaller than the correlations between the characteristics of adults and their own SES (cf. Jensen, 1981a; 1998). The same pattern appears when comparing the biological features of adults according to their social status or aspiration level and according to their social origin (cf. Blau and Duncan, 1967; Cliquet, 1963; Gibson *et al.*, 1983; Herrnstein and Murray, 1994; Nettle, 2003) (Figure 7.3). However, much more direct evidence on the influence of social assortment processes has been obtained from investigations in which biological characteristics are directly studied according to social mobility.

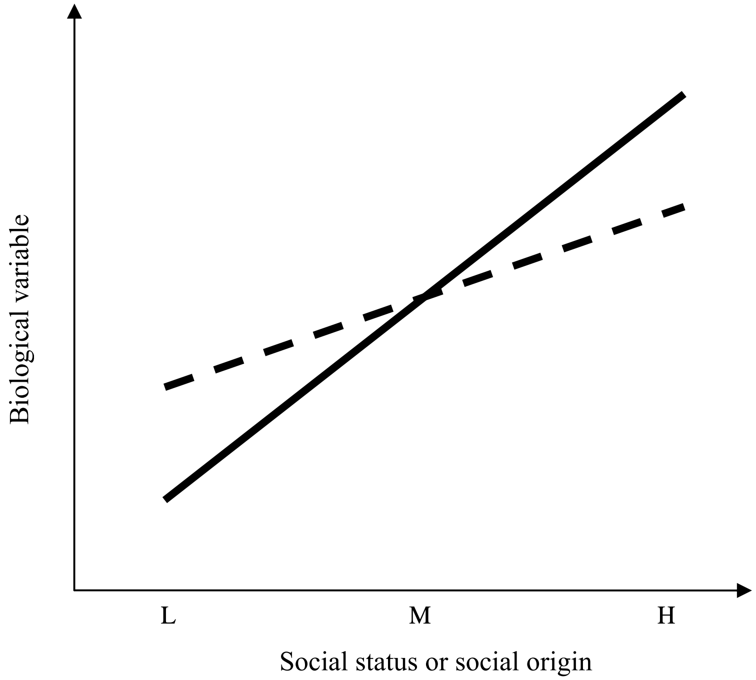


Figure 7.3. Schematic presentation of biological differentials according to social status and social origin.
Legend: ▬▬▬ *Biological differences according to social status*
▬ ▬ *Biological differences according to social origin*
L: low; M: middle; H: high.

In social-biological investigations the definition of social mobility is usually limited to the intergenerational change in socio-economic status from one generation to another. Different degrees of upward mobility – change from a lower to a higher status in the structure of social stratification – and downward mobility – change from a higher to a lower level – can be distinguished. The social-biological research strategy consists of comparing the biological characteristics of different degrees of upwardly mobile individuals, stationary individuals (at different levels), and downwardly mobile individuals. In some relatively small-sample studies, only three categories of mobility are distinguished – upward, downward, and sedentary (cf. Young and Gibson, 1963; Gibson, 1970; Waller, 1971) – whilst in others, requiring large samples, all degrees of upward and downward mobility are considered (cf. Cliquet, 1968; Bielicki and Charzewski, 1983; Bielicki and Waliszko, 1992).

Different sampling techniques have been used to classify mobility categories. The most obvious and most used approach is to compare the SES of parent(s) and (adult) offspring (cf. Anderson *et al.*, 1952; Cliquet, 1968; Bielicki and Waliszko, 1992). Another approach is to study the biological characteristics of children and construct mobility categories by comparing the SES of the children's parents and grandparents. In the past these studies were usually limited to consideration of the father and the paternal grandfather (cf. Walter, 1962; Thienpont and Verleyen, 2003). A third approach, used to study the biological characteristics of women, is to compose mobility categories based on the comparison of the SES of the woman's father with the SES of her husband (cf. Illsley, 1955; Knight and Eldridge, 1984). Finally, some researchers have compared the mobility patterns of pairs of brothers or sisters within families (Gibson, 1970; Schumacher and Knussman, 1977; Bielicki and Charzewski, 1983; Zarca, 1995). The remarkable thing is that all four approaches produced identical results as to the type of relationship between biological variation and social mobility.

A particular and most rewarding type of mobility research consists of not just studying the characteristics of one generation and analysing the variation according to intergenerational social mobility, but also in recording the biological characteristics of parent-offspring pairs and analysing the offspring variation according to their type of social mobility. As far as can be ascertained, this research strategy has been applied in only a few samples for IQ (Burt, 1961; Young and Gibson, 1963; Gibson, 1970; Waller, 1971; Mascie-Taylor and Gibson, 1978).

Given the difficult research constraints in mobility research, it won't come as a surprise that the available literature on the relationship between social mobility and biological variation is more limited than that on the association between social status or social origin and biological variation. Nevertheless, empirical data are available for quite a large and diversified number of biological characteristics.

Direct empirical data on the association between biological characteristics and social mobility were gathered first by Schwidetzky (1938; 1942). In the second half of the twentieth century data became available on body height and other biometric measurements (cf. Cliquet, 1968; Bielicki and Waliszko, 1992; Blane *et al.*, 1999), maturation (Mascie-Taylor, 1990), physical attractiveness (Elder, 1965), blood groups and other polymorphic genetic markers (Cartwright *et al.*, 1976; Mascie-Taylor *et al.*, 1985), reproductive outcomes (Illsley, 1955), health (cf. Rahkonen *et al.*, 1997; Karvonen *et al.*, 1999; Hallqvist *et al.*, 2004; Jankowska *et al.*, 2008), mental disorders (cf. Turner *et al.*, 1967; Fox, 1990; Johnson *et al.*, 1999; Miech *et al.*, 1999; Timms, 2004), breastfeeding (Martin *et al.*, 2007), and mortality (e.g. Stern, 1983; Fox *et al.*, 1985; Hart *et al.*, 1998; Claussen *et al.*, 2005).

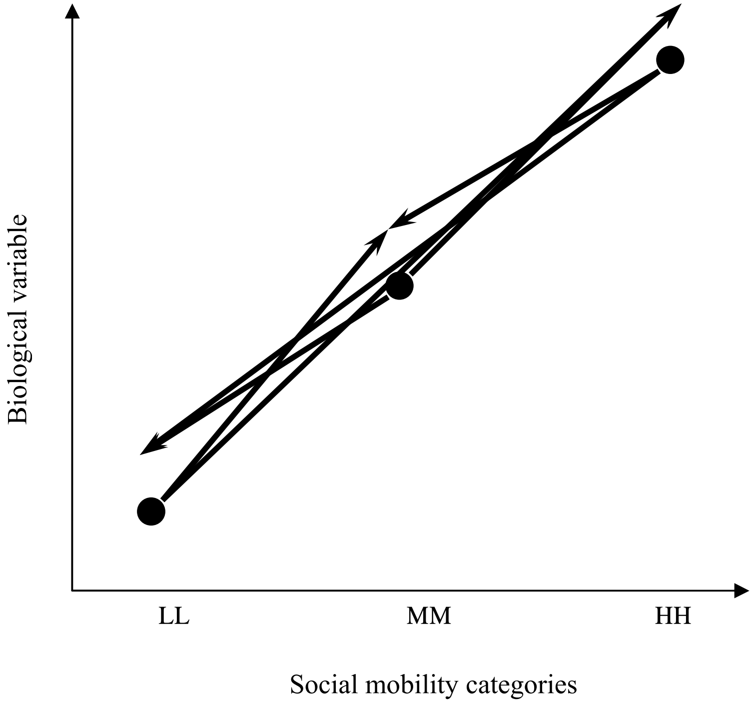


Figure 7.4. Schematic presentation of the relationship between social mobility and biological variation

Legend: LL = low sedentary group; MM = middle sedentary group; HH = high sedentary group.

Black dots: average values of low, middle and high sedentary groups;

Arrows: indicate the direction and the degree of upward or downward mobility.

The most striking and best documented issue concerns the relationship between social mobility and indicators of educational attainment (cf. Blau and Duncan, 1967) or measures of cognitive performance (cf. Anderson *et al.*, 1952; Burt, 1961; Cliquet, 1968; Gibson, 1970; Waller, 1971; Gibson *et al.*, 1983; Herrnstein and Murray, 1994; Mascie-Taylor, 1995; 1998; Savage and Egerton, 1997; Saunders, 2002; Nettle, 2003; Deary *et al.*, 2005; Strenze, 2007). The association between performance on intelligence tests and social mobility is much larger than the association between physical characteristics and social mobility. However, IQ alone does not explain most of the variation in both individually achieved class and class mobility. Numerous other individual difference factors, including personality characteristics, values, and health are involved. Nevertheless, intelligence is the strongest single factor related to social mobility in modern society (Nettle, 2003).

All of the associations between biological variation and social mobility point in the same direction: on average, socially upward-moving individuals are taller, mature earlier, are healthier, achieve better school results, and perform better on intelligence tests than sedentary (socially non-mobile) individuals. Downward mobility is characterised by smaller physical stature, later maturing, more physical and mental impairments, and lower intelligence (Figure 7.4).

Also striking is the fact that the significance of the biological differences between mobility categories is clearly related to the degree of upward or downward mobility (cf. Cliquet, 1968; Waller, 1971; Gibson *et al.*, 1983). Upwardly mobile individuals, on average, score higher than those already occupying the sedentary status category toward which they move, whilst downwardly mobile individuals, on average, also score higher than the sedentary category they join. Whereas the first phenomenon could be explained by the constraints upwardly mobile individuals have to overcome, the second phenomenon might be due to the positive effects of the better environment of the social category from which they come.

Although social mobility is a statistically significant and increasingly common phenomenon in modern society, linked to the generalisation and democratisation of higher forms of education (cf. Rotberg, 2001; Breen, 2004; Svallfors, 2007), recent studies in several countries indicate that socio-economic inequalities in higher education have not declined. Notwithstanding the substantial increase in the absolute number of people from all socio-economic backgrounds participating in higher education, there is little evidence that the relative participation rates of children from lower socio-economic status (SES) groups has changed over time (cf. Smyth, 1999; Bynner and Joshi, 2002; James 2007). The expansion in higher education participation has occurred within all social strata, but the differences between strata remain stable. Young people from lower-class origins continue to have relatively low chances of pursuing university studies (cf. Blossfeld and Shavit, 1993; Tan, 1998; Marks and McMillan, 2003; Verbergt *et al.*, 2009). Several studies show that the relative representation of workers' children in institutions of higher education has not increased in recent decades, and in some countries there are even indications that educational inequality by class origin is again increasing (cf. Livingstone and Stowe, 2001). Even in countries where working class youths have had relatively good opportunities to attain higher levels of education, they continue to face major barriers to achieving a university education. Children from lower socioeconomic status (SES) groups tend to perform more poorly in school than upper-SES groups, and they tend to stay in school for a shorter time. Students from lower socio-economic strata are also less represented in elite institutions (cf. Carnevale and Rose, 2003). These patterns exist in all regions of the world, within all socio-political systems, and regardless of the level of a country's economic development (cf. Blossfeld and Shavit, 1993; Arnove and Clements, 2002).

Figures on unequal SES participation rates at higher levels of education are often used as proof of persisting social inequities (cf. Maoz and Moav, 1999; Duru-Bellat and Kieffer, 2001; Mookherjee and Napel, 2007). However, the interpretation of such figures needs to be qualified. There are, as a matter of fact, two problems with interpreting those findings. First, most studies do not consider the quite substantial changes that, in recent decades, have taken place in the structures of social stratification. The composition of the various social and occupational strata has changed in both absolute and relative terms, and has been mainly characterised by a decrease in the proportion of manual workers and people of a low educational background. Second, most studies reporting continued unequal university access do not control their data on the proportion of lower-class children who pursue university studies according to scholastic achievements or intelligence test results. They assume that the capacity to learn is distributed equally amongst those born into all social classes – an assumption that may be too optimistic in modern societies, where there is a commitment to policies that democratise educational participation and the population composition is changing according to educational level. However, the studies that did control for IQ or scholastic achievement still found a considerable waste of talent in the lower classes (cf. Sewell and Shah, 1967; Mingat, 1981; Schiff *et al.*, 1986; Herrnstein and Murray, 1994; Korenman and Winship, 2000; Astin and Oseguera, 2004; Thienpont and Verleye, 2004). For instance, Mingat's (1981) simulations in which he estimated the higher education participation rate per socio-economic group, corrected for the measured intelligence distribution within each group, resulted in an increase of the university participation of children from working-class families from 8 to 24 percent – resulting in an estimated waste of $(24-8)/24 = 66$ percent of the group being considered capable for doing such studies. His figure may even underestimate the potential waste because intelligence measures may be partly suppressed by social deprivation. There is clearly a need for the further democratisation of access to higher education.

Explanations of the relationship between social mobility and biological variation

Investigations relating biological variation within populations to social mobility clearly show that individuals are more or less differentially assorted across the various social strata in society according to a number of their biological or biologically influenced characteristics. Social assortment is a major, though certainly not the only or even most important mechanism that explains the biological differences that are found between different social strata. As argued before, many environmental factors have also been found to influence differentially the living conditions within the various social layers. The SES-specific factor that hinders individuals from moving up in the educational system is mainly the limited amount of cultural and social capital that children from lower social strata possess, although financial limitations may also play a role (cf. Caspi *et al.*, 1998; Arnove and Clements, 2002). Often, low SES parents, having themselves a low level of education, cannot transmit to their children the necessary cultural capital; they have low aspirations and future expectations for their children and are minimally involved in the formal education of their children. In many countries, it is a matter of public policy to provide financial support for children from economically modest or poor families to gain educational opportunities. But such policies often fail to deal adequately with the impediments to education for lower-class children, which can include family autonomy, insufficient cultural and social capital, and persistent social inertia and conservative forces. Taking into account the cultural and social capital of students from diverse backgrounds as well as their financial resources, would constitute a major move toward a more inclusive and equitable education system (cf. Avramov 2008).

Last but not least, it is also important to recognise that many biologically influenced traits and other social or psychological factors can, in various combinations, be involved in social mobility processes. The substantial within-group variance that has been found for each distinct individual biological variable within each social stratum is a clear sign of the multitude of factors contributing to the composition (as well as the change in composition) of social strata. The general consensus among researchers is that the observed differences in physique, health and cognition are driven largely by a complex set of causal processes rather than by one or another single factor or trait.

The explanation for the social assortment of biological characteristics obviously relies on the specific requirements of the social stratification system in modern culture. The increasing weight put on individual qualities such as acquired knowledge, responsibility (social skills), and dynamism as criteria for moving toward a high(er) social status requires the personal development of biological or biologically influenced qualifications including quality of health (cf. West, 1991; Lundberg, 1991; Blane *et al.*, 1993; Power *et al.*, 1996) and cognitive and emotional personality characteristics. Many authors coming from a functionalist point of view consider intelligence to be the most important assorting factor in modern society (cf. Schwidetzky, 1950; Herrnstein and Murray, 1994; Jensen, 1998). Some scholars even think that individual differences in general intelligence may be, at least in part, the cause of some mobility-related biological inequalities, for instance in the field of health (Gottfredson, 2004).

For variation in tallness, various explanations have been given. Schwidetzky (1950) considers differences in height a by-product of the assortment for intelligence: hence her concept of '*Mitsiebung*'[2]. However, many authors point to the role that tallness plays as a factor in phenomena such as dominance, strength, attractiveness in sexual selection, and fitness (cf. Mueller and Mazur, 2001; Herpin, 2005).

The findings about social differentials in body build (such as muscle-bone mass and slenderness-sturdiness) are probably related to the effects of specific occupations which are differentially distributed across various social strata. An interesting case of an occupationally related social assortment was described by Cliquet (1963; 1965), who included in a large sample of Flemish young male adults a group of students preparing themselves for the Roman Catholic priesthood. The seminarians appeared to have been intellectually assorted to be able to cope with theological studies, but anthropometric measurements showed that these young men, who had chosen an occupation involving celibacy, appeared to show a more gynandromorphic body build. This implied that their vocation was partially determined by biological constitutional factors. This study confirmed earlier findings, such as those of Seltzer (1945), showing an assortment amongst students choosing studies in different university faculties according to masculinity-femininity differences in body build and psychological predisposition.

The measure of health characteristics includes congenital conditions that interfere unfavourably with the requirements of reaching or maintaining highly

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[2] Assortment of a trait due to its correlation with a characteristic that is the real cause of the assortment process.

qualified and demanding social positions and functions. In addition, many environmentally induced illnesses, the effects of which often accumulate during the life course, must be taken into consideration (Lundman, 1964; Rahkonen *et al.*, 1997; Hart *et al.*, 1998; Goldman, 2001). However, in many cases a mixed genetic-environmental aetiology of illnesses may be responsible for the differential mobility opportunities between individuals. Some investigations, particularly those on intragenerational social mobility, have shown only a weak relationship between personal health status and the likelihood of occupational mobility (cf. Cardano *et al.*, 2004; Claussen *et al.*, 2005). Bartley and Plewis (2007) found that the probability of illness is actually higher in men and women who move intragenerationally into more favourable employment conditions and the probability of illness is lower in those who move to less favourable conditions than that of other members of the destination class. This led them to conclude that mobility does not increase class differences in health status. One explanation for this phenomenon might be that some negative health conditions, thanks to treatment made available by modern medical care, no longer form a primary obstacle to upward social mobility. It is also possible that upward social mobility itself has negative effects on health.

A question preoccupying both social and biological scientists is whether social assortment is the result of societal opportunities, stimuli, or even pressures to assign the right job to the right person, or whether assortment is mainly the result of individuals' inner ambitions for status acquisition? We have no knowledge of empirical data that would provide a quantitative answer, but there are arguments in favour of both explanations, which are, in our view, not mutually exclusive. Considering the strong human drive toward status acquisition, as a proximate factor in what sociobiologists call the maximisation of inclusive fitness, we are of the view that the role individual drives play in social assortment processes is a powerful mechanism in social mobility. However, there can be little doubt that the type of society in which individuals function can be an equally important factor in stimulating or inhibiting the social status drives of its members. Additionally, the strength of genetic influences on status attainment is a function of specific structural elements in society. For instance, Adkins and Guo (2008) theorise that the influence of genomes on status attainment is relatively high among hunter-gather groups, declines through horticultural and agrarian societies, and increases again in advanced industrial societies (Figure 7.5).

In modern culture, with its value system favouring equal opportunities for individual development, and its creative dynamism and drive for change and progress, in many sectors of social activity – for instance, economic production, scientific innovation, recreation and sports, cultural creativity, and political action – there are powerful structures in place that incite individuals to competition. As argued in Chapter 2 on 'Individual Variation and Individualism', the current neo-liberal cultural climate may even push this competitive drive to unsustainable levels from a long-term perspective.

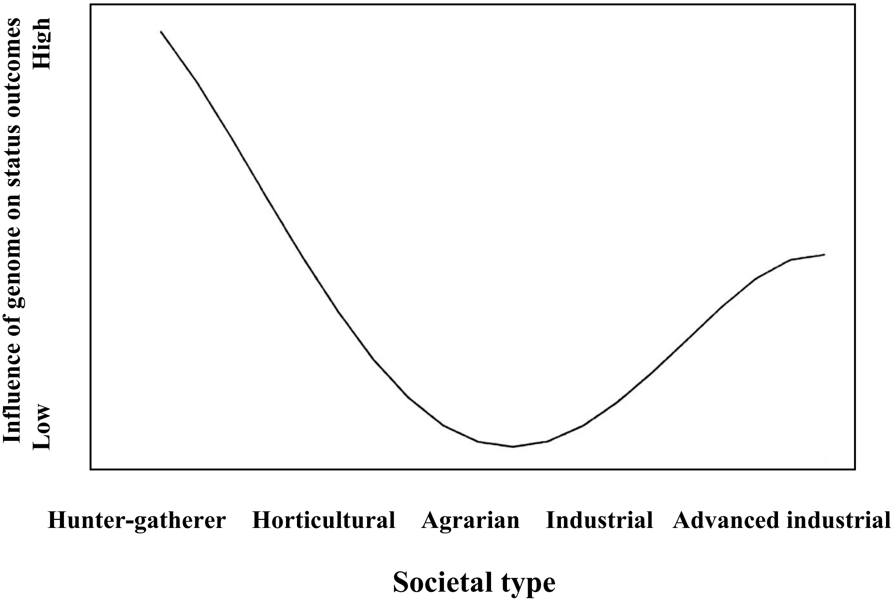

Figure 7.5. Variation in the influence of the genome on status attainment across societal types. Source: Adkins and Guo (2008).

GENETICS AND SOCIAL MOBILITY

So far, the relationship between biological variation and social mobility has been analysed in terms of the differential distribution of phenotypes. It is now time to look also at the relationship from a genetic point of view. Several issues must be discussed in this respect:

- To what degree are not only phenotypes, but also genotypes being assorted?
- What are the implications for social mobility of the processes of segregation and recombination of genes?
- What role does mate choice play in the social assortment of biological characteristics?

The assortment of phenotypes and genotypes

If the variability in biological traits assorted through social mobility is predominantly or exclusively environmentally determined, then social stratification-related differences in the observed variance of those traits must be attributed largely to differences in the environmental influences individuals experience in their social surroundings. If, on the other hand, the observed variation comprises a substantial genetic component – in other words, has a high heritability – social mobility may not only have a sifting effect on phenotypes, but also on genotypes. If this is case, socio-economic status differences must be partially genetic (Jensen, 1981a; 1998; Scarr, 1997).

Many biological or biologically influenced characteristics involved in social mobility assortment show a relatively high heritability: stature (h^2 = 0.7–0.9) (Silventoinen *et al.*, 2003), body weight (h^2 = 0.4–0.5), vulnerability towards schizophrenia (h^2 = 0.63–0.67) (McGue *et al.*, 1983), intelligence (h^2 estimated between 0.4 and 0.8 in Western populations (cf. Fuller and Thompson, 1978; Plomin and Loehlin, 1989; Jensen, 1981a; 1998; Daniels *et al.*, 1997; Plomin *et al.*, 2008), and emotional personality characteristics (h^2 = 0.3–0.5) (cf. Fuller and Thompson, 1978; Ebstein *et al.*, 2002; Plomin *et al.*, 2008).

Numerous studies on the heritability of intelligence, based on family studies, twin studies, and adoption studies show that estimates of h^2 range between 0.4 and 0.8 (Nichols, 1978; Bouchard and McGue, 1981; Bouchard, 1997; Jensen, 1998; Plomin *et al.*, 2008). Even when one considers the lowest estimates, it is clear that genes are a major factor influencing individual differences in intelligence. Advanced studies on the relative importance of environmental and genetic factors in the population variance of measures of cognitive performance show that additive gene effects are the most important component. Interaction between genetic and environmental factors appears not to be an important source of variation. Shared family environmental effects, such as social class effects, have been shown over and over again to be quite small (Loehlin, 1989; Loehlin *et al.*, 1997; Jensen, 1998).

The evidence in favour of a substantial genetic variance underlying the phenotypic variance of characteristics such as intelligence males possible the conclusion that the non-random social mobility related to such characteristics is an important factor in the causation of a partial genetic differentiation of socio-economic status groups.

We cannot end this section without referring to the ingenious, although simple ‘social mobility’ experiment on *Drosophila melanogaster* flies that Thoday and Gibson (1970) undertook to measure how the environmental and genetic factors contribute to between- and within-group variances for a polygenetic trait subjected to phenotypic assortment and environmental differences. They studied the change in group variances of the number of sternopleural bristles – a polygenetic trait that is also influenced by environ-mental factors – by raising flies in two distinct environmental conditions (different in temperature) and by moving flies with the highest and the lowest number of bristles between the two groups. After nine generations it was found that 42 percent of the intergroup difference was influenced by the genetic component, whereas the genetic portion of the intragroup variance was 13 percent. The experiment confirmed that intergroup mobility leads to genetic differences between groups even when there are significant environmental differences between groups.

Implications of segregation and recombination of genes for social mobility

The genetic basis for social mobility resides in the Mendelian inheritance system of sexually reproducing organisms. Through the processes of gene segregation at meiosis and recombination of genes at fertilisation, the genetic constitution of children does not completely resemble that of their parents. This phenomenon is particularly salient for polygenic traits because of the possibility of the formation of non-allelic recombinations and of influence from environmental factors, resulting in a high proportion of hidden genetic variability, which may become visible in successive generations (see Chapter 2). Indeed, sexual reproduction does not allow a purely 'vertical' transmission of genetic information in a genetically heterogeneous population (Figure 7.6), but produces, in particular for polygenic traits, a redistribution of the genotypes over the various phenotypic categories in a random mating population (Figure 7.7).

The effect of this redistribution is generally referred to as 'regression toward the mean' (Galton, 1889; McNemar, 1940; Thorndike, 1942; Dessen and Jansen, 1982). Francis Galton (1889) was the first who pointed to this phenomenon – known as Galton's law on filial regression – on the basis of observations of the height distribution of parents and their children. When plotting the mean heights of offspring against the average height of their parents, Galton obtained a linear relationship, but the regression line indicated that offspring were, on average, less exceptional than their parents. Parents whose average height was below the population mean tended to have children taller than themselves but still below the mean. Parents above the mean tended to have offspring shorter than themselves. Regression to the mean refers to the most extreme expressions of traits being drawn toward the population mean. Manifest between-group differences will with time be smoothed over because extreme values in all groups will be drawn toward the general population mean whereas variants more to the centre of the distribution will reappear at the extremes.

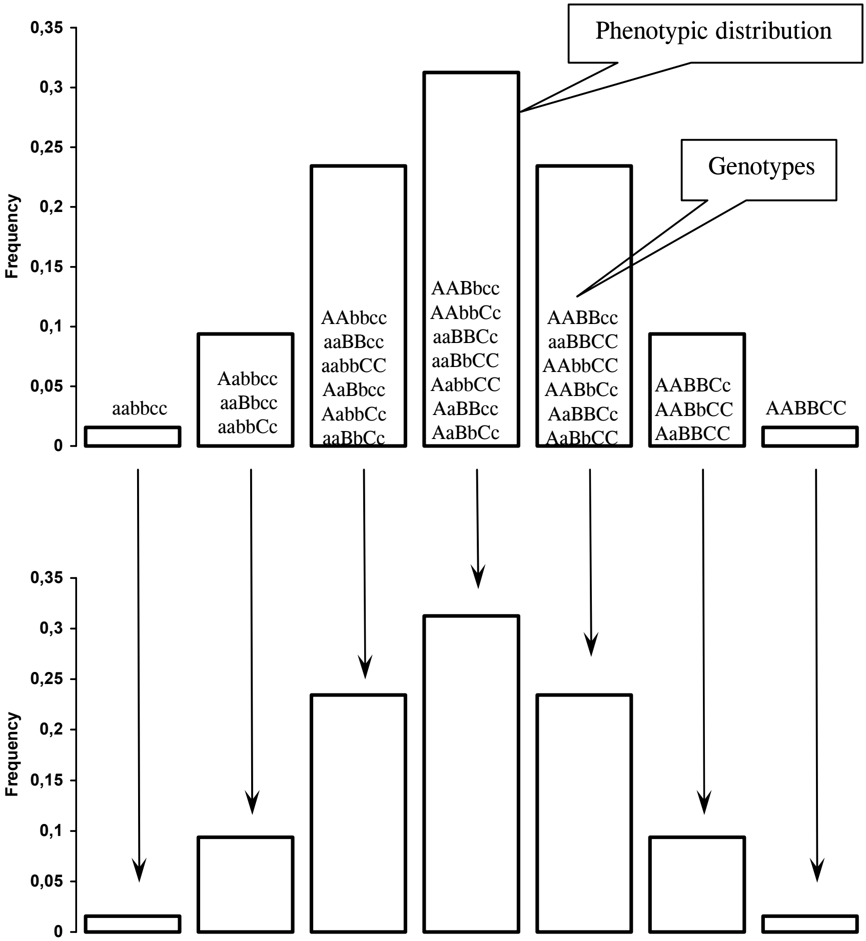

Figure 7.6. *Between-generation genotypic and phenotypic redistribution in a non-sexually reproducing species for a polygenetic trait determined by three allele pairs. Legend: Vertical intergenerational transmission of genotypes takes place due to the non-sexual transmission of genotypes between the parental and filial generations (Cliquet and Delmotte, 1984, after Li, 1971).*

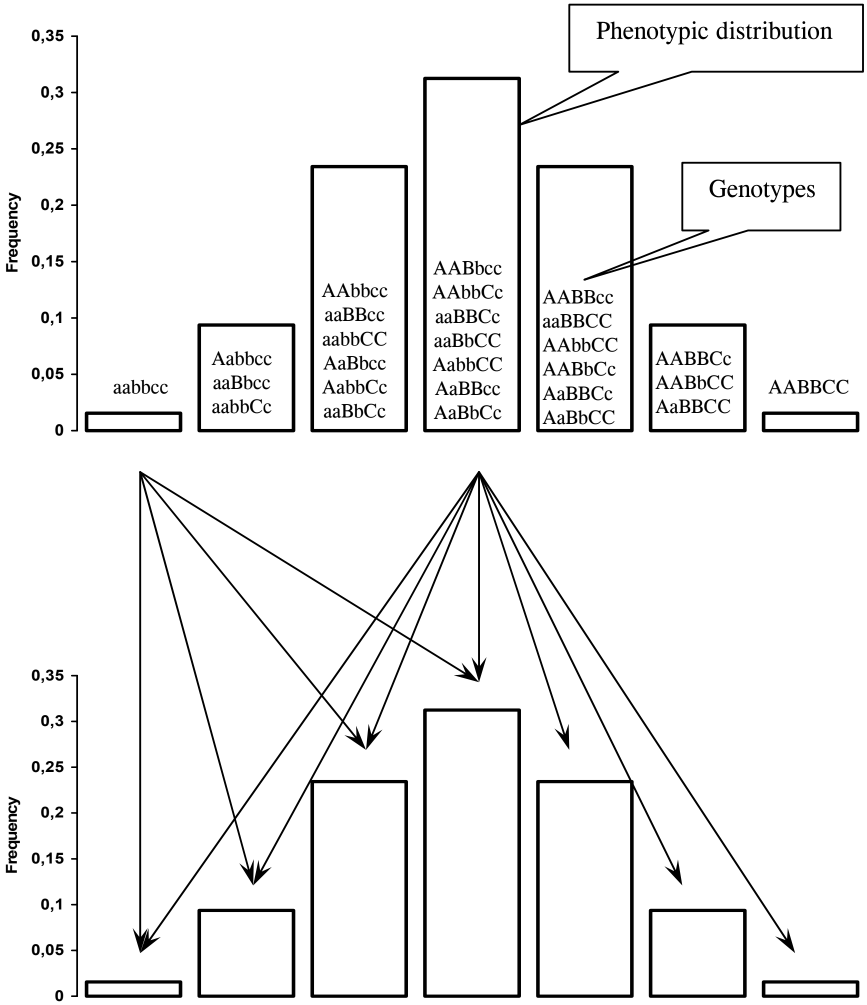

Figure 7.7. Between-generation genotypic and phenotypic redistribution in a sexually reproducing species with random mating for a polygenetic trait determined by three allele pairs. Legend: the redistribution of genotypes across the various phenotypic categories in a population is due to the recombination of allelic and non-allelic genotypes (the redistribution has been represented only for categories 1 and 4) (Cliquet and Delmotte, 1984, after Li, 1971).

As far as IQ test scores are concerned, several studies have shown a considerable amount of regression toward the population mean. Calculations based on Waller's (1971) sample show that the values for the filial regression, weighted on the parental population mean, are +10 percent and +8 percent for the two social categories below the mean, and −5 percent and −13 percent for the two social categories above the mean. The results for filial regression, based on data from Mascie-Taylor and Gibson (1978), are +11 percent and + 3 percent for the two socio-economic categories below the mean, and −6 percent and −7 percent for the two categories above the mean (Cliquet and Delmotte, 1984). With both data sets, the values for regression were calculated before the son's social migration.

Hypothesising a covariance between different genotypes and different social strata within a population, the intergenerational (poly)genetic redistribution system will dissociate this covariance, and maintain genotypes in social strata where they do not belong. Only social mobility can re-establish this relationship between recombined genotypes and functionally differentiated social strata. Hence, social mobility is a necessary mechanism for counterbalancing the effect of allele recombination which restores the genetic heterogeneity of genetically assorted social categories in subsequent generations. Social mobility is a kind of cybernetic system resulting in the maintenance of a homeostatic state in each social class through a constant influx and outflow (Young and Gibson 1963; Weiss, 2000).

Several arguments support this conclusion: the high heritability of measured intelligence, the high parent-child correlation for measured intelligence, and the strong correspondence between SES mobility patterns and the intergenerational redistribution of the genotypes of polygenic traits.

The high degree heritability of measured intelligence offers considerable support to the view that the phenotypic assortment of variables measuring cognitive performance is to a high degree associated with an assortment of alleles determining these characteristics. Indeed, it is nearly impossible that that assortment of traits for which heritability values of 40 to 80 percent have repeatedly been reported, would involve only the environmental fraction of the observed variance.

The parent-child correlation (r) for measured intelligence amounts to a value of approximately 0.50, which means that at most 25 percent (r^2) of the variance of this characteristic amongst the children can be explained by its variance amongst parents. At least 75 percent ($1-r^2$) of the variance is unexplained. A correlation coefficient of 0.50 also means that parents showing a difference of one standard deviation in measured intelligence (e.g. 15 IQ points), will have children who, on average, will only differ by $r \times SD = 0.5 \times 15 = 7.5$ IQ points. In other words, parents with the same IQ will have children who on average will differ amongst themselves by $SD(1-r^2)^{1/2} = 15(1-0.5^2)^{1/2} = 13$ points (Jencks *et al.*, 1972, 357).

Table 7.1. Theoretical probability for F1 offspring remaining sedentary or migrating to 'lower' or 'higher' phenotypic categories than those of the parents due to genetic recombination for a polygenetic trait determined by three gene loci, and assuming random mating and the absence of environmental influences (as presented in Figure 7.7).

Phenotypic categories			1	2	3	4	5	6	7	
Parental generation			1.6	9.4	23.4	31.3	23.4	9.4	1.6	100
Offspring generation	Sedentary	Frequency in population	0.2	2.4	7.6	10.9	7.6	2.4	0.2	31.3
		Frequency within phenotypic categories	12.5	25.0	32.5	35.0	32.5	25.0	12.5	
	Upwardly mobile	Frequency in population	1.4	6.5	11.7	10.2	4.1	0.6	0	34.4
		Frequency within phenotypic categories	87.5	68.8	50.0	32.5	17.5	6.3	0	
	Downwardly mobile	Frequency in population	0	0.6	4.1	10.2	11.7	6.5	1.4	34.4
		Frequency within phenotypic categories	0	6.3	17.5	32.5	50.0	68.8	87.5	
Percent mobility in the total population			1.4	7.1	15.8	20.4	15.8	7.1	1.4	68.8
Percent mobility per phenotypic category			87.5	75.5	67.5	65.2	67.5	75.5	87.5	

Source: Cliquet and Delmotte, 1984

Using the earlier polygenic model with three allele pairs with no dominance or environmental effects, and assuming random mating, the theoretical probability can be calculated that offspring will migrate toward a lower or a higher 'mental' category due to genetic recombination (Table 7.1). From this exercise it appears that a considerable amount of mobility takes place. The greater the distance of the parental phenotypic category from the median category, the larger is the regression toward the population mean and, mutatis mutandis, the greater the probability of mobility. Amongst all categories below the median category, the probability of upward mobility is greater than amongst the categories above the median, and vice versa. The proportion of upward mobility equals the proportion of downward mobility. The regression and migration effects are strongest for the extreme categories of the distribution but, due to the low frequencies of these categories, their relative statistical effect in the population is limited (Figure 7.8).

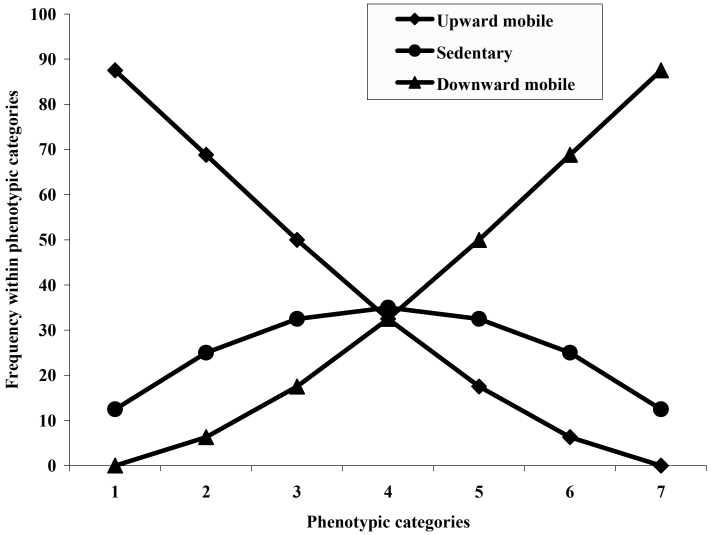

Figure 7.8. Theoretical probability of F1 offspring remaining sedentary or migrating to 'lower' or 'higher' phenotypic categories than those of the parents (3 allele pairs). Source: data from Table 7.1.

Application of the same procedure to an observed set of mobility data taken from Mascie-Taylor and Gibson's (1978) investigation yields the results shown in Table 7.2. Generally speaking, the same trends appear as in the above polygenetic model, reflecting regression towards the mean. The only relatively important difference concerns the unequal proportion of upward and downward mobility, the former being twice as large as the latter.

Despite the striking general similarity between the polygenic model and the modern mobility pattern, we cannot conclude that polygenic regression is the only cause of social mobility. The actual situation is undoubtedly much more complex. Cognitive performance is certainly controlled by many more allele pairs than is assumed in the above-presented model, and other genetic mechanisms such as dominance and epistasis must also be considered. Furthermore, there can be no doubt that several other personality and physical characteristics are involved (cf. Jensen, 1998). Finally, environmental factors must be taken into consideration, not least the role played by parental social and financial capital in determining the intergenerational inheritance of socio-economic status (cf. Rowe *et al.*, 1998; Arrow *et al.*, 2000; Bowles and Gintis, 2002; Bowles *et al.*, 2008).

Table 7.2. Observed social mobility according to the data of Mascie-Taylor and Gibson (1978). Source: calculations based on data from Mascie-Taylor and Gibson (1978).

Socio-economic status categories			1	2	3	4	5	6	Total
Parental generation			9.8	16.1	51.3	4.7	11.4	6.7	N = 193 (100%)
Offspring generation	Sedentary	Frequency in population	0.5	4.7	31.3	0.5	3.6	4.6	45
		Frequency within phenotypic categories	5	29	61	11	32	69	
	Upwardly mobile	Frequency in population	9.3	11.4	13.9	2.6	1.0	0	38
		Frequency within phenotypic categories	95	71	27	56	9	0	
	Downwardly mobile	Frequency in population	0	0	6.2	1.6	6.7	2.1	17
		Frequency within phenotypic categories	0	0	12	33	59	31	
Percent mobility in the total population			9	11	20	5	8	2	55
Percent mobility per phenotypic category			95	71	39	89	68	31	

As far as social mobility itself is concerned, socially conservative pressures are known to suppress exchange between SES groups. However, to the extent that unequal opportunities for access to education and occupational positions disappear in complex modern societies, the social assortment of cognitive performance and other genetically influenced traits that are important for success in specific occupational activities will increase – and so will the association between those characteristics and SES categories. The achievement of an egalitarian society will not only eliminate environmentally induced inequalities, but will also increase genetic diversity amongst functionally differentiated socio-occupational categories.

Because of the numerous characteristics involved, including the effects of environmental factors and incomplete assortative mating, the assortment of talent, which, indeed, acts at the phenotypic level rather than at the genotypic level, will never be complete. Hence, the reassortment of talents via social mobility will have to be reproduced in every successive generation.

This mobility, and its associated assortment of genetically influenced characteristics, does not lead to the establishment of genetically fixed social classes, as has been supposed by Young (1968). It must, however, be acknowledged that continual social mobility over many generations might, at some time, be somewhat self-limiting, as Eckland (1975) has argued. In particular, strong assortment at the extremes combined with positive assortative mating may lead to high frequencies of homozygous genotypes and less recombinations than in the middle categories. But even then, the above-mentioned factors – non-allelic recombinations, environmental factors, and the involvement of different characteristics – will continue to produce genetic heterogeneity within each assorted social category. A possible future decline in assortment processes will not result in the complete elimination of social mobility, but rather in the creation of a homeostatic system. In any case, this will require the elimination of traditional rigid class barriers and will result in an open society with a horizontally, rather than a vertically differentiated socio-occupational structure.

Several decades ago, Li (1971, 172) pointed to a fundamental misunderstanding about the role of Mendelian genetics in social class differentiation that is still often common amongst social scientists and lay people who presume that genetic factors, unlike environmental conditions, are intergenerationally fixed and, hence, unchangeable:

> *"Environmentalists sometimes misunderstand the implications of population genetics, thinking that heredity would imply 'like class begets like class'. Probably the opposite is true. Only very strong social and environmental forces can perpetuate an artificial class; heredity does not. From this point of view, social forces are more conservative than hereditary ones."*

The role of mate choice in the social assortment of biological characteristics

In Chapter 5 on 'Family Variation and Familism' the behaviour associated with human mate choice was described in some detail. There is a vast literature showing that mate choice is overwhelmingly characterised by positive assortative mating (cf. Spuhler, 1968; Epstein and Guttman, 1984; Mascie-Taylor, 1988).

Individual mate choice and social assortment have been shown to interact. Socially mobile individuals tend to marry in the direction of the class they are moving to (Hazelrigg and Lopreato, 1972). This is apparently the result of both passive and active mate choice. Education, socio-economic background parameters, and area of residence cause geographical and social propinquity that defines the marriage market and sets limits to the availability of possible mates; this is the passive component of mate choice (Nagoshi *et al.*, 1987; Heath and Eaves, 1985). Individual mate choice – the active component – can only take place within the limits of this sociological sorting process. Mascie-Taylor and Vandenberg (1988) found that the passive component – social, geographical, educational and familial propinquity – accounted for approximately two-thirds of the total spousal similarity for IQ; the remaining one third was ascribed to personal choice.

Mate choice based on shared variants of a trait has the same effect as non-random social mobility: it redistributes the trait variance, resulting in an enlargement of the variance. Assortative mate choice can therefore be deemed an amplifier to the assortative effect of non-random social mobility.

In mate choice, physical attractiveness plays a significant role, either directly in everyday exchange (Mulford *et al.*, 1998), or indirectly through its perceived association with intelligence (Jackson *et al.*, 1995; French, 2002; Hamermesh and Parker, 2003). Girls who become upwardly mobile through marriage are characterised by greater physical attractiveness. Amongst women from the working class, physical attractiveness is even more predictive of marriage to a high-status man than educational attainment (Elder, 1965). In this way, beauty features may lower the sorting effects of social mobility on characteristics such as intelligence that are generally to be considered the most relevant for attaining high social status in modern society.

The controversy over 'The Bell Curve'

Before concluding this chapter, it is necessary to dwell briefly on a high-profile controversy that swept through the social-biological, psychological and sociological literature in recent years concerning a book by Herrnstein and Murray (1994) called 'The Bell Curve', because it is a recent example of the recurring surfacing of the old-fashioned nature-nurture controversy. The book is about the role of intelligence in social assortment processes. In some quarters, the authors' work has been severely attacked and their conclusions rejected for a variety of reasons. Although several criticisms are justified, overall, a fairer and more balanced judgement would have been appropriate.

Herrnstein and Murray published their voluminous 872-page and well-publicised tome 'The Bell Curve' in 1994, in which it is argued that social stratification in contemporary American society is almost uniquely a question of individual differences in intelligence levels, resulting in the emergence of a 'cognitive elite' that is getting richer, increasingly physically segregated, and increasingly endogamous.

Herrnstein and Murray's study first sketches the important transformation American society underwent in the twentieth century regarding the valorisation of cognitive ability through democratisation of the educational system, and its consequences for social stratification. From this analysis the authors conclude that existing educational opportunities in the United States have already reached such a level that programs aimed at expanding opportunities for the disadvantaged are not going to make much difference in getting most talented youths to college.

The bulk of 'The Bell Curve' consists of a statistical analysis of data from the National Longitudinal Survey of Youth (NLSY). At the start of the NLSY in 1979, the sample consisted of 12,686 14 to 22 year old young men and women. In late 1980, 94 percent of the sample was subjected to the Armed Forces Qualification Test (AFQT) to measure their cognitive ability. On the basis of these test data and information gathered up to the 1990 interview wave about the demographics, wealth and poverty, education, and occupational choices of the interviewees, the authors identify a series of social problems that are the consequence of low intelligence: the risk of ending up poor, becoming or remaining unemployed, becoming chronically dependent on welfare aid, and developing criminal behaviour. Herrnstein and Murray also relate all these relationships to the ethnic/racial composition of American society. In their final chapter, Herrnstein and Murray deal, from an ideologically conservative point of view, with the policy implications of their findings.

'The Bell Curve' has elicited a variety of ideologically prejudiced as well as justified scientific criticisms. We will not dwell upon the ideologically inspired comments. For many social scientists, as rightly argued by Thienpont (2000–2001), genetics is unfortunately still a taboo and concepts such as intelligence and heritability are – unjustifiably – easily brushed off the table.

Equally unfortunate and unjustifiable, however, is that Herrnstein and Murray's approach and conclusions do not completely fit with the diversified and nuanced scientific insights that have accumulated in recent decades on the role of intelligence in assortment processes in modern society. Undoubtedly, intelligence is becoming an increasingly important factor in social mobility and social status attainment, but many investigations show that it is still only one of various important factors, such as family background, health and social skills, which interact in complex intergenerational social processes. This objection is substantiated by a number of reanalyses of the data used in 'The Bell Curve', many of which challenge the one-sided emphasis in IQ as the most important economic asset (cf. Cawley *et al.*, 1997) or argue for the use of more elaborate multivariate models, for instance in predicting criminal behaviour (cf. Manolakes, 1997).

Although 'The Bell Curve' includes numerous interesting findings on the increase in educational levels in the course of the twentieth century, the authors interpret the gradual within-population differences in a dualistic polarity – the emergence of a cognitive 'elite' versus the others. This dualistic polarisation probably appeals to the popular imagination, but does not fit the authors' own data. Moreover, doubts have been expressed about their assertion that only a negligible cognitive elite existed before the second half of the twentieth century (e.g. Lemann, 1997).

Several scholars have also criticised Herrnstein and Murray for using exaggerated heritability estimates of IQ, which they put on average at 0.60 (cf. Daniels *et al.*, 1997). Even using the more moderate estimates derived from recent meta-analyses, which are somewhat below 0.50 for broad heritability and around 0.33 for narrow heritability (cf. Plomin and Loehlin, 1989; Chipuer *et al.*, 1990; Daniels *et al.*, 1997), the authors could have made their point about the increasing importance of social assortment of cognitive ability in modern society.

Although Herrnstein and Murray include in their book a rather nuanced, though quite selective and incomplete discussion of the impact of environmental factors on the development and valorisation of cognitive ability, they largely omit this information in their concluding chapter on public policy (cf. Gardner, 1995; Nisbett, 1995; Resnick and Fienberg, 1997).

Most surprising, however, is that Herrnstein and Murray, who cannot have been unaware of the regression-to-the-mean phenomenon resulting from the segregation and recombination of genes across generations, do not mention the redistributing role of polygenetic inheritance in their analysis of the role of cognitive ability in social class and social mobility dynamics in America, let alone in their conclusions about the policy implications of their findings. This omission can only be explained by the assumption that their ideological prejudice has been playing tricks with them.

EGALITARIANISM VERSUS MERITOCRACY?

Egalitarianism is an ethical principle that advocates that all people should have equal political, economic, social, and civil rights. In educational matters the concept of equality – likeness or sameness in quality, status or degree – is usually understood as equality of opportunity (cf. Schaar, 1967). It is generally assumed that equality of opportunity provides each person, regardless of such ascribed characteristics as family background, religion, ethnicity, race, or gender, the same chance of acquiring a favourable socio-economic position (cf. Parelius and Parelius, 1987). However, equal educational opportunity does not necessarily imply that people will end up equal, socially or economically. Differences in abilities or work effort are usually differentially valued and rewarded.

Meritocracy (Latin: *meritorius* = worthy of reward) is a concept used to describe a type of society where social status is earned through talent and competence, rather than through wealth (plutocracy), family connections (nepotism), sex (sexism), ethnic group (ethnocentrism) or race (racism), class privilege (classism), religious or political adherence (ideological favouritism), friends (cronyism), or other forms of preferential treatment.

The term 'meritocracy' was first used by Michael Young (1958) in his book 'Rise of the Meritocracy 1870–2033: An Essay on Education and Equality'. The irony is that the author who coined the word half a century ago and used it in a pejorative way, recently expressed his disappointment about the way the word has gone into general circulation and is now used in a positive way by many scholars and politicians (Young, 2001).

Indeed, despite its negative origin the concept of meritocracy has acquired a positive evaluation in the mind of many scholars because it is believed to lead to a more fair and efficient societal order and function than other or older societal systems. Modern societies are more meritocratic than premodern ones (cf. Bell, 1973; Crook *et al.*, 1992; Esping-Andersen, 1993; Marchall *et al.*, 1997). However, there is still much evidence that factors such as family wealth and family connections, social capital, class privilege, ethnic origin, and religious or political adherence continue to exert a considerable influence on an individual's life chances, which makes Bilton *et al.* (2002) conclude that meritocracy is one of the most cherished myths of our time.

Young's (1958) fear that a meritocratic society would result in the rise of a new exclusive social class as discriminatory as the older ones, is due to a fundamental misunderstanding of the redistributive power of the genetic (in particular polygenic) transmission system in sexually reproducing organisms. As argued earlier in this chapter, the social assortment of (poly)genetically influenced traits does not lead to intergenerationally fixed genetic castes. The segregation and recombination of genes requires social mobility to reshuffle, in each generation, the phenotypes across the different social strata in society.

What one has to fear is that nepotism or another of the socially conservative mechanisms that formed the basis of non-meritocratic systems, will continue to undermine the very foundations on which a meritocratic society is built. But here one has to deal with the effects of totally different biological drives, such as nepotism, ethnocentrism, and class prejudice, than with the consequences of genetic segregation and recombination of genes (Kuznar and Frederick, 2007).

However, Young's concerns should not be brushed aside completely. Eckland (1971), for instance, has argued that the increasing relevance of education in sorting out intelligent individuals, in combination with increasingly assortative mating practices, might lead to a situation where a child's future position might be just as accurately predicted from the status of his biological parents as in a caste society. Years earlier, Schwidetzky (1950) had referred to this perspective with her concept of '*Aussiebung*'. In a mobility simulation for a single gene that is responsible for success and an upward shift in status, Dahlberg (1947) showed that it would rapidly concentrate in the uppermost socio-economic classes. Halsey (1972) made an identical simulation, but pointed out that many assortment decelerating factors occurring in real life have to be taken into account, as argued above.

Nevertheless, even if social strata were to become genetically more differentiated as modern society evolves, the multitude and diversity of biological and biologically influenced traits and factors involved in social success cannot result in a system of unalterable socio-genetic stratification into α, β, γ, δ, and ε classes as described in Aldous Huxley's (1934) "Brave New World". Social success can be the result of various combinations of different biological aptitudes – cognitive intelligence, social intelligence, energetic drive, health, beauty, etc. Also, we shouldn't forget that assortative mating is seldom completely homogamous for all characteristics involved. When the famous Irish writer George Bernard Shaw was told by the beautiful dancer and socialite Isadora Duncan that they should have a child together because it would have her beauty and his intelligence, Shaw retorted "but what if instead the child has my beauty and your intelligence?"

The question is now, how do egalitarianism and meritocracy interrelate? Are they incompatible forms of societal organisation, as some maintain?

If egalitarianism is understood as the creation of a strictly egalitarian society in which excellence is to be avoided rather than to be promoted, then there is no doubt that it is diametrically opposed to the goals of a meritocratic system. However, when egalitarianism is understood as a system that creates and guarantees equal opportunities for individuals to develop their talents, then both systems are perfectly compatible and a synergy between both is even necessary. Of course, harmony between egalitarian and meritocratic aspirations for society requires agreement on several additional societal goals – for instance, with regard to a socially acceptable range of personal incomes, collective protection of vulnerable members of society, and the employment of less capable members of society.

The latter issue is a particularly sensitive question. We should be aware that people differ in their cognitive or other abilities, and that in advanced modern societies in which such a high value is placed on intellectual abilities and qualifications, an increasing proportion of the population may not be able to meet the requirements of a competitive, creative, and fast-evolving economy. There are historical examples of societies failing to resolve the conflicts between within-generation and inter-generational sources of biological variation and social stratification inequalities. The former communist regimes in Eastern Europe had full employment policies but were unsuccessful in motivating their workers. Today, many Western European countries with generous welfare policies suffer from high and non-random rates of unemployment.

If we hypothese that modern societies want to remain functional and continue to assign jobs and social status on the basis of personal abilities, social mobility must reallocate social positions in each generation, due to the redistribute effects of Mendelian genetics, especially polygenic inheritance. Hence, inter-generationally rigid class or caste structures are incompatible with the requirements of modern societies that need 'the right people on the right jobs' in order to maintain their dynamic functionality and creativity. Modern societies need strong democratisation policies to reassort, across the different social strata in each generation the talents of individuals in the population.

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CHAPTER 8

RACIAL VARIATION AND RACISM

INTRODUCTION

The intentionally provocative title of this chapter – 'Racial Variation and Racism' – covers only part of the subject matter that will be discussed. This chapter, in fact, deals with the social-biological aspects of all forms of between-population variability – biological, cultural, and political – and related attitudes and behavioural patterns, such as racism, ethnocentrism, and xenophobia. Why then limit the title to 'race' and racism? This ambiguity is a purposeful act, intended to expose the flagrant misunderstandings that flourish in everyday discussion about these concepts.

In the biological sciences, the concept of 'race' has a very specific meaning. In population-genetic terms, it is defined as a population that is statistically significantly distinguished in its allele frequencies from other populations, is distributed within a more or less localised territory, and may interbreed with neighbouring populations in areas of geographical overlap. However, the number of allele pairs to consider in identifying a race is an arbitrary matter. The genetic categorisation of races is a probabilistic matter. Hence, many racial classifications are possible. Usually, populations that differ in only a few of their allele frequencies are not characterised as races. As a rule, the concept is reserved for important biological subdivisions of a species that are distinguishable by a substantial combination of genetic characteristics resulting from their evolutionary past. Races are, as a matter of fact, intermediary stages in the process of species formation. Species are populations that are genetically so different that they are reproductively isolated. They cannot exchange genes any longer.

In zoology, the concept of race is equated with a subspecies or variety in terms of a minimum threshold of genetic differentiation or as a distinct evolutionary lineage within a species (Smith *et al.*, 1997; Templeton, 2002). The standard threshold for a subspecies is minimally set at F_{st} = 0.25–0.30[1]. For instance, Barbujani *et al.* (1997) found a value of F_{st} = 0.156 for 16 populations from the major continents, implying that racial variation amongst humans is considerably lower than the standard set for animal species.

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[1] F_{st} is a measure of the relative amount of genetic diversity found within and between populations, with 0 indicating that all genetic diversity is individual with no differences between populations, and a value of 1 representing the opposite.

The major genetic subdivisions of the present-day human species emerged a long time ago. Due to population dynamics in the history of humankind, whose reproductive communities continuously changed in their genetic composition by means of migration, fission, fusion, and differential demographic growth, the term 'race' has become a concept that is scientifically difficult to apply to population-genetic differences within the human species. Human populations are, indeed, seldom demarcated by precise genetic boundaries (Jorde and Wooding, 2004). The reproductive communities in which particular combinations of genetic traits converged historically no longer completely correspond with present-day geographic or social groups in which genes are transmitted intergenerationally.

Scientifically, 'race' is a population concept that is, in principle, not applicable to individuals, although most individuals can be classified into non-overlapping population genetic entities (Rowe, 2005), especially when a large number of biological characteristics or genetic markers are used (Knussmann, 1992). Knowledge gained from the 'Human Genome Project' (cf. Watson, 1990; Collins *et al.*, 2003; Bonham *et al.*, 2005) and research on human genome variation have considerably boosted the possibility of identifying the overall genetic differences between populations and even between individuals of different ancestry (cf. Mountain and Cavalli-Sforza, 1997; Risch *et al.*, 2002; Rotimi, 2004; Tishkoff and Kidd, 2004; Royal and Dunston, 2004; Patrinos, 2004). In this way, molecular genetics has largely eliminated the distinctions and opposition that existed between methodologies to classify race, such as: (1) the traditional 'typological' race classification based on morphology and anatomy, which can be traced back to Bernier (1684), Linneaus (1758), and Blumenbach (1776), (2) the new variability method which, according to Schwidetzky (1962), was advanced by Rensch in the 1920s, but made a breakthrough only with the development of the new systematics (Huxley, 1940) and (3) the new evolutionary biology based on genetics, ecology and evolution (Stepan, 1982).

The biological and evolution-based sciences, particularly biological anthropology, originally concentrated mainly on the role of biological factors in between-population variability. Early anthropology was characterised by its mostly descriptive approach, which lead to the creation of a variety of biological between-population classifications (cf. von Eickstedt, 1934). Later, a more analytic and dynamic approach developed, largely under the influence of evolutionary theory (Lasker, 1978; Washburn, 1953) and fuelled by the discovery of an increasing number of new genetic polymorphisms (cf. Boyd, 1950; Nei, 1987; Cavalli-Sforza *et al.*, 1994). Genetic differences between populations are now most often studied under the heading of population genetics, (cf. Cavalli-Sforza and Bodmer, 1971; Cavalli-Sforza *et al.*, 1994), anthropological genetics (cf. Crawford and Workman, 1973; Crawford and Mielke, 1982), or even molecular anthropology (Goodman and Tashian, 1976; Devor, 2005).

Nonetheless, a remarkable disunity continues to exist in the scientific consensus about race (cf. Ossorio and Duster, 2005). The literature in several fields is full of arguments about ‘the end of race’ as a useful concept in scientific discourse, practice, and application (Katz, 1995; Bhopal, 1997; Chaturvedi, 2001; Schwartz, 2001; Shields *et al.*, 2005). This no-race argument has provoked opposing positions in favour of the continued use of the race concept as a helpful proxy of ancestry (Risch *et al.*, 2002; Burchard *et al.*, 2003). The taxonomic classification of populations based on a large number of genetic markers corresponds quite well with self-identified race or ancestry categories (Mountain and Risch, 2004). The present scientific discussions about the concept of race are virtually a repetition of the disputes about the UNESCO statements on race following World War Two (UNESCO, 1950; 1952; see also Shipman, 1994).

Furthermore, the biological differences between populations are not always due to genetic differences; many biological population characteristics can be the result of environmental influences, in addition to genetic differences. This is particularly true for biological differences found between populations in modern societies and populations who still endure the hardships of pre-modern living conditions. In his book on ‘*La Biologie du Noir*’ Heuse (1957) even concluded that the ‘normal’ biology of the Negroid race is not known or cannot be compared to the ‘normal’ biology of the Europid race.

Also, population-genetic entities must be clearly distinguished from cultural entities such as ethnic groups, linguistic groups, or religious groups, as well as from political entities. Ethnicity typically describes membership based on identity, solidarity, and difference felt by members of a group. It includes shared traditions and a sense of common descent, based on language, religion, and customs in general (Whitfield and McClearn, 2005). Because biological, cultural, and political group characteristics often coincide, biological population characteristics are frequently confused, or combined, with cultural, linguistic, religious or even political characteristics. Popular misconceptions, often reinforced by in-group prejudice or expansionism, resulted in the use of the word ‘race’ in common language, such as the Jewish race, the Semitic race, the Aryan race, the French race, the Germanic race, etc. – none of which exist.

Given all these complications, it is understandable that many scientists – undoubtedly *bona fide* – want to abolish the concept of race or even deny that racial differences exist or are of any importance. Although we greatly sympathise with such concerns, we shouldn’t take an ostrich policy attitude either. Between-population genetic differences and relations are important social issues and are connected to ethically and politically sensitive population problems, and therefore should be dealt with appropriately (Wang and Sue, 2005). Moreover, it is often extremely difficult for individuals to distance themselves from familiar stereotypes when evaluating the strengths and weaknesses of others or oneself.

After World War Two, largely in response to the genocides and other group-related crimes committed in the name of so-called races (cf. Bauer, 1982; Charny, 1982; Avramov, 1995), biological anthropologists concentrated on showing that genetic factors are not the basis of the sociological dominant-subordinate relationships that often characterise pluri-racial or pluri-ethnic societies (cf. Montagu, 1950; 1997; UNESCO, 1950; 1952). This line of thought, however, did not explain the virulence of inter-racial or inter-ethnic tensions and conflicts that flared, and have regularly and easily (re)emerged, in the post-war era.

The emergence of the second Darwinian revolution in the 1960s and 1970s (Hamilton, 1963; 1964; Williams, 1966; Maynard Smith and Price, 1973; Trivers, 1972; 1974; Alexander, 1974) included new theories on the biological-evolutionary background of various forms of social behaviour. It resulted in the broadening of the evolutionary-biological interest in between-group differentiation and within-population group dynamics to a broader variety of socio-biological in-group/out-group relationships ranging from partner relations, friends, social classes, and political parties to ethnic and racial groups (cf. Alexander, 1979; van den Berghe, 1978; 1981; Rushton *et al.*, 1984; Reynolds *et al.*, 1987; Shaw and Wong, 1989; van der Dennen, 1995).

In recent years, despite progress in cultural, economic and political globalisation, several societal processes linked to modernisation have been accompanied by upsurges in or intensifications of ethnic and racial tensions in many parts of the world. These processes include increasing population density and ever-expanding means of geographical mobility, which lead to increasing international migration movements; the ongoing democratisation process in many societies, *inter alia,* leading to emancipatory movements among racial and ethnic minorities; the collapse of national communist regimes; and the rise of in-group fundamentalisms against modernisation.

Massive migration movements are establishing or expanding the multi-racial and/or multi-cultural composition of many countries, stimulating the (re)emergence of racist political movements in the receiving countries and strengthening fundamentalist reflexes amongst the immigrants. In pluri-ethnic states, democratisation is triggering regional nationalistic movements that aspire to greater autonomy or independence.

At first sight there seems to be a contradiction between the forces of the ongoing cultural, economic and political globalisation and the continuous presence or (re)emergence of in-group/out-group tensions or conflicts. Social scientists and politicians in particular seem to be puzzled by this paradox. This lack of understanding may be partly explained by their insufficient knowledge of recent developments in evolutionary biology with respect to the underpinning of social behaviour, and partly by their refusal to take into account evolutionary-biological insights because of ideological prejudices or group interests. Relevant evolutionary insights can be gained from *kin selection* theory (Hamilton, 1964), *reciprocity* theory (Axelrod and Hamilton, 1981; Trivers, 1974), *genetic similarity* theory (Rushton, 1989), and *evolutionary groupism* theory (Alexander, 1987; Tullberg and Tullberg, 1999). Yet most social scientists and politicians remain completely oblivious to their implications for in-group/out-group behaviour (cf. Alexander, 1979; Van den Berghe, 1978; 1981; Reynolds *et al.*, 1987; Eibl-Eibesfeldt and Salter, 1998).

Within the complex relationship between individual attitudes and behaviour on the one hand, and group membership on the other hand, belonging to a particular racial or ethnic group under specific circumstances may increase in importance as a determinant of individual behaviour. As group membership is one of the most essential features of human social life, the study of the composition of societies in terms of racial or ethnic groups is at the forefront of contemporary social science. The evolutionary perspective of sociobiology offers a valuable framework within which historical trends, present conditions and options for the future can be discussed.

THE EVOLUTIONARY BACKGROUND OF BETWEEN-POPULATION GENETIC VARIATION

The source of between-population genetic differences can be traced back to the origin and evolution of the present human species, *Homo sapiens sapiens.* The oldest racial differentiation can be seen in the separation of the African branch on the one side and the Australid-Europid-Mongolid branch on the other side. This differentiation occurred somewhat more than 100,000 years ago. The separation between the Australid and the Euro-Asian groups is estimated at 50,000 years ago, whereas the separation between the Europid and Mongolid groups probably took place some 35,000 to 40,000 years ago (Cavalli-Sforza *et al.*, 1994).

The basic population-genetic mechanisms of between-population genetic differentiation were already dealt with at the occasion of the discussion of the causes of individual genetic variation in Chapter 2: mutation, genetic drift, gene flow, and selection. These basic mechanisms are involved in the three main causes of the establishment of genetic differences between populations:

1) Splitting of populations, resulting in genetic isolation and involving 'genetic drift';
2) Fusion or interbreeding of populations, as a consequence of migration or neighbouring contacts;
3) Adaptation of populations, as a consequence of the occurrence of mutation, and selection in different environmental living conditions.

Splitting of populations

The splitting up of a population into two or more reproductive communities between which no further gene exchange takes place, resulting in between-population genetic isolation, creates conditions for some allele pairs to evolve in different directions. This is particularly important with regard to neutral mutations of monogenes, and is more likely to occur as the populations get smaller. Genetic drift (the 'Sewall-Wright-effect') can then make itself fully felt. If the 'founding fathers' of the new reproductive units, due to chance events at the sampling process, do not form a representative sample of the original population, the allele frequencies of one or more of the new reproductive units can substantially differ from the parental population. The presence of demographic bottlenecks increases the likelihood of a quite rapid expansion of genetic distance between populations (Nei, 1987).

Independent from each other and using different methods, Nei and Roychoudhury (1982) and Cavalli-Sforza and colleagues (Bowcock *et al.*, 1991; Cavalli-Sforza, 1991; 2000; Cavalli-sforza *et al.*, 1988; 1994) produced population-genetic dendrograms for the present-day human populations, using more than one hundred monogenetic serological traits (blood groups and serum proteins) (Figure 8.1). The results of these large-scale investigations on multilocus genetic data are quite similar, though for some populations there are some differences in their mutual genetic affinities. Furthermore, the maximum likelihood trees made on the basis of molecular genetic markers tend to support traditional taxonomic classifications, based on palaeontological and morphological data, and even socially defined groups, except for features which are clearly adaptations to similarities between environments (Cavalli-Sforza, 2000; Risch *et al.*, 2002; Mountain and Risch, 2004). Whereas anthropometric trees, based mainly on polygenic characteristics, can represent both ancestry and adaptation, genetic trees, mainly based on monogenes or even smaller DNA units, are more likely to reflect phylogenetic history.

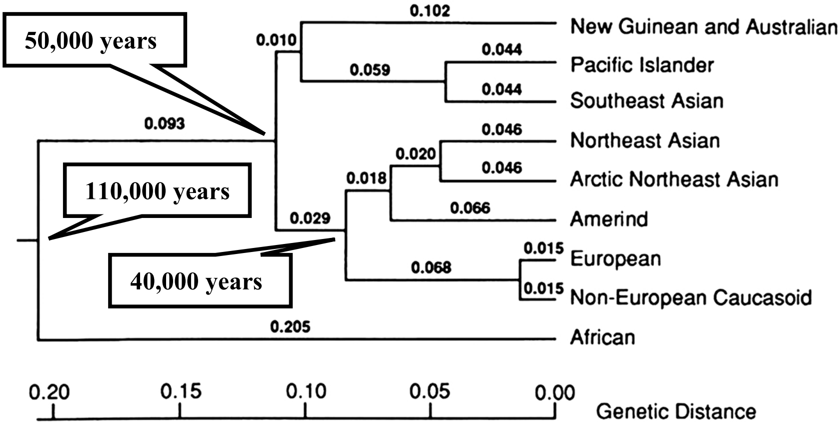

Figure 8.1. Population-genetic dendrograms for present-day human populations based on more than one hundred monogenetic serological traits. Source: Cavalli-Sforza et al., 1994.

Cavalli-Sforza *et al.* (1988; 1991) also found an impressive correspondence between the genetic affinities of human populations and their linguistic affinities as elaborated by Greenberg and others (Ruhlen, 1987; Ross, 1991) (Figure 8.2).

This genetic-linguistic connection is not the consequence of a genetic causal relationship with particular languages, but is the result of historic-demographic processes. The splitting of populations influences not only the differentiation of genes, but also of languages, although in some cases, there is no complete correspondence. Genetic-linguistic discordances result from the fact that genetic and cultural features can be transmitted intergenerationally through different mechanisms: whereas genes can only be transmitted vertically (from parents to offspring), memes (cultural units) can be distributed vertically as well as horizontally. Consequently, cultural substitution can go hand-in-hand with genetic continuity; in the case of 'gene flow', the opposite can occur with cultural assimilation – namely, cultural continuity combined with genetic substitution.

Fusion

The merging of separate and genetically partially different populations leads to new gene pools that are different from the original parental populations. Crossovers between individuals from genetically different populations not only result in the establishment of heterozygous genotypes in the next generation, but also lead to gene migration from one population to another and to the constitution of new hybrid reproductive units. Gene migration results in an increase in the genetic variability within the population(s) involved, and in a decrease in between-population genetic differences.

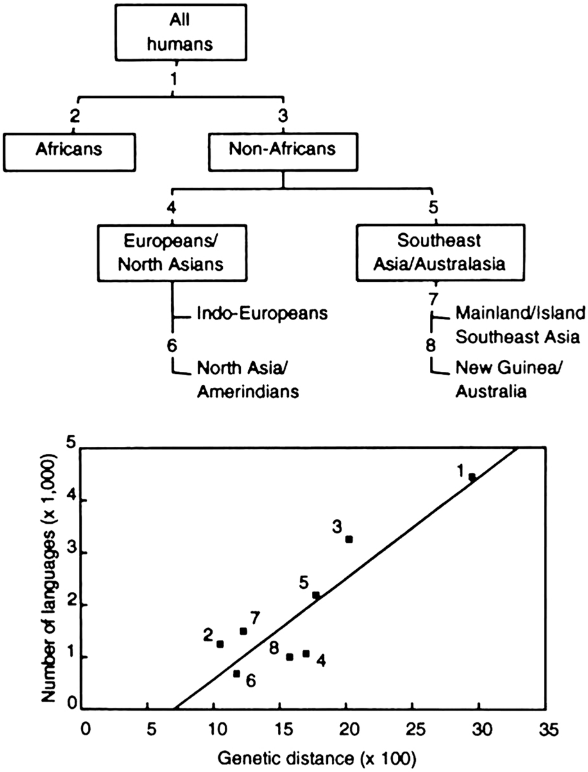

Figure 8.2. Correspondence between genetic and linguistic differentiation. Source: Foley, 1984, in Cavalli-Sforza et al., 1994.

Wherever migratory movements are massive in scale and immigrant populations are not well integrated, new isolates may be formed. Such forms of migration may lead to population-genetically stratified societies in which immigrant groups often are confined to lower socio-economic and occupational strata and are residentially segregated in less attractive quarters (cf. de Lannoy, 1978; Van der Haegen, 1995). Population movements of this nature are traditionally well known in the America's, but in recent decades they have also taken place in many Western European metropolitan areas, and even in other fast-growing economies in the Near East and the Far East.

The transfer of genes from one population to another can be a one-off event or a systematic process. With regard to the latter, a very small gene transfer per generation suffices to produce, in the long run, a substantial change in the gene pool. A classic example of such a limited but systematic 'gene flow' exists in the United States population of African origin that, due to an average absorption of ±2.5 percent (Roberts and Hiorns, 1962) to ±3.6 percent (Glass and Li, 1953) European genes per generation, now includes an average of 30 percent genes of Europid origin (Reed, 1969). More recent studies reveal, on average, lower percentages of genes of European origin in African Americans ranging in different U.S. regions from about 12 percent to 25 percent (Chakraborty *et al.*, 1992; Parra *et al.*, 1998). On the basis of such data, it can be predicted that, with time, genetic differences between the African American and European American populations in the US will disappear, as Stern (1954) calculated for skin colour. The speed of this trend towards such uniformity, particularly for visible traits, will partially depend upon the rigidity of biosocial barriers preventing or enhancing gene flow between the two populations (Benoist, 1986).

Historically, scientific investigations of the biological effects of genetic hybridisation were preceded by a mythological believe in the presumed unfavourable consequences of racial crossing and hybridisation, which were said to include: decreased fertility, disharmonic phenotypic combinations, mental retardation, etc. (cf. Scheidt, 1925). At first sight some investigations seemed to confirm the thesis that racial crossings produce unfavourable effects. Some hybrid populations, indeed, showed less favourable traits, such as reduced growth, worse health conditions, and a higher frequency of genetic defects. However, soon it appeared that the explanation for such observations was to be found in the less favourable conditions in which many hybrids were forced to live (Benoist, 1986). Often they were cast out by both parental races, and ended up in less favourable socio-economic strata characterised by nutritional deficiencies, lower educational opportunities, less income, etc. In some cases hybridisation led to social isolation, and in the case of small populations, to increased inbreeding and inbreeding depression (cf. Witkop *et al.*, 1966).

Meanwhile, anthropological and genetic investigations of hybrid populations have shown that hybrids, as can be expected on the basis of Mendelian genetics, manifest intermediairy characteristics between both parental races, are phenotypically well adapted, do not show disharmonic trait combinations, and have a normal if not a higher fertility (cf. Trevor, 1953; Garn, 1971; Benoist, 1986). Contrary to the unfavourable effect of racial crossing expected by some, zoological and botanic research points to the opposite: the offspring of racial crossings often manifest signs of heterosis or hybrid vigour, namely a larger size, higher fertility and better resistance to diseases. In a number of cases, phenotypic effects characteristic for heterosis have been observed in human populations, for instance: a higher fertility and stature among the offspring of French Canadian and Ojibwa Indian marriages (Boas, 1894), a higher fertility and body size among the hybrid offspring of the English *HMS Bounty* mutineers and Tahitian women on Pitcairn Island in the Pacific Ocean (Shapiro, 1929; Refshauge and Walsh, 1981), and the so-called Rehoboth Bastards descending from Dutch men and Hottentot women in South Africa (Fischer, 1913). To what degree these phenomena are really the consequence of heterosis is, however, still unknown.

Adaptation

In addition to genetic drift and gene flow, genetic adaptation to changing environmental living conditions forms the third major source of between-population differentiation. A preliminary condition for genetic adaptation is the presence of genetic variability caused by mutations. However, the most important dynamic factor for genetic adaptation to changing environmental conditions is natural selection. Obviously, human populations can also physiologically and/or behaviourally adapt to their changing environment, but such acclimatisations have no impact on the genetic differentiation of populations because they are not transmitted to subsequent generations.

Bio-anthropological investigations have identified a broad array of environmental factors to which human populations developed specific genetic adaptations. The most important are climatic factors and infectious diseases, although some population-genetic features have also been linked to specific nutritional factors and particular geographical environments.

An example of a nutritional adaptation is lactose intolerance (Kretchmer, 1972; Beja-Pereira *et al*., 2003). This phenomenon is due to an autosomal recessive gene that is responsible for the inability to metabolise lactose – a sugar found in milk and other dairy products – due to the absence or low levels of the required enzyme lactase. Whereas most people of European ancestry are able to safely consume milk products all their lives, most modern East Asians, sub-Saharan Africans and native peoples of the Americas and Pacific Islands are lactose-intolerant as adults.

An example of an adaptation to particular geographical environment is the existence of significant differences in some physiological and morphological characteristics of peoples living in high mountain regions which may result not only from acclimatisation, but also partly from selective processes (cf. Baker, 1978; Moore, 2001).

The influence of climate on the human is manifested both through developmental acclimatisation and genetic adaptation, although it is generally accepted that the share of genetic selection is much more important than that of physiological acclimatisation in the development of between-population variability (Roberts, 1953). Population-genetic traits that are generally considered to be genetic adaptations to climatological conditions include skin colour, general body build, basal metabolism, and nose shape. Thus, a number of climatological rules of biological characteristics have been formulated, first on the basis of zoological data and later also based on anthropological research: Gloger's (1833) rule, Bergmann's rule (1847), Allen's rule (1877), and the rule of Thomson and Buxton (1923).

Gloger's rule, for instance, states that populations that evolved in sunnier environments close to the equator tend to be more darkly pigmented than populations originating farther from the equator (Rensch, 1935; Parra *et al.*, 2004). The correlation between climate and skin pigmentation is usually explained by the protection the melanin layer in the skin offers against several unfavourable effects of UV radiation, such as sun burn and skin cancer (Aoki, 2002). However, the distribution of lighter skin colour in more temperate climatic zones might also have been influenced by sexual selection because, in partner choice, it appears that cross-culturally a lighter-than-average skin colour is preferred over a darker complexion (Darwin, 1871; Van den Berghe and Frost, 1986; Aoki, 2002).

It is generally believed that diseases have been a major selective factor in human evolution (Damon, 1971). Nevertheless, it remains quite difficult to show that differences in pathologies which are found between populations of different genetic origin are related to those genetic group differences. Genetic subdivisions of the human species often simultaneously show correlations with several environmental factors such as socio-economic differences in living standards, differences in risks of contracting infectious diseases, differences in nutrition, differences in behavioural patterns, and differences in sexual habits. Most population-related pathological differentials appear to be explained by one or more of these environmental living conditions. In some cases it is presumed that genetic group differences have a modulating effect (Polednak, 1989).

Nevertheless, some pathological genes are clearly more prevalent in particular population-genetic entities than in others: for instance, sickle-cell anemia is characteristic for some African populations (Kwiatkowski, 2005), Tay-Sachs disease is more frequent among individuals of Ashkenazi Jewish ancestry (Frisch *et al.*, 2004), cystic fibrosis is more common in people of European ancestry (Rosenstein and Cutting, 1998), and prostate cancer is more common in African Americans than among European Americans (Stanford *et al.*, 1999; Sartor *et al.*, 1999). One of the most common health disparities experienced by

African Americans is hypertension (Anderson *et al.*, 1991): the 235T variant of the gene angiotensinogen (*AGT*) which encodes a key component of the renin-angiotensin blood-pressure regulation pathway, has a frequency as high as 90 percent in some African populations and as low as 30 percent in European populations (Nakajima *et al.*, 2004).

Sickle-cell anemia is a classic example of a genetic condition (Pauling *et al.*, 1949) for which a clear causal relationship with an infectious disease has been established: the original distribution of the autonomous recessive gene Hb^S is causally related to the presence of malaria (Allison, 1954), because the heterozygous genotype Hb^A/Hb^S (‘sickle-cell trait’) provides a better resistance to infection by *Plasmodium falciparium* than the homozygous ‘normal’ genotype Hb^A/Hb^A. Resistance to several other infectious diseases (cholera, typhoid, and tuberculosis) has been hypothesised for the heterozygous advantage of the autosomal recessive mutant that causes cystic fibrosis (Wiuf, 2001). The relatively frequent incidence of Tay-Sachs disease in Ashkenazi Jewish populations is probably due to genetic drift (Risch *et al.*, 2002). For the strong prevalence of hypertension in African Americans, several explanations have been proposed – including genetical predisposition (Harshfield and Grim, 1997), reaction to stress related to racism and discrimination (Clark *et al.*, 1999) – but this polygenic trait probably involves complex interactions amongst external factors (such as stress or diet), internal physiology (the biological systems that regulate blood pressure) and the genes involved in controlling blood pressure (Cooper *et al.*, 1999).

The salient differences in the health profiles of different racial/ethnic groups, particularly in the United States with its major between-group problems, has in recent decades intensified research and discussion about the ways genes affect disease and also how to explain racial variation in disease prevalence (Rowe, 2005). African Americans, for example, experience significantly higher mortality rates than Americans of European ancestry; their age- and sex-adjusted death rate from all causes is 60 percent higher, resulting in a life expectancy gap between African Americans and European Americans of 8.2 years for men and 5.9 years for women (Whitfield and McClearn, 2005). The genetic level of analysis may help resolve such between-group health disparities (Yee *et al.*, 1993).

An interesting case of biosocial coevolution has recently been documented regarding the between-population genetic variation in the incidence of the S allele of the serotonin transporter polymorphism (5-HTTLPR) that is significantly correlated with cultural values of individualism–collectivism which, in turn, are related to the historical variation in pathogen prevalence and epidemiology of affective disorders, such as anxiety and depression (Fincher *et al.*, 2008; Chiao and Blizinsky, 2009).

BIOLOGICAL BETWEEN-POPULATION DIFFERENCES

In the human species there are many biological characteristics that show statistical significant differences between populations (cf. von Eickstedt, 1934; Garn, 1971; Cavalli-Sforza *et al.*, 1994). Most of these characteristics are genetically determined, but polygenetic traits often also vary due to different environmental living conditions. For some environmentally sensitive characteristics it is even impossible to compare populations from developed and developing countries.

Human populations show a strong overlapping in their biological characteristics: for most characteristics, different variants (phenotypes, genotypes, alleles) are present in most if not all populations, with larger or smaller differences in frequency distribution. Consequently, genetic barriers between populations are difficult to identify. Usually genetic gradients, so-called 'clines', are observed with gradually increasing genetic differences with geographical distance (Bamshad *et al.*, 2004; Serre and Paabo, 2004) (Figure 8.3).

Investigations of the genetic distances and variation between human populations have shown that between-population genetic variation is only a small fraction of the total population-genetic variation. In his classic article 'The Apportionment of Human Diversity', Lewontin (1972) used data from blood group systems and proteins (in total 17 loci). Lewontin estimated that roughly 85 percent of genetic variance occurs between any two individuals within any socially identified racial group; roughly nine percent occurs amongst different populations within a socially identified race; and only the remaining six to seven percent occurs between socially identified races. Lewontin (1972) concluded:

> "*It is clear that our perception of relatively large differences between human races and subgroups, as compared to the variation within these groups, is indeed a biased perception and that, based on randomly chosen genetic differences, human races and populations are remarkably similar to each other, with the largest part by far of human variation being accounted for by the differences between individuals.*"

Other researchers have arrived at identical conclusions using more powerful data sets obtained with more technologically advanced methodologies (cf. Latter, 1980; Wainscoat *et al.*, 1986; Cann *et al.*, 1987; Barbujani *et al.*, 1997; Jorde *et al.*, 2000; Rosenberg *et al.*, 2002; Marth *et al.*, 2003; Kidd *et al.*, 2004), or through simulation analyses (Templeton, 1999).

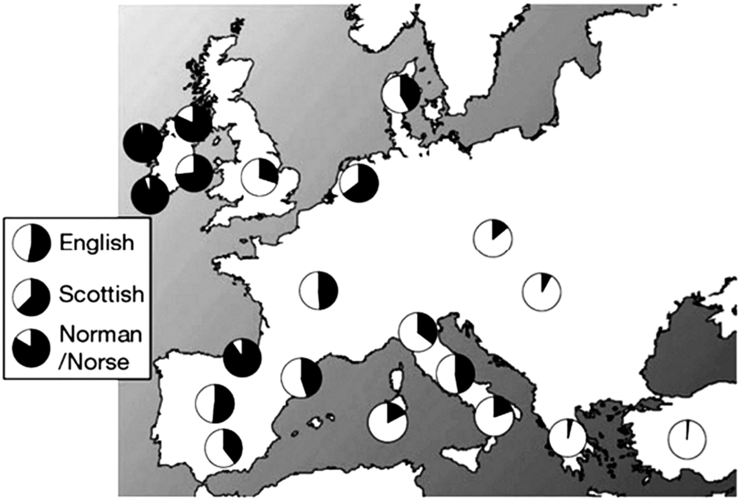

Figure 8.3. A cline of Y-chromosome haplotypes in Europe. The cline goes from 1.8 percent in Turkey to peaks of 89 percent in the Basque Provinces and 98 percent in Western-Ireland. Source: Hill et al., 2000, 351.

The 'Human Genome Project' shows that people and chimpanzees have 98 percent to 99 percent identical DNA. People of different racial groups probably have about 99.9 percent identical DNA (Plomin and McGuffin, 2003).

However, if just 0.1 percent of DNA bases vary, the number of potential genetic differences is still huge. The human genome contains approximately three billion DNA building blocks, which means that, between any two people, there are at least three million points of possible difference in the DNA (Crow, 2002; Rowe, 2005).

Molecular genetic data are often used to support the thesis that racial differences do not have a biological basis or that population-genetic differences do not matter. Many cultural anthropologists and sociologists believe that race is a socially constructed, not an evolutionary determined or biologically supported, concept (cf. Smedley, 1993; Smedley and Smedley, 2005). Apart from the fact that between-population genetic differences are scientifically very important for the anthropological study of the origin and history of the human species and its subdivisions, they are part of the social reality in which they play, in many cases, an important role by producing social and interpersonal tensions and conflicts. These conflicts have become incompatible with the ecological context and the value systems of present-day modern democracies.

Behavioural-genetic between-population differences

A sensitive and controversial matter is the question whether genetically different populations also differ in some behavioural characteristics that are partly genetically influenced, such as cognitive ability, emotional personality characteristics (e.g., extraversion, neuroticism, psychoticism, socialisation, impulsivity, sensation seeking, and aggression), and sexual behaviour (cf. Barrett and Eysenck, 1984). In particular, this question has been raised with regard to measured intelligence, especially in the United States where a good deal of research has been done on different population groups in relatively comparable living conditions.

The sensitivity – ethical, social as well as political – of this question is related to several issues. First of all, characteristics such as intelligence are thought to play an important role in various domains of social life, such as cultural creation, economic achievement, social prestige, and political power. Second, in pluri-racial or pluri-ethnic societies, such as the United States, inter-racial and inter-ethnic relations have suffered – and continue to suffer – from historical and even present-day inequalities and inequities. Important also is the fact that various ideologies tend to either ignore or even deny the existence of possible genetic factors in behavioural differences between populations, or use and abuse scientific knowledge about possible genetic differences to justify socially conservative or even politically exploitative policies. Last, but not least, in the past the social and behavioural sciences have under the influence of the 'Standard Social Science Model (SSSM)', largely been operating under the hypothesis of environmental determinism of individual and group behaviour. It has been taboo to hypothesise that genetic factors might also be partially involved, particularly with regard to group differences, and this perspective is therefore commonly avoided by career-conscious academics (Gottfredson, 1994; Nyborg, 2003; Meisenberg, 2006). Dealing with genetic issues often entailed the risk of being accused of favouring a racialist discourse. In some cases, there have even been threats on persons and their careers (Pearson, 1996). A well-balanced approach, based on a scholarly examination of the facts is a rarity in this area of study.

From a theoretical perspective, it is not impossible that behavioural traits, just as with morphological and physiological characteristics, may become differentiated under the pressure of natural selection, given that the major genetic subdivisions of the human species have been separated for tens of thousands of years, and have adapted to different environments. Loehlin, Lindzey and Spuhler

(1975) calculated that even small differences in selective advantage between populations for characteristics such as cognitive ability may result in substantially different gene frequencies if the selective differential prevails over a sufficiently long period of time. Indeed, taking into account current estimates of the timing of the African European split and the Negroid-Europid IQ difference, Levin (1997, 124) arrived at extremely low values of selection intensity to produce the observed difference. It is another thing to show that natural selection produced such a difference.

It is a fact that quite substantial phenotypic differences in the performance on so-called culture-fair intelligence tests have been repeatedly observed between populations of different racial or ethnic origin living in the same country or in comparable societies and cultures. On standardised mental ability tests with an average of 100 and a standard deviation of 15, Ashkenazi Jews universally score with the highest averages ranging between 107–115 (Storfer, 1990; Cochran *et al.*, 2006), followed by populations of mongoloid (East-Asian) origin such as Chinese and Japanese, with averages ranging between 103–113 (Vernon, 1982; Stevenson *et al.*, 1986; Lynn, 2006). European populations and the US population of European origin show averages of 100–102, American Hispanics have averages ranging between 88–96 (Suzuki and Gutkin, 1993), American Indians have an average of 90 (Vraniak, 1994), and African Americans have an average of 85 – one standard deviation below the average of Americans of European descent (Coleman *et al.*, 1966; Jensen, 1969; 1973; 1998; Osborne and McGurk, 1982; Reynolds *et al.*, 1987; Shuey, 1966; Vraniak, 1994) (Figure 8.4).[2]

An important observation is that, notwithstanding the average differences found between genetically or ethnically different populations, there is considerable overlap of the frequency distributions. Individual differences within groups make a far more important contribution to total variance: race: 14 percent; social class: 8 percent, interaction of race and class: 8 percent; and individual differences: 70 percent (Jensen, 1998). Group means have no direct implications for individuals or for relations between individuals.

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[2] Research on populations on other continents have yielded identical or even more pronounced differences in measured intelligence (Rushton, 1995; Lynn and Vanhanen, 2002; 2006; Lynn, 2006; 2008), especially for populations that are not only culturally different from the West, but are also living in socio-economic and biosocial conditions that are signficantly different from modern patterns. Some of these results, with averages 67 for sub-Saharan African populations, 62 for Australian aboriginals and even 54 for San Bushmen, which fall within the range of mental retardation, have been seriously questioned, especially because of the authors' assertion that the population differences in IQ are largely genetic in origin (cf. Meisenberg, 2006; Mackintosh, 2007).

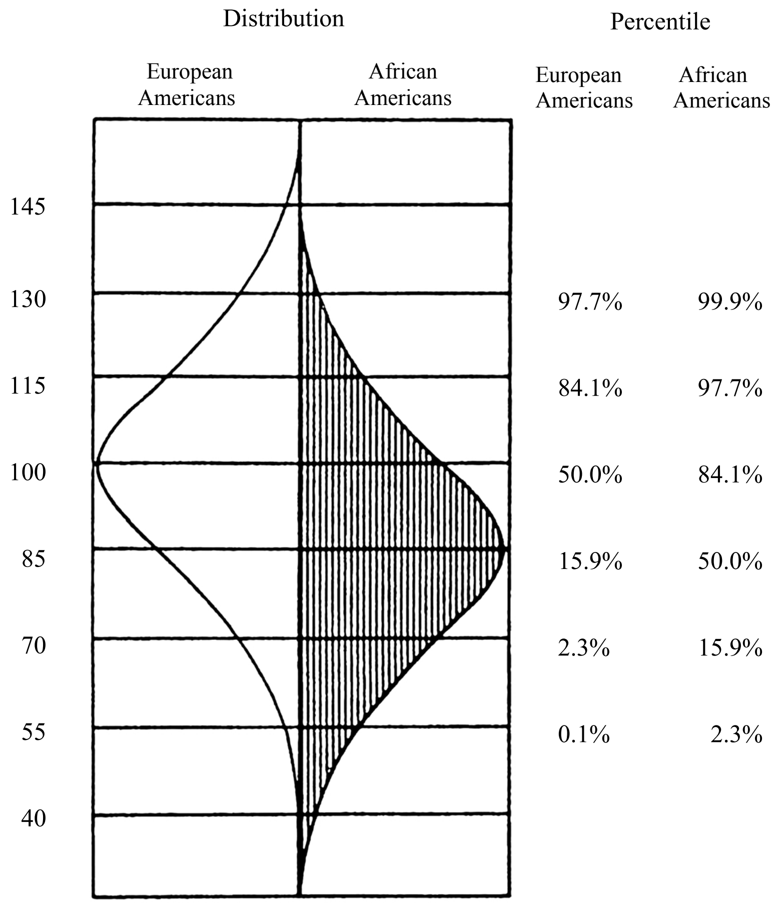

Figure 8.4. IQ distribution in European American and African American populations in the United States. Source: Jensen, 1998, 356.

The question now is how to explain the between-population differences in measured intelligence? When the renowned psychologist Arthur Jensen (cf. Nyborg, 2003; Modgil and Modgil, 1987; Scarr, 1998; Detterman, 1998) published his scholarly and well-documented paper on ‘How Much Can We Boost IQ and Scholastic Achievement?’ in the Winter 1969 issue of the *Harvard Educational Review*, a storm of ideologically and often politically motivated protests, mis-interpretations, and vilifications burst out, but there were also scientifically based critiques (e.g. Biesheuvel, 1972; Bodmer, 1972). The reactions were provoked mainly by a small section of the article dealing with between-population differences in intelligence which concluded with a cautiously and carefully qualified hypothesis about the possible partial effects of genetic factors in the intelligence differences between African and European Americans (Jensen, 1969, 81):

> *"So all we are left with are various lines of evidence, no one of which is definitive alone, but which, viewed all together, make it a not unreasonable hypothesis that genetic factors are strongly implicated in the average Negro-white intelligence difference. The preponderance of the evidence is, in my opinion, less consistent with a strictly environmental hypothesis than with a genetic hypothesis, which, of course, does not exclude the influence of environment or its interaction with genetic factors."*

Since Jensen's 1969 publication, the hypothesis of genetic factors as partial explanation for between-population differences in intelligence has been taken up by other scholars such as Eysenck (1971; 1998), Rushton (1995), Brand (1996), Levin (1997), Lynn (2006); Lynn and Vanhanen (2006). In several subsequent publications Jensen (1973a; 1973b; 1998) himself has extended his views on race differences in intelligence. In a recent article Rushton and Jensen (2005) review the last 30 years of evidence to support their argument that the long-standing, worldwide Black-White average differences in cognitive ability are more plausibly explained by their hereditarian (50 percent genetic causation) theory than by culture-only (0 percent genetic causation) theory (see also Gottfredson, 2005).

Meanwhile, an avalanche of articles and books have been published to refute the hypothesis of genetic influences on between-population differences in intelligence and to argue that those differences are only due to cultural and other environmental influences (e.g., Montagu, 1997; Flynn, 1980; Gould, 1981; Lewontin *et al.*, 1984; Jencks and Phillips, 1998; Fish, 2002; Sternberg *et al.*, 2005).

Jensen's 'default hypothesis' of between-population differences in cognitive ability

In his classic treatise on general mental ability (The 'g factor') Jensen (1998, 444) defines his default hypothesis on the nature of between-population differences in 'g' as follows:

> *"In brief, the default hypothesis states that the proximal causes of both individual and population differences in heritable*

> *psychological traits are essentally the same, and are continuous variables. The population differences reflect differences in allele frequencies of the same genes that cause individual differences. Population differences also reflect environmental effects, as do individual differences, and these may differ in frequency between populations, as do allele frequencies."*

Major arguments in favour of the hypothesis of the implication of genetic factors as partial explanation for between-population differences in measured intelligence relate to: within- and between-population heritability; regression toward the mean in different populations; the absence of between-population bias in intelligence tests; the relationship linking between-population differences and g-loadings of the tests; shared and non-shared environmental effects in between-population differences; population-genetic admixture; cross-population adoption; between-population differences in brain functioning; and secular changes in the between-population intelligence differences:

- ➢ With regard to 'heritability', it has been argued that populations that have been isolated for many generations have a high probability of differing in their gene pools from the parent population, and consequently are likely to show differences in any phenotypic characteristics having high heritability. Although it is acknowledged that heritability within groups cannot empirically prove heritability between group means, within-group evidence does imply the plausibility of the between-groups differences being due to the same factors, genetic or environmental (Jensen, 1969). In a recent, more sophisticated argumentation Jensen (1998) shows that the absence of between-population heritability, in the presence of strong within-population heritability, would require much higher degrees of between-population environmental variation than are empirically observed. Regarding the heritability of performance on mental tests, some evidence has been found suggesting a lower heritability of intelligence for African Americans than for European Americans (cf., Scarr-Salapatek, 1971), but most studies show that it is about the same for both populations or possibly slightly lower in the African American group, and definitely lower in the lower social strata of both populations (cf. Osborne, 1980; see also Loehlin *et al.*, 1975; Jensen, 1998). Several researchers, using structural equation modeling to dissect phenotypic mean differences into their genetic and environmental components, found that the observed IQ test differences were best explained by both genetic and environmental factors (Rowe, 1994; Rowe *et al.*, 1994; Rowe and Cleveland, 1996; Ree and Carretta, 1995; Jensen, 1998).

- As far as concerns 'regression toward the mean' – a well-known phenomenon in genetics – a purely environmental theory of between-population differences in intelligence would imply the absence of just such regression. Now, it appears that African American children show, just as do European American children, regression toward the population mean of their parents IQ (Scarr, 1971). Moreover, as expected from genetic theory, regression toward the mean is greater for African American children with high IQ parents and siblings and less for African American children with low IQ parents and siblings in comparison with European Americans. This is because, for a given parental or sibling IQ, regression occurs about halfway to their population mean (Jensen, 1998). Also interesting is the fact that the parent-offspring or sibling correlations for IQ lie somewhat below the theoretical genetic value of 0.50 in both populations, indicating that non-genetic factors affect the correlations similarly in both populations (Jensen, 1973; 1998).
- Regarding IQ test results, research has disproved the claim that African Americans' mental abilities are underestimated because mental tests are biased against them (Jensen, 1998; Gottfredson, 2005). African Americans perform most poorly, relative to European Americans, on culture-fair tests such as Raven's Progressive Matrices and Cattell's Culture Fair Intelligence Test, which are highly loaded on the general factor of intelligence and show a high heritability. Moverover, the test score differences between African and European Americans are positively correlated with the g-loadings of the tests (Jensen, 1985; 1987; Roth *et al.*, 2001). The same was found for the reaction time performance for elementary cognitive tasks (Vernon and Jensen, 1984).
- As far as concerns the effects of socio-economic status (SES) differences, behaviour-genetic research suggests that relatively little of the difference between African Americans and European Americans in adult measured intelligence is due to shared family factors (such as poverty or parents' education) (Jensen, 1998; Gottfredson, 2005). Moreover, the average IQ differences between African and European Americans continue to persist after controlling for (attained) SES. This reduces the mean group difference in measured intelligence by only about one third, or around 5 IQ points (cf. Shuey, 1966; Gordon and Bhattacharya, 1994). Also, the higher proportions and rates of mental retardation (IQ < 75) amongst African Americans than amongst European Americans has been found to be independent of SES; in other words, equally high figures are found within the higher social strata as within the lower strata (Jensen, 1973). Virtually all social science claims

that parental rearing practices and quality of socioeconomic resources influence intelligence measures rest on studies that confound genetic and nongenetic influences – an example of the so-called sociologist's fallacy (Scarr, 1997). Indeed, due to social assortment resulting from social mobility (see Chapter 7), attained SES iself has a large genetic component, resulting in a genetic correlation between SES and IQ. Whatever remains after controlling for SES between two populations does not represent a wholly environmental effect (Jensen, 1998). There is also basically no evidence supporting for the more recent culture-only claims that more subtle and more race-specific psychological factors such as racism-depressed motivation, racial stress, race-based performance anxiety ('stereotype threat'), and low self-esteem are the root causes of group differences in cognitive performance (Jensen, 1998; Gottfredson, 2005).

- Some investigations about race admixture show that hybrid offspring have intelligence measures scores between those of the two parental groups (cf. Weinberg *et al.*, 1992; Lynn, 2002; Rowe, 2002). Modest correlations also have been found between intelligence levels and degree of European admixture in the African American population supporting the hypothesis of a partial genetic explanation for the differences between African and European Americans (cf. Shuey, 1966; Lynn, 2002; Rowe, 2002). However, environmental factors, related to a decrease in discriminatory practices with increasing paleness, should not be excluded from contributing to this correlation. Studies on the relationship between IQ and skin colour as a measure of the amount of African-European admixture, ranging from 0.12 to 0.30 (Jensen, 1973; Lynn, 2002), point in the same direction, but Jensen (1998) argues that this relation may rather be due to cross-assortative mating. In some cases, the effects of race admixture may even be the result of heterosis (cf. Eyferth, 1961; Nagoshi and Johnson, 1986).
- The IQs of adopted African American children in European American families are more similar to those of their biological mothers than to those of their adoptive mothers (Scarr and Weinberg, 1976; 1983). The same pattern of results has been observed amongst Korean and Vietnamese children adopted into European-American homes (cf. Clark and Hanisee, 1982; Frydman and Lynn, 1989).
- Several morphological and physiological indicators of brain size and functioning have been found to correlate significantly with IQ: brain weight or volume, measured by various methods such as MRI, PET, endocranial volume from empty skulls, wet brain weight at autopsy, and external head size measures (cf. Van Valen, 1974; Andreassen *et*

al., 1993; Jensen, 1994; Rushton, 1995; Posthuma *et al.*, 2002; Haier *et al.*, 2004; McDaniel, 2005), glucose metabolism (Parks *et al.*, 1988), and average evoked potential (Lynn and Vanhanen, 2002; Rushton, 2003).

- So far, intervention programmes have not eliminated or permanently reduced the mean African American and European American group difference in IQ (cf. Spitz, 1986; Currie and Thomas, 1995). Nationally representative data on racial and ethnic IQ differences during the twentieth century provide no evidence that the gap between African Americans and European Americans in mesured cognitive ability has narrowed. Although the Flynn effect implies the possibility of improving test scores, especially at the low end of the IQ distribution, the 'g'-factor is independent of the Flynn effect (Rushton and Jensen, 2005).

The 'culture only' hypothesis of between-population differences in cognitive ability

Arguments made by scholars refuting the hypothesis of a partially genetic determination of between-population differences in general cognitive ability fall into two major categories:

(1) The contesting of basic concepts such as race, heritability, the 'g'-factor in cognitive ability, and the measurement of intelligence, on which the hypothesis of partial genetic influence on between-group population differences in measured intelligence is based;

(2) Asserting that differences in measured intelligence between population groups can be explained by the accumulation of differences in educational, cultural, social, political, psychological and biological living conditions.

For the first category the following arguments have been brought to the fore:

- Regarding the race concept, it is argued that in the human species, races don't exist. In its common usage, the term race has no biological basis, but is a social construct (e.g. Gould, 1996; Templeton, 1998; Lewontin, 2000; Graves, 2001; Tate and Audette, 2001; Biondi and Rickards, 2002; Brace, 2002; Cooper, 2003; Kittles and Weiss, 2003; Long and Kittles, 2003; Sternberg *et al.*, 2005). Moreover, the use of the term 'group differences' in referring to patterns of intelligence scores amongst racial-ethnic populations ignores the reality that individual scores overlap between groups and perpetuates the myth that nearly everybody within one racial-ethnic group performs higher than practically everybody within another group (Suzuki and Valencia, 1997).

- The study of heritability within groups is uninformative for the understanding of heritability differences between groups (cf. Lewontin, 1970; 1972; 1982).
- Regarding the concept of intelligence, it is argued that there is no ‘g’ (= single general factor of intelligence) (cf. Sternberg *et al.*, 2005), that intelligence tests don’t measure innate cognitive ability but reflect culturally acquired skills and behaviours (cf. Ogbu, 2002), that intelligence is not inherited (cf. Kamin, 1974), and that molecular genetics has not yet identified genes linked to intelligence in general, thus failing to demonstrate a compelling genetic link between race and intelligence (Sternberg *et al.*, 2005).
- Furthermore, it is argued that it has been shown that substantial increases in IQ test performance have been observed in many countries (Flynn, 1984; 1987). Cognitive abilities therefore appear to be malleable: individual IQ can be raised by 8 to 25 points (cf. Ramey and Ramey, 1998; Barnett and Camilli, 2002). The differences in IQ test performance between African and European Americans have decreased considerably in recent decades (cf. Hedges and Nowell, 1998; Grissmer *et al.*, 1998). Racial and ethnic differences in IQ reflect only a small part of intelligence as a totality, and the best evidence suggests that the differences are largely or entirely environmental in origin (Sternberg *et al.*, 2005).

For the second category the following elements have been advanced:

- First of all, it is argued that a large body of literature has documented that environmental process variables (such as e.g. parental attitudes and parent-child interaction patterns) account for a substantial proportion of the variance in intellectual performance and academic achievement (e.g., Marjoribanks, 1979; Henderson, 1981; Laosa and Sigel, 1982; Gottfried, 1984; Laosa and Henderson, 1991).
- Minority status, not race causes low IQ test scores. Minority groups such as African Americans suffer from exclusion from cultural amplifiers, segregation, inferior education, and job discrimination. Voluntary and involuntary minorities show differences in measured intelligence and scholastic achievements (cf. Ogbu, 2002).
- Discriminated groups also suffer from expressive discrimination, internalisation of the dominant-group beliefs about the inferior status of subordinate groups (Ogbu, 2002), and racial stigma (Loury, 2001).

Stereotype threats[3] can depress standardised test performance of a variety of groups for whom stereotypes allege inferior abilities in some domain (cf. Steele, 1997; Aronson, 2002; Wicherts *et al.*, 2005). Lower IQ test results are also partly the consequence of resistance to the dominant-group culture (e.g. Ogbu, 2002).

- The racial/ethnic differences in cognitive performance are mainly due to differences in attitudes, aspirations, self-images, and societal stereotypes (Sowell, 1994; Loury, 2001; Ogbu, 2002).
- When US Blacks and Whites are given equal opportunity for exposure to information that conveys to them the meanings of new words, no differences in knowledge have been observed, supporting the assumption that exposure to information, rather than intellectual ability, may account for racial differences in IQ (Fagan and Holland, 2002). Performance on a highly g-loaded task (such as Raven's Standard Progressive Matrices) can be improved significantly through mediated learning experiences. African American students, by virtue of their sociopolitical history, are especially likely to have been deprived of mediated learning experience (Skuy *et al.*, 2002). Whereas IQ fails to show stable gains over time, compensatory preschool education for children in poverty improves cognitive abilities during early childhood and academic achievement and school success over the long run (cf. Barnett and Camilli, 2002).
- There are no differences in measured intelligence according to the degree of African-European racial admixture (cf. Scarr *et al.*, 1977).
- The majority of studies in the United States on US black children adopted by white parents tend to support environmental interpretations of group differences (Nisbett, 1998).
- Since culture affects nearly all psychological phenomena, it is entirely possible that biological indicators of intelligence are also affected (Suzuki and Aronson, 2005).
- The differences in measured IQ between African Americans and European Americans have decreased in recent decades (cf. Williams and Ceci, 1997; Jencks and Phillips, 1998; Neisser, 1998).
- Asians are not genetically superior to other racial/ethnic groups, but relative functionalism accounts for the high achievement of Asian Americans beyond their measured IQ (Sue and Okazaki, 1990).

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[3] Stereotype threats = anxiety regarding one's performance in a particular domain of social life based on negative stereotypes that exist in reference to one's group.

Drawing conclusions about the genetic-environmental controversy over between-group differences in cognitive ability

First of all, its should be stressed that the so-called genetic-environmental controversy over between-group differences in cognitive ability is largely an asymmetrical matter (Nyborg, 2003). Researchers who favour an exclusively environmental explanation oppose behavioural geneticists and educational psychologists supporting a mixed genetic-environmental hypothesis or theory based on empirical or experimentally controlled data and analyses. Those taking the 'mixed' position are often the subject of viscious *ad hominem* attacks by ideologically motivated opponents moved by self-assumed moral authority, undoutbedly driven by feelings of social responsibility and care for the disadvantaged, as argued for example by Pearson (1996) and Sesardic (2000).

Factual, objective and well-balanced publications on the relative contributions of genes and the environment to racial and ethnic differences in performance on intelligence test (in the United States) and their social and scientific implications are rare. Although published several decades ago, 'Race Differences in Intelligence' by Loehlin, Lindzey and Spuhler (1975) remains a renowned classic in this domain. Their careful evaluation of the then-available evidence resulted in the following conclusions (Loehlin *et al.*, 1975, 238–239):

> *(1) "observed average differences in the scores of members of different US racial-ethnic groups on intellectual-ability tests probably reflect in part inadequacies and biases in the tests themselves, in part differences in environmental conditions among the groups, and in part genetic differences among the groups. It should be emphasised that these three factors are not necessarily independent, and may interact;*
>
> *(2) A rather wide range of positions concerning the relative weight to be given to these three factors can reasonably be taken on the basis of current evidence, and a sensible person's position might well differ for different abilities, for different groups, and for different tests;*
>
> *(3) Regardless of the position taken on the relative importance of these three factors, it seems clear that the differences among individuals within racial-ethnic (and socio-economic) groups greatly exceed in magnitude the average differences between such groups."*

Now, several decades later, although much additional relevant scientific evidence has accumulated, the obvious scientific uncertainty about the relative contribution of genetic and environmental factors to between-population differences in innate cognitive ability has not been completely removed. The scientific community remains clearly divided on this matter (cf. Snyderman and Rothman, 1988). For instance, a public statement on 'Mainstream Science on Intelligence' published in *The Wall Street Journal*, on December 13, 1994 and signed by 52 internationally known experts on intelligence and allied fields (Gottfredson, 1994), stated that

> *"There is no definitive answer to why IQ bell curves differ across racial-ethnic groups"… "Most experts believe that environment is important in pushing the bell curves apart, but that genetics could be involved too."*

But a report of a task force established by the Board of Scientific Affairs of the American Psychological Association, released August 7, 1995, concludes (Neisser *et al.*, 1996):

> *"The differential between the mean intelligence test scores of Blacks and Whites (about one standard deviation, although it may be diminishing) does not result from any obvious biases in test construction and administration, nor does it simply reflect differences in socio-economic status. Explanations based on factors of caste and culture may be appropriate, but so far have little direct empirical support. There is certainly no such support for a genetic interpretation. At present, no one knows what causes this differential."*

Likewise, Nisbett (1998; 2005) reached the conclusion that "the most relevant studies provide no evidence for the genetic superiority of either race". At the same time, in a well documented review of both the 'culture-only' (0 percent genetic–100 percent environmental) and the so-called 'hereditarian' (50 percent genetic–50 percent environmental) models of the causes of differences in mean African American and European American cognitive ability, Rushton and Jensen (2005) conclude that genetic and cultural factors carry the exact same weight in influencing the mean differences in IQ as they do in causing individual differences in IQ.

It is quite likely that those who advocate a partial genetic hypothesis to explain between-population differences in measured cognitive abilities undervalue the cumulative impact of unfavourable educational, social, economic, cultural, psychological and political living conditions and life experiences on the performance of socially discriminated minority groups. At the same time, the arguments that aim to refute the hypothesis that genetic factors are partially responsible for between-group differences in measured intelligence are often weak and socially or politically even counterproductive. Moreover, they often blatantly distort the so-called 'hereditarian' thesis which is, by the way, anything but exclusively hereditarian. An extreme example of scientific distortion in this field is Gould's (1981) 'Mismeasure of man' (cf. Jensen, 1982; Carroll, 1995; Rushton, 1997; Sesardic, 2000; Nyborg, 2003; Oeijord, 2003). Meanwhile, the carefully developed and scientifically well-argued writings and nuanced conclusions made by Jensen in his early publications on between-population differences in cognitive ability (Jensen, 1969; 1973) and in his recent classic on the g-factor (Jensen, 1998) have never been convincingly refuted by facts and figures.

Arguments that human races don't exist or are merely social constructs, that intelligence tests don't measure innate cognitive abilities, that heritability of intelligence is zero, and that there is no g-factor in intelligence are not only scientifically indefensible, but they are also socially and politically unwise. Those who refuse to take into account important and substantiated facts run the risk of losing credibility on all accounts and/or wasting efforts on actions that are not fully knowledge-based.

This does not mean that the hypothesis of partial genetic influences on between-population differences in cognitive ability is not amenable to further precision, particularly regarding the degree of genetic influences, and the nature of the environmental determinants of those differences. For instance, the phenotypic IQ differences between populations that are genetically closely related (e.g. American Indians and East-Asians; African Americans from different regions in the United States; Americans of European ancestry and Hispanic Americans) need further explanation. Concerning the nature of environmental influences on between-population differences in cognitive ability, the striking fact is that the empirical data point mainly to the influence of non-genetic biological life course events, such as low birth weight and prematurity, obstetric complications, breastfeeding, nutritional deficiences, and other micro-environmental factors that produce within-family variance, and not to shared socio-economic living conditions that result in between-family differences (Jensen, 1969; 1998).

In conclusion, the hypothesis of a partial genetic explanation for between-group differences in cognitive ability can not (yet) be discarded (cf. Rowe, 2005; Gottfredson, 2005). It can be expected that future progress in molecular genetics will allow for more precise analysis of the questions of within- and between-population variation in cognitive ability (Rowe, 2005).

Evolutionary explanations for the origin of between-population differences in cognitive ability

As argued above, different ecological and cultural living conditions may have a differential effect on the selection of particular traits. In some environments particular physical abilities, and in others specific mental abilities, may be more strongly favoured and thus selected.

Some authors have tried to explain the significant three-way IQ differences among Blacks, Whites, and East Asians as a result of evolutionary adaptations to climatic differences (cf. Beals *et al.*, 1984; Lynn, 1991; 2006; Rushton, 1995; Templer and Arikawa, 2006) and/or to the evolutionary novelty of their locations of origin, measured by the distance of various locations from the ancestral environments in which each racial variant emerged (Kanazawa, 2004; 2008). These evolutionary theories about the implications of the selective effects of climate on human intelligence for the cultural development of particular population-genetic variants have been questioned and criticised, however, even by scholars who are not averse *a priori* to evolutionary explanations of between-group variation (cf. Mackintosh, 2007; Meisenberg, 2006).

Another evolutionary explanation for some between-population differences in measured intelligence might be found in selective migration, as the superior athletic performance of African Americans compared to Americans of European descent suggests for physical traits (Entine, 2000; Harpalani, 1998; Goldberg, 1990). Moreover, the horrendous living conditions on the slave ships sailing to the Americas, as well as the living conditions for slaves on the American plantations, must have exerted profound additional selective pressures on the physical constitution of the slave population, screening out the weak as well as many of the more able revolting (cf. Postell, 1970; Dunaway, 2003; Berlin, 2003).

IN-GROUP/OUT-GROUP BEHAVIOUR

Typology

Between-population relations often go hand in hand with attitudes and forms of behaviour characteristic of the in-group/out-group syndrome[4]. This concept bundles all possible forms of social behaviour for situations in which social entities are opposed to each other, and is characterised by a variety of attitudes or feelings of alienation but can also be associated with attitudes and forms of behaviour that involve feelings of superiority versus inferiority and can even be a source of latent or open animosity. The in-group can be defined as a couple, a nuclear or extended family, a circle of friends, a sports club, a clan, a tribe, a social class, a religious or philosophical group, a linguistic group, a cultural

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[4] Syndrome: a group of symptoms that together are characteristic of a specific behaviour, disorder, or disease.

community, a nation, a race, or a species. Opposite to the in-group stands the antagonistic out-group, the strangers, the 'others'.

Typical (and often closely related) forms of in-group/out-group relations for between-population relations include ethnocentrism, xenophobia, and racism (Reynolds *et al.*, 1987; Thienpont and Cliquet, 1999).

The term 'racism' describes the belief that genetic differences between human populations, determining particular socially or culturally relevant biological and psychological qualities, justify and legitimate making a discriminating distinction between people belonging to or descending from those populations, and thus trreating them differently. Nevertheless, in everyday language the concept of racism often has a much broader meaning, as Bourdieu (1997, 87) wrote:

> *"Il faut avoir à l'esprit qu'il n'y a pas un racisme, mais des racismes: il y a autant de racismes qu'il y a de groupes qui ont besoin de se justifier d'exister comme ils existent, ce qui constitue la fonction invariante des racismes."*[5]

However, from an etymological point of view, the concept of 'racism' should be limited to the discriminating relations between genetically distinguishable population groups. Race is a biological concept and should not be confounded with concepts such as ethnicity, religion, nation, or state.

Contrary to what one can find in many publications and even in respectable encyclopediae (such as the Oxford English Dictionary, Merriam-Webster's Dictionary, and Macquarie Dictionary), racism should also not be equalised with views about differences between races, and even less with the study of race or the scientific observation of genetic differences between populations, just as sexism should not be affiliated with research about sex, or ageism with the study of age.

The United Nations 'International Convention on the Elimination of All Forms of Racial Discrimination' of 7 March 1966 defines the term 'racial discrimination' as

> *"any distinction, exclusion, restriction or preference based on race, colour, descent, or national or ethnic origin which has the purpose or effect of nullifying or impairing the recognition, enjoyment or exercise, on an equal footing, of human rights and*

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[5] *"One must be aware that there is not one racism, but that there are many racisms: there are as many racisms as there are groups that have the need to justify themselves for existing as they exist, which constitutes the invariant function of racisms."* (author's translation)

> *fundamental freedoms in the political, economic, social, cultural or any other field of public life.”*

This is a correct definition in terms of discrimination, although by adding ‘national or ethnic origin’ the definition far exceeds the biological concept of race.

Ethnocentrism refers to feelings of loyalty toward one’s own cultural community, usually coupled with negative attitudes toward other, different communities. Ethnocentrism is a broader concept than racism, because different types of qualities can characterise culturally identifiable groups: language, values, norms and customs, religion, etc. Obviously, ethnocentrism and racism often coincide, because many culturally different entities also show (some) biological specificities due to historical developments related to population-splitting and isolation, as explained above. When ethnicity is politicised, it transmutes to nationalism with political aspirations for autonomy, holding the nation-state as the ideal political formation (Van den Berghe, 1999).

Xenophobia (<Greek: xenos = strange, foreign; phobos = fear) concerns feelings of fear or aversion of, if not hatred for, foreigners. Xenophobia is simply the flip side of the same coin as ethnocentrism, although it doesn’t derive inevitably from ethnocentrism. One can be ethnocentric without detesting others. Ethnocentric feelings can, obviously, turn into hostile feelings as a consequence of negative experiences with neighbours (Van den Berghe, 1999).

The cultural history of racism, ethnocentrism, and xenophobia

According to scholars such as Comas (1958) and van den Berghe (1978) racism is a relatively new phenomenon, mainly linked to the encounter of populations over long distances during the last 500 years. In contrast to ethnocentrism, it is not of a universal nature.

If one understands racism in terms of the pseudo-scientific racialist theories that developed in the wake of the emerging biological sciences in the 1800s, in particular of Darwinism, one can fully endorse this view. However, when one considers racism from a behavioural point of view, it appears to be much older and universal (cf. Rushton, 1995; Sarich and Miele, 2004). In ethnology, many examples are known of peoples that call themselves ‘humans’ and designate their neighbours, the foreign others, with a nickname that suggests inferiority, for instance, ‘*οί βάρβάροί*’ in Greek and ‘*yi*’ in Chinese (Cameron, 1989). In some cases – such as the Old Testament, the writings of Aristotle (384BC–322BC), Ibn Khaldun (1332–1406), Al-Abshibi (1388–1446), and others – explicit reference is made to descent, but in most cases one can only guess whether sentiments of alleged superiority of the in-group are motivated by cultural or biological elements. Biological or ethnic, the ‘others’ were, irrespective of their features, and according to economic necessity, enslaved or subjected to genocide. The only reason why, statistically speaking, racism was less common than ethnocentrism before the great European voyages of discovery was because most encounters with other populations were with biologically closely related neighbouring groups, whereas most people were less acquainted with biologically significantly different populations from other continents.

With the development of modern science, the first racial classifications emerged. According to Poliakov (1986) they were invariantly racist in nature: the classifications of Bernier (1684), de Buffon (1749–1804), and Linnaeus (1758) are all of a hierarchical nature, concerning physical differences but focusing on psychological and even moral qualities. The line of thought of enlightened philosophers such as Voltaire, Kant, Goethe, Fichte, and Hegel went in the same direction. Hence, Poliakov (1986) speaks about ‘*le préracisme des Lumières*’.[6]

Although count de Boulainvilliers argued as early as 1727 that the French aristocracy descended from a superior race of dolichocephalic nordic Franks, the first extensive treatise in which race is considered as the primary pacesetter of history, also from the hand of a French aristocrat, dates only form 1853–1855: it concerns the notorius treatise of de Gobineau entitled ‘*Sur l’inégalité des races humaines’*. After this, numerous identical works appeared in other European countries and in America (including de Lapouge, 1899; Chamberlain, 1911; Stoddard, 1920; Grant, 1921; Günther, 1922; Rosenberg, 1934). All advanced the thesis of the superiority of the so-called Aryan race as the motor of cultural innovation and progress. In Germany this myth was made to the fundamental doctrine of National Socialism and formed the pseudo-scientific justification for the genocide of the Jews, gypsies, and other allegedly inferior races.

Although most of the above-mentioned Aryan racialist theoreticians were no scientists, it must be mentioned and humbly admitted that, especially in Nazi Germany, some scientists contributed to the further establishment of this myth. They bear a great deal of responsibility for the murder of millions of people who, notwithstanding their alleged racial inferiority, were socially stigmatised by being required to wear a Star of David to be recognised. The role of racialist scientists in Nazi-Germany has been extensively documented, amongst others by Saller (1961), Proctor (1988), Müller-Hill (1998), and Weigmann (2001).

Racist theories usually show the following common characteristics:

- Races can be ranked hierarchically, with a distinction between superior and inferior races;
- There is a strong belief in genetic determinism;

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[6] *“The pre-racism of the Enlightenment”*

- All cultural signs as well as customs and mores, are considered to be genetically determined;
- Racial admixture results in biological degeneration;
- Sociological dominant/subordinate relations result from genetic superiority/inferiority and/or racial purity/admixture.

Behavioural patterns related to in-group/out-group relations

Groups of individuals that distinguish themselves through sociological dominant/subordinate relations in pluri-racial or pluri-ethnic societies are often characterised by the following distinctions:

- Differences in social status;
- Differences in opportunities for social mobility;
- Differences in economic prosperity;
- Differences in political power;
- Differences in rights and privileges;
- Presence of a superiority or inferiority complex, respectively.

Such sociological dominant/subordinate relations can coincide with genetically different groups, such as those between Americans of European and African ancestry in the United States; Tutsi and Hutu in Ruwanda and Burundi. But such differences are often only characterised by linguistic, ethnic or religious characteristics, as between the French and Dutch linguistic groups in the formerly unitary Belgium; Turks and Kurds in Turkey; Serbs, Croats and 'Muslims' in the former Yugoslavia; and Protestants and Catholics in Northern Ireland. The same relations can be found between merely socio-economic groups (= social classes) and in many countries such dominant/subordinate relations also exist according to sex and gender. Hence, as Bourdieu (1997) wrote, different 'racisms' can be distinguished, and in each case theories and myths have been developed aimed at giving the sociological group differences a genetic, and therefore an allegedly unchangeable, foundation.

The presence of an inferiority complex amongst sociologically subordinate or discriminated groups requires some explanation. It is a well-known phenomenon that different forms of 'racisms' are accompanied by attempts by the subordinate group to adopt the characteristics of the dominant group; examples of this can include: the common practice amongst African Americans a few decades ago of marrying a pale partner; the desire of the Flemish petty bourgeois to Frenchify in the pre-federal Belgian state; the bourgeois imitative behaviour of working class families in most industrial countries; and the masculine imitative behaviour of many present-day feminists. The only groups who make an exception for this assimilation drive are religious groups. Such groups are, as a matter of fact, subject to indoctrination about the valuation of their own features and qualities and often display a feeling of ideological superiority about belonging to ‘the chosen ones’, and show contempt for others, such as unbelievers, pagans, religious dissidents, etc. (Cliquet and Thienpont, 2005).

The inferiority complex of sociologically subordinate groups, however, depends largely on the emancipatory phase they are in. Simpson and Yinger (1953) distinguished four major emancipatory strategies amongst subordinate groups:

1. The assimilationistic strategy: the subordinate group desires to merge into the dominant group;
2. The pluralistic strategy: the subordinate group wishes to be integrated into a pluralistic and tolerant society on an equal basis with other groups;
3. The secessionistic strategy: the subordinate group strives for cultural and political independence;
4. The militant strategy: the subordinate group evolves from an egalitarian toward a dominant strategy.

The inferiority complex manifests itself most saliently when the subordinate group is still in its assimilationistic emancipatory phase: it wishes to renounce to its own specificity and merge into the dominant group. In the pluralistic and secessionistic phases, the inferiority complex weakens and, at least theoretically, disappears. In the militant phase, the inferiority complex transitions into a superiority complex.

Explanations for sociological dominant/subordinate relations

As already argued, racialist theoreticians explain the existence of sociological dominant/subordinate relations as the consequence of genetic differences between the populations involved, either as a result of differences in allele frequencies, or as a function of the degree of hybridisation. One cannot be sufficiently incredulous in reaction to the superficiality and lack of criticism displayed by the authors of the above-mentioned, often voluminous racialist tracts displayed.

As a matter of fact, there is no sustained relationship between the development of an advanced culture and membership in a particular population-genetic unit. For instance, the ancient cultures of classical antiquity of China, India, Mesopotamia, Egypt, Greece, and the Roman empire developed in particular ecological, political and cultural circumstances, but were quite soon overwhelmed by populations which were, in those times, considered backward barbarians, while the populations of classical antiquity dissolved into anarchy and underdevelopment. Such changes cannot be due to genetic processes which would require much more time to evolve.

Even a brief glance at the diversity of sociological dominant/subordinate relations described in the literature reveals that genetic factors are unlikely to be the common explanatory factor for the social position of African Americans in the United States, Catholics in Northern Ireland, Flemings in pre-federal Belgium, labourers in the nineteenth century industrial world, or women in the pre-emancipatory era of modern culture. The common factor in all of those situations is more likely to be found in the particular historical combination of favourable or unfavourable political, cultural, economic, and possibly also ecological conditions that forced a particular genetic, ethnic, social or sexual group into a position of underdevelopment, neglect, and/or exploitation.

Inferior and superior populations?

The belief in the innate superiority of one's own tribe – namely genetically higher value, merit or quality – in comparison with neighbouring tribes, or of one's own nation or 'race' compared to other nations or races, is probably as old as our species (Zuckerman, 1990). However, do such beliefs have any scientific foundation?

The question whether there are genetically inferior and superior populations can easily be answered on the basis of evolutionary theory. From such a viewpoint 'inferior' and 'superior' can only mean that a population is poorly or well adapted to the environment in which it evolved. Hence, genetic inferiority and superiority cannot be defined in absolute terms. Adaptation must always be viewed in terms of functionality within a particular environment.

As explained above, populations that reside for a long time in a particular ecological environment will, under the influence of selective processes, undergo adaptive modifications. For instance, in many respects Eskimid populations are morphologically and physiologically well adapted to polar climatic circumstances. Without any doubt they display superior traits compared to the occasional Europid or Negroid polar traveler whose constitutional and dermatological characteristics are adapted to rather different climatic environments. In the same way, the slender, dark-skinned Negroids are much better adapted to living and working in tropical climatic surroundings than the depigmented Europid populations. Even mutations such as the S-hemoglobin (sickle-cell anemia), which is in itself unfavourable, can, under particular conditions, such as in malaria-infested regions, have a relative advantage because, in heterozygous combination, they provide superior protection against the malaria parasite. Populations that are adapted to particular environmental conditions can, obviously, experience a relative disadvantage when they migrate to totally different environments. Negroids are more vulnerable in cold climates, as Europids have a more difficult time in the tropics.

The question of the existence of inferior and superior populations has also been raised with respect to between-population differences in susceptibility to genetic diseases. The presence of such differences constituted one of the best-known racist arguments for discrimination against Jews (cf. Kohn *et al.*, 1999; Cochran *et al.*, 2006). The relatively more common incidence of some genetic diseases amongst Jewish populations is caused by the demographic bottlenecks they experienced since the diaspora, as a consequence of the many persecutions and attempts to exterminate them. Such bottlenecks are associated with the 'founder-effect' and genetic drift of genes. Moreover, small isolated populations have a larger risk of inbreeding and consequently of the formation of homozygous genotypes through which unfavourable recessive alleles become visible.

The crucial question whether there are also between-population differences in intelligence has been discussed above. As argued, the hypothesis of a partial genetic explanation for some of the average differences cannot, as yet, be excluded, but the much more substantial difference in measured intelligence found within-populations, as opposed to between-population variation, makes it impossible to establish population-linked dichotomies or hierarchies of the potentiality for cultural creation or performance.

EVOLUTIONARY EXPLANATIONS FOR THE IN-GROUP/OUT-GROUP SYNDROME

Many explanations have been given for phenomena such as racism, ethnocentrism and xenophobia (e.g. Banton, 1987). Some explanations emphasise individual personality characteristics (e.g. Adorno *et al.*, 1950) or other individual life experiences such as frustration and aggression (e.g. Dollard *et al.*, 1939), whilst other explanations situate the causes mainly in social processes (e.g. Cox, 1948). The formation of effective group alliances obviously has many advantages, especially in situations of between-group competition (cf. Silverman and Case, 1998), and in-group alliances can easily lead to in-group egoism (cf. Tullberg and Tullberg, 1997).

But why are in-group/out-group relations so strongly linked to similarities between the members of the in-groups and dissimilarities with members of the out-groups? And why do the similarities and dissimilarities apply to phenotypic as well as to social and cultural characteristics?

The different psychological and sociological explanations for the in-group/out-group syndrome are not necessarily incorrect or even contradictory, but they do not penetrate to the deeper underlying drives, the ultimate factors that lie at the bottom of in-group/out-group antagonisms and conflicts. Indeed, the universality and pervasiveness of these processes cannot be overestimated. In the 'Environment of Evolutionary Adaptedness' (EEA), the primary hostile force of nature in human evolution was, and perhaps still is, other human beings inducing between-group competition. In bio-anthropology, the human mind is increasingly seen as an adaptation to dealing with other people rather than with ecological environments (Alexander 1979; 1987; Van der Dennen, 1995; Thayer, 2004). And yet, the explanations usually concentrate on the proximate psychological or social needs of individuals. A biological explanation based on human evolution, in contrast, returns to the fundamental origins of these forms of behaviour: genetic selfishness grounded in kin selection theory, reciprocity theory, and similarity theory.

Kin selection theory

As explained in the introductory chapter, the evolutionary analysis of social behaviour in animals received its crucial impetus in the resolution of a problem that puzzled Darwin and remained a fundamental theoretical problem for evolutionary biology until William Hamilton (1963; 1964) formulated the model of 'inclusive fitness'. As has been demonstrated, an individual acting in an altruistic way reduces his or her chances of survival and reproduction and therefore represents a genotype that will be selected against. How can altruistic behaviour spread in the population if it is reproductively disadvantageous? The key to resolving the paradox lies in the fact that relatives have a proportion of genetic material in common: brothers and sisters share on average 50 percent of their genetic material, grandparents and grandchildren share 25 percent, etc. Altruistic behaviour can therefore be readily selected for, as long as the benefits of the altruistic act (the proportion of genetic material being transmitted to subsequent generations as a consequence of the altruistic act) outweigh the costs (the reduction of individual procreation by the altruist). This kin selection is the central tenet of the inclusive fitness model.

Probably the most logical inference of the inclusive fitness model is that humans evolved to be exceedingly effective nepotists (Van den Berghe, 1978; Alexander, 1979). The word nepotism derives from the Italian 'nipoti' which refers to any family descendent; in Latin 'nepos' stood for grandson or nephew. Nepotism is defined as favouritism shown to relatives. Behaving nepotistically, namely by favouring one's own kin, increases the probability of enhancing one's inclusive fitness by favouring the reproduction of the genes one shares with the recipient of one's altruism. In modern, 'post-kinship' society, where individual qualifications, irrespective of kinship relations, have become the instruments of and norms for assigning social status and mobility, nepotism has acquired a very negative connotation (Bellow, 2003).

The proximate biological mechanisms inducing nepotistic behaviour are probably manifold. Several genetic predispositions may be present, but various learning experiences with different kinds of people, relatives and others, causing positive and negative reinforcements and determining different degrees of relatedness by means of phenotypic markers, etc., may also be involved. Alexander (1979; 1987) suggested that social learning from parental care and social interaction form the proximate mechanism. Discriminative nepotism is also a function of positive reinforcement, dependent on the evaluation of social interaction. Both social interaction and evaluation thereof are partly determined by the phenotype of partners in social interaction, since phenotypic clues are important criteria for distinguishing kin from non-kin.

Van den Berghe (1978; 1981; 1999) applied kin selection theory and its behavioural result – nepotism – to ethnic groups which he considers to be extended kin groups, characterised by extended kin nepotism. This idea has, meanwhile, also been developed by several other scholars (cf. Johnson, 1986; Vanhanen, 1999; Jones, 2000; James and Goetze, 2001; Salter, 2001; 2003). Ethnic groups are populations that are characterised by cultural markers, but they are usually also defined by common descent and maintained by endogamy, the members of which are genetically more related to each other than they are to other ethnic groups. Ethnic groups are also characterised by ethnic sentiments that are nothing more than extended kin sentiments. Ethnic attitudes of nepotism and ethnocentrism increased the inclusive fitness of the members of an ethnic group. In human beings, the biological inclination toward nepotism is culturally extended by the capacity to create kin like attachments benefiting people who are not biological relatives (Bellow, 2003).

The strong human predisposition to socialisation and processes of indoctrination obviously facilitates the development and exploitation of ethnocentric feelings that are easily used and abused by ideological mentors and community leaders (Eibl-Eibesfeldt and Salter, 1998).

Reciprocity theory

In kin selection theory the fundamental guideline for behaviour revolved around the element of genetic relatedness. Trivers (1971) extended the theory of inclusive fitness to include altruistic behaviour toward non-kin. Natural selection benefits altruism when this altruism can be expected to be reciprocated in the future. A cost/benefit analysis will determine whether an individual will act altruistically or not. An individual's expectation that the beneficiary of his altruistic acts will reciprocate toward either himself or his relatives will determine the probability of an altruistic act. Selection will act against cheaters when the costs of cheating outweigh the benefits of the failing to reciprocate. This occurs when the altruist reacts to cheating by avoiding any future altruistic acts toward the cheater.

With his extension of the inclusive fitness model to non-kin, Trivers (1971) drew attention to the pivotal role of reciprocity in human social organisation. Axelrod and Hamilton (1981) suggested two mechanisms to explain the origin of reciprocal altruism. The first is a close genetic relationship between the actors, so that reciprocal altruism is initiated on the basis of kin selection. The alternative mechanism is the adoption of the Tit for Tat strategy, as developed by Axelrod (1984). He demonstrated that a simple game strategy based on reciprocal cooperative behaviour leads to a higher reproductive result than any other strategy. Interpersonal reciprocity as a social phenomenon has a long tradition of research within sociology (Homans, 1961), but with the development of the Tit for Tat model, the prevalence and universality of reciprocal behaviour as the cement of social organisation was shown to have a biological basis.

Reciprocity theory forms a strong additional foundation for Van den Berghe's thesis that ethnic and racial sentiments are extensions of kin and nepotistic sentiments.

Similarity theory

In making choices about partnership, selection of friends, and their way of living in general, people appear to enjoy being surrounded by persons with whom they share identical or similar traits, interests, hobbies, and convictions. This idea has been developed in the 'genetic similarity theory'. Although the fundamentals of the theory go back to Hamilton (1964), the most systematic formulation can be found in the work of Rushton and colleagues (Rushton *et al.*, 1984; Rushton and Nicholson, 1988). In a nutshell, the theory suggests that genetic similarity also serves as a basis for the development of mutually supporting social environments such as friendship, marriage, social relationships and even ethnocentrism. The underlying mechanism of the model consists of epigenetic rules[7], defined as a programme, complete with a self-correcting feedback

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[7] Epigenetic rules are inherited regularities of development that channel the interactions between genes and the environment during the development of an antomical, physiological, cognitive or behavioral trait in a particular direction. Examples of social phenomena that are thought to be particularly affected by genetic rules include altruism, aggressvity, emotional bonding, incest taboos, territorial defense, and facial expressions (see Lumsden and Wilson, 1981).

system, whereby individual development is guided in one direction rather than another.

Obviously, the tendency to choose similar partners, friends, associates and allies is also rooted in priordial familial dispositions which, in turn, originate in the drive toward securing and propagating the genetic self.

Research suggests the existence of in-group/out-group hierarchies is expressed as social distance in modern societies (cf. Hagendoorn, 1995; Parrillo, 2008). Relating several measures of country-level ethnic, linguistic, cultural, religious, and racial diversity (or ‘fractionalisation’) to the Gini index[8] in regression models with other predictors, Meisenberg (2007) found that ethnic diversity was slightly related to the Gini index ($r = 0.19$), whereas racial diversity showed a much higher correlation ($r = 0.43$). The effect of racial diversity persisted when controls for spatial and cultural factors were introduced.

Selfish gene theory as the basis for in-group/out-group antagonisms

The three above-mentioned theories – kin selection, reciprocity, and similarity theory – converge in inducing behavioural patterns that favour the intergenerational transmission of an individual’s own genes, either via kin or via more remotely related consorts. Selfish gene theory (Williams, 1966; Dawkins, 1976) is the ultimate, common denominator of these theories.

Undoubtedly there is still much to be learned about the precise proximate mechanisms – genetic, developmental, social learning and interaction – through which the innate drives operate that produce kinship relations and favour nepotism, extended kinship or non-kin relations characterised by markers of similarity (Brigandt, 2001). However, the idea that kin-related phenotypic markers of genetic similarity are extended to ethnic or other socio-cultural group characteristics in larger communities is empirically well-supported by research on the characteristics and behavioural patterns of group formation ranging from homogamous partner choice and sex- and age-related bonds to friendships, occupational units, and ideological (religious and political) groups, and ultimately ethnic and racial communities. Equally well-documented are the kin-extended sentiments of familiarity, solidarity, and support that may be confered to all groups with which individuals share markers of biological,

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[8] The Gini index is the Gini coefficient expressed as a percentage and measures inequalities in income over the whole range of incomes within a society: a low Gini index indicates more equal distribution of income or wealth whilst a high Gini index indicates more unequal distribution (Deaton, 1997).

social or cultural identity. The communality of various forms of behaviour lumped together under the in-group denominator is not limited to next of kin, but is instead defined by the degree of perceived relationship which can go far beyond any genetic affinity. The nepotistic drive is simply extended from kin to other forms of group identity that involves similarity in phenotypic, social, cultural, linguistic, religious, or political characteristics. It is interesting that the phenotypically weakest markers of similarity (ideological groups) make the strongest use of kin-related nomenclature categories – fatherhood, motherhood, brotherhood, sisterhood.

Balance of power theory

The cultural evolution of humankind, starting from the gathering/hunting stage, through the agrarian stage, to the industrial stage, favoured and even necessitated the increase in group size. According to Alexander (1979), the increasing size of human populations in all probability emerged quite early in hominid evolution, in part as a protection against other human groups. The further increase of the size of human societies, mainly in more recent cultural stages, can be explained on the basis of what Alexander called the 'Balance of Power' theory.

This theorys explains why the development of ever-larger groups gradually became more prominent in human evolution and history. The function of population size was not only protection against external threats such as raiding and predation by other human groups, but also as an instrument in the conquest of new territories and resources, especially in periods of scarcity. The size and the cohesion of the group were crucial for its success in inter-group competition. Competition induced more intensive cooperation within the groups and reinforced the power of in-group elites. A feedback loop emerged between the pressure for larger groups and more intensive cooperation within groups (Choucri, 1974).

It is only with the development of modern culture, with its technologically sophisticated weaponry that the demographic factor has lost some strength in determining the balance of power between groups. The demographic reflex in inter-group competition has shifted from the production of numerous offspring to the production of numerous devices of mass destruction resulting in the absurd present-day potential for global nuclear overkill and the paradoxical stalemate in which such devices actually have become too dangerous to be used.

In-group/out-group syndrome: maladapted to the novel environment of modern culture

In conclusion, humans have a propensity to favour kin, we form social groups on a basis of kinship (Hamilton, 1964), reciprocity (Trivers, 1974; Axelrod and Hamilton, 1981), and kin or non-kin similarity (Rushton *et al.*, 1984), and during the course of our evolution, the formation of large groups turned out to be a most advantageous strategy for survival and reproduction (Alexander, 1979). Viewing ethnicities as ‘superfamilies’ (Van den Berghe, 1978; 1999) makes it much more understandable why the universal and so-easily provoked in-group/out-group schisms are fundamental to our social life. There are, thus, not only proximate, but also ultimate advantages to groupism on the basis of kin or other (genetic or cultural) signs of similarity.

The evolutionary analysis of the in-group/out-group syndrome clearly shows that this was a successful strategy in the ‘Environment of Evolutionary Adaptedness’ (EEA). Small population units had survival and reproductive advantages; thus increasing their inclusive fitness via reinforcement of the in-group solidarity and cohesion, facilitated defensive or offensive actions against competing out-groups. Even in the agrarian phase of humanity’s cultural history, the more evolved forms of ethnocentric tribalism – patriotism and nationalism – had adaptive advantages.

In the novel environment which emerged from modern culture, with its means of mass destruction and its increased mobility and communication opportunities, leading to a globalisation of commerce, tourism, culture and politics, the historic in-group/out-group syndrome has largely lost its adaptive advantage. On the contrary, in several respects, it may have become a maladaptive strategy. Moreover, in modern culture, the syndrome reveals a remarkable sociobiological paradox. On the one hand, population genetics shows that the genetic differences between populations are relatively small – much smaller than within-population variability. On the other hand, most people perceive externally observable features – genetic or otherwise – to be very important for in-group/out-group categorisation and in the formation of their attitudes and behaviour toward ‘others’.

Consequently, as Tennov (1999) argued, efforts at education and socialisation will have to be substantially increased in order to counteract the innate drives toward nepotism, tribalism, ethnocentrism, racism, and xenophobia. The in-group/out-group syndrome is a feature of the human biogram which was adaptive in pre-modern living conditions, but which has become largely obsolete in modern culture because the speed of human cultural development has so considerably outspaced the rate of genetic change.

It may, moreover, be feared that the political and educational efforts needed to master in-group/out-group antagonisms will have to take into account a possible flaring-up of the syndrome in many places, since many ethnic communities are only now reaching a stage of emancipatory liberation, or have yet to do so. In other cases, emancipatory movements may get mixed up with or be usurped by fundamentalist or counter-reformatory forces opposing the inexorable modernisation process.

In modern society, individual abilities and capabilities may have become much more important than markers of group identity – whether kinship, political, ethnic, or racial – in order to be selected as a partner, obtain resources, or achieve social success. This does not mean that sound community development and social solidarity are not important (cf. Salter, 2003). Individual emancipation as well as societal progress strongly depend on community coherence, but they both need to move beyond in-group narrow mindedness and rigidity. Evolutionary theory warns us that the strength of the in-group drive should not be underestimated. In the end, the human remains an inherently social being who can only be emancipated via group life, though the criteria for group identity are not strictly fixed and can be chosen and changed partly on the basis of individual interests. Consequently, the novel modern environment we are developing may even lead to the development of new forms of group identity and groupism, as the history of the twentieth century shows. Some of the new types of (ideological) group identity which have already emerged in modern culture have pushed in-group/out-group relations beyond all limits, despite their universalistic pretentions.

CULTURAL AUTONOMISM, INTEGRATIONALISM, OR MULTICULTURALISM?

One of the salient characteristics of modernisation is the greatly increased geographical mobility over large distances, both of individuals and groups. Increased genetic and cultural heterogeneity are phenomena that challenge historic in-group/out-group patterns. Increased cultural heterogeneity is an ‘enrichment’ that often is stressed by advocates of the so-called multicultural society. From a biological point of view, increased geographical mobility has even more fundamental implications, for instance in the increasing opportunities for partner choice, union formation and new, heterozygous combinations of alleles in descendants – all on condition, obviously, of continued progress in the societal integration of allochthone individuals and groups. The same forces of change bring with them increased risks of new in-group/out-group conflicts as a result of the social confrontation and competition between natives and immigrants.

Modernisation has not only increased the opportunities for geographical mobility. It also influenced values and norms with respect to in-group behaviour. Communication and transportation opportunities, and knowledge about and experience with ‘others’, via a diversity of channels such as scientific discoveries, commercial and industrial activities, mass media, and tourism, have broadened, if not opened people’s minds, and made them less averse to strangers, to ‘out-groups’. Inevitably, this must lead to a further broadening of the mating and reproductive communities, and hence, to the breaking up of geographical as well as social isolates, and in-groups.

Another trend in modern society that has important implications for in-group/out-group relations concerns the emergence or strengthening of emancipatory movements amongst ethnic groups in pluri-ethnic societies, with their demands for equal rights, expanded autonomy, or even independence (cf. Wilmsen, 1996).

Hence, two types of problem groups have to be distinguished when discussing in-group/out-group relations within modern societies: the attitudes and behaviour of majority natives toward immigrants, and toward their society’s own historical ethnic minorities. This distinction is not always made, even in some reports prepared for the Council of Europe in which ethnic minorities and immigrants are dealt with under the same heading and no differentiation is made between these population sub-groups (cf. Coussey, 2000; Niessen, 2000).

To resolve the societal problems related to in-group/out-group relations between native nationals and groups of immigrants or between various historical ethnic groups within pluri-ethnic societies, three major policy strategies can be distinguished: cultural autonomism/independence, integrationalism, and multiculturalism.

Cultural autonomism/independence for historical ethnic components

Some historical multi-ethnic countries have constitutionally organised the multicultural relations between their ethnic components. In Europe, Belgium and Switzerland are examples of such countries, but in Belgium the federalisation process is still progressing toward a more coherent autonomy for its ethnic constituants or even a confederal constitution.

Those countries are federal or confederal states in which the historical ethnic communities are legal constituents of the society, have autonomous governmental and administrative bodies, and the different ethnicities enjoy equal language or other cultural rights in education, welfare care, administration, and governance. The ethnic constituants in these countries, however, are largely autonomous and homogeneous entities and the ethnicity-specific language rights and duties are restricted to the areas inhabited by the different ethnic entities. Exceptions are the capital cities where administrative and governmental bodies have national competences.

In recent years several former multi-ethnic countries in Europe characterised by a federal organisation of their major ethnic constituants – Czechoslovakia, Yugoslavia, and the Soviet Union – disintegrated largely or completely along the lines of their ethnic composition. The cultural autonomy of different groups in these countries ended up in independent and (more) homogeneous ethnic states.

There are still other countries in Europe, such as Spain, France and the United Kingdom, with historical ethnic minorities that do not yet have full constitutional rights or autonomy. But they are either in the process of institutionalising their multicultural composition in a federal or confederal way, or there are empancipatiory movements within some ethnic groups or minorities seeking to obtain greater cultural or political autonomy or even complete independence.

There are also countries in Europe with small historical ethnic minorities whose low numbers, local fragmentation or dispersion in border areas form obstacles to the development of structurally defined multicultural systems (cf. Haug *et al.*, 1998; 2002). They rarely have fully equal linguistic or cultural rights, or complete cultural or political autonomy. They are expected to adapt to the dominant national language, culture, and administration.

Integration of recent immigrant groups

Many modern countries have increasing numbers of recent immigrants. These newcomers are expected by the native populations to make a very big effort to adapt to the host country, to learn the language and to get used to the customs and rules of the host country. They are expected to obey local laws and all societal regulations and customs that deal with the major aspects of social life: civil rights and obligations, language, education, health, employment, housing, and taxation. The remainder of ‘differences’ and non-conformist, multi-culturally variable behaviour is restricted to the private domain: leisure, worship, private use of language, dress, and cuisine. From a societal organisational point of view, such manifestations of differences are tolerated and even assisted, provided they do not disrupt the social order or undermine cohesion – but these private activities do not establish collective rights or affect institutional organisation of societies. Integration of recent immigrants is an outcome that is generally desired both by the native community and the overwhelming majority of the immigrants themselves (e.g. Avramov, 2008).

Proponents of integration policies stress that no host community wants to see its language, cultural heritage, and identity substituted by the language, culture and values of newcomers. Such replacement occurs only under coercion, or when a particular society is in a position of cultural, technological, or economic inferiority (cf. Simpson and Yinger, 1953).

For the sake of the immigrants, it is argued that full integration in their host society is the path to prosperity and social mobility. Immigrants can take advantage of opportunities for social progress only by integrating. Some go so far as to affirm that multiculturalism and non-integration perpetuate segregation by not providing immigrants with the knowledge and tools for social mobility. The contemporary concept of integration which is currently a politically correct term in general use, is understood as a process by which ethnically different immigrants are integrated in the labour market and educational system of the host country, and have access to resources such as social protection and social services. Immigrants are not expected to take up the religious or philosophical orientation of the dominant population, or of any particular group for that matter, but are bound by the laws of the country and are expected to not pursue practices that violate basic norms. Immigrants, like other citizens, are expected to share a consistent body of normative standards. It is generally recognised that descendents of immigrants benefit from the knowledge of their mother tongue, although its use is limited to private spheres. Immigrants are expected, encouraged, and often assisted by receiving countries to follow special educational programmes to learn the official national language, become more competitive in the labour force, and become acquainted with the norms, standards and laws of the host country (Avramov and Cliquet, 2005).

However, on the social integration scale immigrants appear to be particularly disadvantaged (Avramov, 2003). There is much evidence that immigrants, particularly from developing countries, are over-represented amongst the unemployed and casually employed. Their descendents are more prone to failure at school and have higher dropout rates than the host population. They are more often unemployed than the parental generation and have a higher rate of unemployment than the population average, are employed in lower socio-economic status jobs, are often badly housed, and show less upward mobility. They are also more often victims of discrimination, xenophobia and racism. In general, many developed countries have failed to achieve a successful, secure and sustained integration of migrants from developing countries (cf. Collinson, 1993; Commission of the European Communities, 2000).

Lack of integration policies and practices are often causes of the deskilling or social exclusion of immigrants who are not well-equipped with the necessary skills needed for stable employment, or who suffer discrimination in their search for better jobs. Obliged to function in ethnic ghettoes, they cannot access opportunities for social mobility and are at risk of reproducing social stratification based on ethnicity (Avramov and Cliquet, 2007; Kovács and Melegh, 2007; Avramov, 2008). Research points to the conclusion that, so far, most modern democracies have badly managed the process of integration of immigrants from ethnically more distant regions who have more distinct features of religious belief and practice (e.g. Papademetriou, 1994). It is no surprise then that many culturally or phenotypically different immigrant communities remain weakly integrated and revert to in-group isolation, residential and social segregation, and enduring endogamy.

From a sociobiological point of view, ethnic groups, defined by endogamy, show signs of assimilation or integration once interbreeding with members of out-groups takes places and the transformation of endogamy to exogamy is well underway. In other words, one can truly speak of integration once gene pools are being shared between ethnic groups (Thienpont and Cliquet, 1999).

Multiculturalism: fact or fiction?

Some countries, especially those with remnants of original indigenous populations and a strong immigration tradition, such as the United States, Canada, and Australia, often proclaim themselves to be multicultural societies in which the different ethnic constituants are ‘mutually adapted’ (or are at least expected to be so). On closer investigation, however, for the most part this appears to be a fiction. The basic principles of multiculturalism include the right of ethnic minority groups to maintain aspects of their cultural heritage and language, the right of equal access to the legal system, equal treatment under the law, rights to employment, education, social services, and political representation, and the right to collective expression in the public sphere. When tested in practice, it appears that the overseas Anglo-Saxon experiment in multiculturalism – meant to replace earlier assimilation policies – is more similar to a strategy of gradual integration than the institutionalisation of ethnic differences. The national language remains the only official and public instrument of communication, all of the constitutional and other legally defined rights and obligations have absolute precedence over ethnic-specific norms, and autonomy does not include political independence or power.

Despite the overwhelming presence of the term in political discourses, and a vast amount of literature dedicated to the idea, the notion of multiculturalism remains vague or is used in many different ways (cf. Kymlicka, 1995; Guibernau and Rex, 1997; Schierup, 1997; Wicker, 1997; Cornwell and Stoddard, 2000; Holmes, 2000; Parekh, 2000; Barry, 2002; Kelly, 2002; Kivisto, 2002). There are authors who tout the enhancement of multiculturalism as a desirable policy goal and those who are opposed to this policy orientation.

Advocates of multiculturalism argue that modern societies have become, or should become, real multicultural states in order to accommodate their minority populations (e.g. Young, 1990; Kymlicka, 1995; Inglis, 1996; Parekh, 2000). Some researchers are of the opinion that the policy of multiculturalism entailing collective rights ought apply to countries with recent immigrant minority populations as well as those with historical minorities. They point to the enriching and stimulating effects that immigrants may have on the host society by contributing to its cultural and intellectual wealth and economic performance. By preserving their cultural identity, immigrants can positively enhance cultural pluralism. Immigrants may contribute to the rejuvenation of the population, the reinforcement of the labour force, the support of the social security system, and the revival of depressed regions or quarters (cf. Rex, 1988; Andorka, 1989; Moreau *et al.*, 1990; Blommaert and Verschueren, 1992).

It is pertinent to note that, in Europe, the issue of multiculturalism as a policy choice did not arise in the years when southern Europeans – such as Italians, Portuguese, Spaniards, and Yugoslavs – or eastern Europeans – such as Hungarians, Poles, and Russians – migrated to western European countries. These migrants were apparently culturally quite close to the West and, notwithstanding their differences, integrated and were eventually assimilated into their host countries. The multicultural discourse took a prominent place at the time when immigrants started coming from more distant regions, had different religious backgrounds, were more recognisable phenotypically or in clothing and decoration, manifested their cultural features more explicitly, and were less willing or were given fewer opportunities to integrate into the receiving society. In some cases, the pressure on recent immigrants to maintain distinct features while living in European countries may be traced to the policies and financial support of some mono-cultural theocracies that want to support and further spread their own religion in the world (cf. Safa, 1997; Van Rooy, 2008).

Critics of a programmatic political platform of genuine multiculturalism argue that the introduction of a broad range of collective rights for ethnically different immigrants would not only induce huge financial costs, but also holds the potential to weaken social cohesion (e.g. Schlesinger, 1992; McKenzie, 1997; Barry, 2002). The implementation of a comprehensive multicultural immigration policy they argue, would encourage immigrants to form separate ethnic groups, delay or even hinder their social integration, and would constitute a barrier to their upward social mobility. A vague or purely verbal exhortation to multiculturalism which is not supported by a substantial body of policy measures guaranteeing equal opportunities of emancipation, development, and cultural or political autonomy, if necessary, might result in a lack of opportunities for minority groups to integrate into the mainstream social life. In particular, minority groups arriving from less developed regions need selective measures to assist them in adapting to their new cultural context. A lack of integration facilities obstructs minorities' upward social mobility and prevents their full participation in (post)modern society and all of its prerogatives and pleasures, dooming them to remain a socially subordinate group. Such an outcome is a source of future inter-ethnic tensions and conflicts, because it results in a structure of social stratification which is organised on the basis of markers of group identity – ethnicity.

Moreover, some traditional values, especially regarding gender relations and the merging of religious and political platforms pursued by some groups, could foster normative and political conflicts with the host culture. Immigrants bring values and norms acquired during their socialisation in their native country which can, in various ways, differ from and even clash with the mainstream normative basis of the receiving country. Examples may include the discriminatory perception and treatment of women, arranged or forced marriages, physical punishments, genital mutilation, polygyny, fatwãs against persons who hold different opinions, and attempts to censor teachings about evolutionary biology. These practices are considered incompatible with the developmental level reached by modern culture, which values science, rights related to gender equality, freedom of expression, and norms promoting individual development, and human rights – all of which are embedded in the legal systems of virtually all modern democracies.

However, the divergent views of 'multiculturalists' and 'integrationalists' are often more of a theoretical and philosophical nature than of pragmatic consequence. In reality, today's immigrants must adopt the language and abide by the laws of their host society and adapt to the institutional setting. These laws and administrative practices embody the major values of modern industrialised culture, in particular with respect to individual emancipation and gender relations, human rights, and democracy. Thus, little room is left for fundamentally different values and practices with respect to the personal development of men, women, and children, in the realms of gender and inter-generational relations, education, with respect to the mainstream concept of human dignity. These core values go hand-in-hand with the right to philosophical and religious pluralism, which is a quite generally accepted practice in most modern democracies.

If one is consistent, the multicultural attitude implies that both historical ethnic minorities as well as newer immigrant groups should have all the collective legal rights and access to institutions existing in constitutionally organised multi-ethnic states. It means that several languages should become official, that government administrators and health and welfare services should serve immigrants in their native languages, and that schools, universities, radio and TV stations, and cultural centres should be set up according to the principles applied, for instance, in the case of the Dutch-French language duality in Brussels. Furthermore, full multiculturalism could also imply that the values of the different ethnic constituents, regarding family formation and the status of women and girls for example, even when in contradiction with some of the fundamental values of the host country, should be socially accepted (Avramov and Cliquet, 2005).

At the individual level, people can be bi-culturally embedded if they grow up in one culture and voluntarily or involuntarily adapt to the culture of a new host country or community. The first generation of immigrants may settle in an intermediary position, especially with respect to language use, but descendants in the second and third generation are usually *de facto* linguistically and largely culturally assimilated.

In conclusion, multiculturalism as an organisational principle in a constitutional multi-ethnic society would build on ethnic components that are largely homogeneous entities with a strong autonomy. Such a constitutional pluri-ethnic state is, in other words, not at all an ideal toward which advocates of multiculturalism would want to move.

THE FUTURE OF BETWEEN-POPULATION DIFFERENCES AND RELATIONS

In the modern, increasingly globalising world, between-population genetic differences are becoming smaller and populations will become genetically more heterogeneous. Nevertheless, the major genetic subdivisions of the human species, undoubtedly with less and less sharp boundaries, will continue to exist for a very long time – a reality which will increasingly confront us and to which we must become accommodated.

Population-bound genetic differences are a fact of life, but they constitute only a relatively modest, albeit often very visible, fraction of the total genetic variability that is characteristic for the human species. Differences in environmental living conditions still contribute substantially to phenotypic between-population differentials. From an evolutionary biological point of view, it is conceptually impossible to hierarchically rank the superiority or inferiority of normal-ranging population-genetic features that arose as adaptations to the ecological or cultural living conditions in which they came into being. In the novel environment created by modernity individual abilities and capabilities are becoming much more important for social position and status acquisition than markers of group identity. Hence, genetic or phenotypic markers of group identity cannot be used to differentially allocate or avoid social responsibilities and functionalities.

Sociobiological theory considers the in-group/out-group syndrome as a deep-seated drive, ultimately oriented toward the protection and dissemination of in-group genes. Whilst his drive likely had advantageous effects in the 'Environment of Evolutionary Adapteness', it has become maladaptive in the novel environment of modern culture. All of the social manifestations of the in-group/out-group syndrome, be it in the form of nepotism, ethnocentrism, xenophobia, or racism, have to be strenuously fought.

However, equally disfunctional is the cultural creation of niches in modern societies that fail to mobilize the potential of genetically and/or culturally identifiable immigrants by not providing them with tools for social integration and upward mobility. Also, the reception of immigrants from pre-modern areas can be no excuse for questioning or challenging the emancipatory philosophical and scientific achievements of modernity. Immigrants have to fully adapt to modern life and integrate harmoniously into their new cultural environment. The currently very fashionable concept of multiculturalism is, in this respect, an unachievable chimera.

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CHAPTER 9

INTERGENERATIONAL VARIATION AND DYSGENISM

INTRODUCTION

Life is in essence an intergenerational process. Genes form the intergenerational building blocks of that process. Although genes can mutate, they guarantee intergenerational continuity. They connect past, present and future. This connection not only allows us to interpret the present based on our understanding the past, but also to anticipate the future (Slaughter, 1994).

Intergenerational variation concerns changes in genetic composition, genotypic structure, and the phenotypic expression in human populations (or in the human species as a whole) from one generation to another. Phenotypic changes can be due either to gene and/or genotypic changes or to changes in the natural or human-made environment. Intergenerational change in population-genetic composition, however, means biological evolution. Consequently, it cannot come as a surprise that intergenerational population-genetic changes can be considered, from a longer-term perspective, the most important source of biological variation.

The biological future of the human species depends on many factors, such as the future physical conditions on the planet, the further development of the natural and man-made environments, our biological and cultural heritage, and, finally our future technological development and value choices. We limit our discussion in this chapter to the biological and cultural heritage from humanity’s past and explore our species’ future prospects, with special attention paid to our possible future biosocial goals and scientific-technological innovations and their applications.

THE TIME DIMENSION

The first question to be discussed regarding intergenerational variation concerns the time dimension one has in mind. According to Cornish (1977) futurologists generally focus their attention on a period lying between five and fifty years into the future. The reason is that the near future (within five years) is a matter of daily concern. In this connection it may be observed that periods of democratically elected governments seldom exceed that time span. Moreover, this space of time is too short to bring about fundamental changes. The period extending beyond fifty years is also generally left out of consideration because so many changes are expected in the coming decades that making long-term predictions and long-term planning are far too uncertain. Nevertheless, some futurologists do consider a little larger time span in their futurological conceptualisations. Based on an idea from Boulding (1989), Slaughter (1994) suggested that our time perspective is most appropriately 'The 200-year present’, meaning a viewpoint spanning 100 years back and 100 years ahead. This more inclusive approach would provide us with a greater consciousness of continuity and change regarding both the past and the future. It would also teach us to think more intently in a multigenerational perspective.

As a subdiscipline of bio-anthropology, human social biology obviously deals with an extended time perspective. Regarding the past, this comprises the whole genesis of hominids covering a period of a few million years. Regarding the future, human social biology is interested in the continuing evolution of humankind. By definition, this relates to what futurologists see as the far future, a period which can comprise many thousands, if not millions of years. It is, therefore, useful to consider two time perspectives, namely the short-term future (<100 years) and the long-term future (> 100 years). In the short term, we are interested in all aspects of the biological development of the human – including demographic, phenotypic, and genetic change. In the long term, we focus mainly on the possible future directions the hominisation process could take.

HERITAGE OF THE PAST

It is quite obvious that the future will have to build on both the positive and negative legacies of the past, with regard to both humanity’s evolutionary heritage and its cultural inheritance. In spite of the considerable cultural progress made due to the development of modern science and its application in modern technology and to the humanisation of social life, it is becoming clearer little by little that the current form of culture is not sustainable (cf. Gallopin and Raskin, 2002; Ehrlich and Ehrlich, 2008; The Worldwatch Institute, 2008). A safe future in which humans and their culture can continue evolving to higher stages of humanisation and civilisation is possible only if humans succeed in achieving a sustainable world system in which the environment is protected, biodiversity maintained, natural eco-systems preserved, sustainable resources exploited lasting moderation, finite resources used sparingly, population growth stabilised at a stationary level, consumption reduced to reasonable levels, competition brought into better balance with cooperation, and international differences in opportunities for development levelled out. Humanity’s future quantitative and qualitative development largely depends on the extent to which we succeed in resolving present-day developmental, demographic, and ecological crises (cf. Harrison, 1992; McMichail, 1993).

Biological heritage

For a long time, our biological future will continue to be determined by the genome that emerged during the era of hunters-gatherers. Moreover, it may well be that we will want to preserve some of our pleasure-giving biological traits, even those which are partially maladapted to modern living conditions. Our genetic heritage helps explain the ease with which people, especially during periods of crisis or profound changes, can be mobilised, dominated and exploited by religious fundamentalists or political bigots who cleverly take advantage of our emotionality and irrationality, both of which are basic to the human biogram (Cattell, 1972; Kieffer, 1979). Contemporary examples of this can be seen in current success of religious fundamentalism in developing countries where the modernisation process is taking off, and in the mega-church and sect movements in regions of the United States that are experiencing the transition from industrial to post-industrial society in an inefficiently structured and, hence, insecure and unsafe perceived societal context (Toffler, 1980; Naisbitt and Aburdene, 1990).

Generally speaking, we will have to continue living with the biological evolutionary mechanism and the interactions between its various components – mutation, selection, drift, migration and partner choice – although we may be able and willing to influence the relative impact of some of them. In particular, we will continue facing the appearance in each generation of genetic variants or genotypic combinations which produce phenotypes that cannot survive or are seriously impaired – an experience that forms such an important source of distress, unhappiness, and even rage in the life course of those affected. Although we attribute our intellectual, social, and physical abilities and performance to the forces of natural selection over thousands of generations, the fact remains that natural selection is a relentless and extremely cruel mechanism that we try to fight or avoid by all means (cf. Galton, 1883; Glad, 2003).

Cultural heritage

The cultural heritage relevant to future intergenerational biological changes includes only two major phenomena: the existence of various and largely conflicting and competing value and norm systems, and the emergence of modern science.

Conflicting and competing value and norm systems

The present cultural stage of the human species is characterised by two major features in the domain of value and norm systems: considerable within- and between-country variation, and a gradual shift from beliefs- toward knowledge-based value and norm systems.

Both the variation and the shift can be observed in value and norm systems that have different origins and natures. Two major types can be distinguished: religious value and norm systems based on belief in God(s), and various secular value systems giving priority to one or another selected facets of human reality, as is the case, for example, in systems such as agnostic or atheistic humanism, capitalism, communism, ecologism, egalitarianism, feminism, individualism, liberalism, nationalism, and socialism.

At the risk of oversimplifying a complex reality, reproductive (non)interventionism, particularly that of a genetic nature, can be seen as one of the major distinctions between belief- and knowledge-based value systems. The most well-known representative of non-interventionism is the Roman Catholic variant of Christianity: it still rejects contraception, abortion, medically assisted fertility, eugenics, and euthanasia (cf. Pius XI, 1930; Paul VI, 1968; John Paul II, 1995). But many adherents of secular value systems such as individualism and egalitarianism also reject some aspects of genetic interventionism, either on the premise that individual rights predominate over societal values (see Chapter 2), or on the premise that all individuals should have not only equal opportunities, but that all individuals are identical, differing only in upbringing (see Chapter 7). Advocates for the rights of the disabled even oppose eugenic prenatal testing and selective abortion because they are of the opinion that life with severe disability is worthwhile or believe that all diseases are part of the diversity of the human experience (cf. Wolbring, 2001; 2003). Disability activists make no distinction between caring for people who were born with or acquired serious physical or mental impairments and the prevention of the birth of offspring with such impairments.

The shift from belief-based to knowledge-based values, particularly regarding human reproductive phenomena, is an ongoing gradual process that progresses at a different pace within as well as between countries and cultural areas. The result is that the near future will continue to be characterised both by within-country/culture debates and conflicts and by considerable between-country/culture disparities in reproductive and genetic interventionalism.

Emergence of modern science

Thanks to the development of modern science and its application in technology and to modern societal ethics, the culture of the modern age made a giant step forward in the control of the physical, biological and social environment resulting in a considerable enhancement of the quality of life.

Wherever modern science developed or was spread, it resulted in a considerable increase in knowledge and education; it eliminated infectious and contagious diseases, and also treated other diseases; it saved people from starvation; it improved housing and considerably raised the physical standard of living in general; and it increased opportunities for leisure activities and quality of life in general. It gradually and increasingly freed humans from many of the earlier scourges of ‘natural’ life.

In modern society a number of ethical principles – individual emancipation, liberty, justice, equality of opportunity, solidarity, and tolerance – were given the chance to assert themselves whilst ignorance and superstition driven norms were pushed back. The implementation of these principles promoted the humanisation of modern societies. Modern science thus created the technological and ethical conditions enabling human-specific potentialities to develop more strongly, especially at the mental and emotional levels. Modern science, in other words, revolutionised human life and society. In the time-space continuum of human cultural evolution, the rise of science appears as a huge and sudden change, almost similar to a biological mutation.

Effects of modern culture on intergenerational variation

Successive generations can differ both in their genetic composition and genotypic structure and in their phenotypic appearance. The latter can be due either to environmental influences or to genetic changes.

Phenotypic effects

The improving phenotypic development of human-specific potentials and the decreasing social differentiation in the development of these potentials are amongst the major achievements of modern culture. Thanks to better nutrition, hygiene, medical care, lengthy schooling, decent housing, and regulated work hours, amongst other profound changes, modern humankind can better develop both physically and mentally. Individuals grow more rapidly, attain a taller and less damaged body build, enjoy better health, can achieve a higher reproductive health, acquire more knowledge, have expanded cognitive performance capacity and are able to develop a richer emotional and relational life. The traditional scourges of (semi)starvation, disease, early death, ignorance, and underdeveloped intelligence and emotional life have been decisively driven back or are in marked regression.

Many people who, in pre-scientific living conditions, would be severely handicapped or would die early because of their hereditary endowment or ontogenetic accidents, are, in modern cultural conditions, not only able to survive, but also to function reasonably well thanks to (replacement) therapies or an adjusted way of life. Phenotypic adaptability has increased considerably in modern culture (Dobzhansky, 1962).

Genetic effects

As was argued in Chapter 2, the basic demographic variables – mating, fertility, mortality, and migration – and their effect on population size are the channels through which allele and genotype frequencies can be changed.

All of these basic demographic mechanisms, but in particular fertility and mortality, have undergone fundamental changes since the onset of the modern demographic transition which can be seen as ultimately having been caused by the development and application of modern scientific knowledge and a number of changes in values and norms which were provoked or facilitated by that knowledge (Cliquet, 2004; 2005).

As argued in Chapter 5, the changing mating behaviour in modern culture results in a variety of genetic effects:

- The broadening of the geographical distance within which one may find a marriage or mating partner breaks up genetic isolates, reducing inbreeding and, hence, diminishing inbreeding depression (e.g. Bittles, 1994);
- There is an increase in exogamic mating leading to inter-population admixtures, and in some cases even to crossing between genetically significantly distinct populations, resulting in a higher population heterogeneity (cf. Leonetti and Newell-Morris, 1982);
- Assortative mating results in increased homozygosity and larger population genetic variance, obviously to the extent that the characteristics involved in mate choice are (partly) genetically determined (e.g. Spuhler, 1968);
- Changes in mate selection can have genetic effects, but it is difficult to evaluate them. The earlier historical forms of celibacy probably had very diverse genetic effects (e.g. Galton, 1869; de Lapouge, 1896). For instance, the current major reduction in the numbers of those who obey

the call in Catholic regions, and who are undoubtedly amongst the more gifted individuals of the population, may have a eugenic effect since many of those people can now be expected to marry and have children. But what about the other changes in mate selection? On the whole, one would expect that the decline of celibacy might induce a decrease in selection, resulting in an increase in population genetic heterogeneity.

In Chapter 6 it was argued that one of the most important changes in modern societies in demographic behaviour and the individual life course consists of the gradual spread of parity-specific birth control in the nineteenth and twentieth centuries. This change may be expected to have several genetic effects:

- The concentration of birth-giving at relatively young ages is generally considered to have a eugenic effect because the prevalence of several genetic impairments increases with the parental age of both women and men (Vogel and Motulsky, 1986), and/or birth order. Hence, such impairments may be avoided by controlling fertility at higher ages or restricting the number of pregnancies (cf. Matsunaga, 1966);
- In recent decades, however, the postponement of births has been pushed further up in the life course, which increases not only the risk of fecundity problems, but also the risks of particular genetic disorders. But more and more genetic impairments can be detected prenatally and eliminated by selective abortion, if so desired (Evers-Kiebooms *et al.*, 2002);
- Postponing births to higher ages increases the generation length of the reproductive period. Genetic differentials in generation length form one of the mechanisms resulting in changed selective processes (cf. Cole, 1954; Bajema, 1963);
- The availability of selective abortion may have two distinct effects on the genetic composition of populations. First, it allows families who have a substantial risk of begetting genetically impaired children to avoid the birth of seriously handicapped offspring and increase their chances of having phenotypically healthy children (Evers-Kebobs *et al.*, 2002). However, for recessive, and perhaps also for polygenetic features, the reproductive compensation resulting from replacement of defective offspring by healthy children increases the relative frequency of carriers of genetic conditions in heterozygote individuals, who may transmit the defective allele(s) to future generations and contribute to the increase of the allele frequency in the population (cf. Fraser, 1972). This latter effect is probably of a temporary nature, because more and more deleterious alleles can be identified in heterozygous conditions and

can be eliminated by selective abortion or change of partner, if so desired. Hence, it may be expected that more remote future genetic screening techniques will be able to prevent the dysgenic effect of replacement fertility;

- Fertility regulation, resulting in a lower number of births combined with an earlier timing of those births in the life course, may have some other, but perhaps less important genetic effects; in fact, all genetic phenomena that are differentially related to maternal or paternal age can be influenced by fertility regulation (cf. Fuhrmann, 1969; Chandrasekhar *et al.*, 1993);
- Data from different countries suggest that the fertility component of the index of opportunity for selection (I_f) (Crow, 1958) decreases in the initial stages of the demographic transition, whereas in later stages it increases (Adams and Smouse, 1985);
- Differential fertility according to educational and socio-economic status (cf. Wrong, 1958; Cochrane, 1979; Vining, 1986) may change the genetic composition of the population, a matter which will be dealt with below.

Another major component of the demographic transition consists of mortality and morbidity control (see Chapter 3), which can have wide-ranging impacts:

- The general protective effect of modern culture and the dissemination of replacement therapies results in selection relaxation (cf. Crow, 1966; Cavalli-Sforza and Bodmer, 1971). This leads to an increase in the genetic heterogeneity of the population;
- A gene that, in pre-modern living conditions, was experienced as ‘abnormal’, is no longer to be considered detrimental if the carrier can now lead a normal life. However, this may mean that such persons are becoming more dependent on the continuation and further progress of a technologically highly developed culture and society;
- The curve-squaring strategy (Gordon *et al.*, 1979) is partially associated with an increase in the incidence of chronic diseases that are largely genetically determined (cf. Verbrugge, 1984; Riley, 1990; Robine *et al.*, 2003).

In Chapter 8 it was shown that modernisation has considerably increased the opportunities for geographical mobility through enlargement of communication and transportation networks. This has resulted in a substantial increase in migratory movements, within as well as between countries. This change has major genetic effects:

- Increasing migration leads to further broadening of mating and reproductive communities, and hence, to breaking up of geographical as well as social isolates and in-groups, resulting in a reduction of inbreeding and inbreeding depression;

- Increasing migration flows make populations genetically more heterogeneous. On the basis of plant and animal experiments, one might expect to witness signs of heterosis or hybrid vigour. Some authors are, for instance, of the view that the modern secular increase in body height is partly due to increasing exogamy. However, conclusive proof of the effect of heterosis in human beings has not yet been established;
- Wherever migratory movements are of a massive scale, and the immigrant populations are not well integrated, new isolates may be formed. Such forms of migration may lead to population-genetically stratified societies, where immigrant groups often are confined to lower socio-economic and occupational strata and are residentially segregated in less attractive quarters (cf. Van der Haeghen *et al.*, 1995).
- Currently it is difficult to judge whether the demographic transition has also influenced selective migration processes. There are indications that such forms of migration do occur (e.g. Bogin, 1988; Mascie-Taylor, 1984; 1998; Mascie-Taylor and Lasker, 1988).

The modern demographic transition has invariably resulted in an increase in population size and is linked to the broadening of marriage or mating distances (cf. Walter, 1956; Lebel, 1983; Wijsman and Cavalli-Sforza, 1984), the breaking up of isolates (e.g. Sheets, 1980; Yanase, 1992), the increase in interclass, interreligious, intertribal, and interethnic matings (cf. Coleman, 1992; Relethford and Mielke, 1994), and even the increase of population-genetic exogamy (cf. Leonetti and Newell, 1982). Also, the effective population size is increased, resulting in a decrease or even disappearance of genetic drift, the founder effect and inbreeding (cf. Sutter and Tabah, 1955; Khlat, 1988; Imaizumi, 1992; Chandrasekar *et al.*, 1993). The decline of inbreeding levels are obviously associated with the decrease, if not the disappearance of inbreeding depression (Figure 9.1).

Contraselective effects of modern culture

From this analysis of the genetic effects of the modern demographic transition it can be concluded that modern culture has, in some respects, contraselective effects on the human gene pool. Two major topics must be distinguished: (1) contraselective effects of medical replacement therapies for deficient or deleterious genes and (2) contraselective effects of differential reproduction, particularly with respect to intelligence.

The contraselective effects of replacement therapies

In modern culture, humans have succeeded in efficiently intervening against disease and death, with the result that a considerable part of modern populations reaches a much higher age than in pre-scientific living conditions. The successful phenotypic care provided in modern culture leads, however, to a relaxation of natural selection. Alleles, which in pre-scientific living conditions were rapidly barred from the gene pool, are at present not only preserved thanks to replacement therapies or other protecting factors, but in many cases their carriers are also able to reproduce. Because of this the frequency of such 'weak' alleles is increasing (cf. Dobzhansky, 1962; Thibault, 1972).

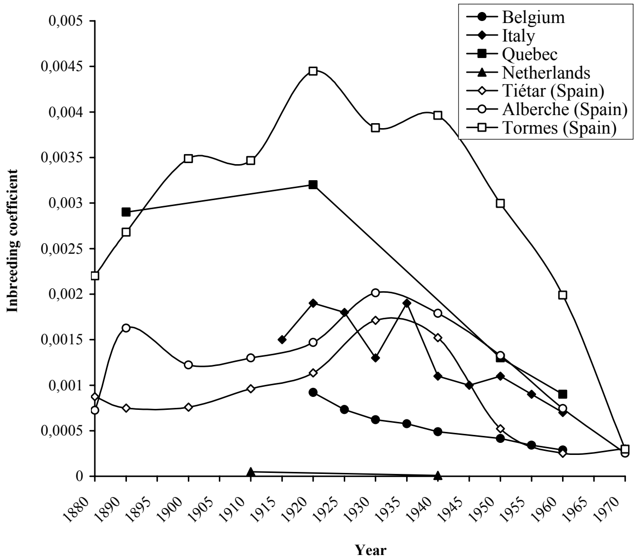

Figure 9.1. The change in the coefficient of inbreeding (F) in the course of the demographic transition. Source: Cavalli-Sforza and Bodmer, 1971; Fuster et al., 1996; Moroni, 1969; Twisselmann et al., 1962.

The selection relaxation caused by mortality control, just as with morbidity control, may furthermore be reinforced by an increase in reproductive fitness. Surviving individuals may find a partner or partners and produce children. This 525effect has already been shown for several diseases, such as diabetes (cf. Aschner and Post, 1956/57; Post, 1971), schizophrenia (cf. Erlenmeyer-Kimling and Paradowski, 1966; Saugstad, 1989; Ritsner *et al.*, 1991; Lane *et* *al.*, 1995; Hutchinson *et al.*, 1999; Jablensky, 2000), and phenylketonuria (cf. Howell and Stevenson, 1971), for which replacement therapies or other types of medication have been developed. The reproductive fitness of such patients undoubtedly has been enhanced, so that an increase in the frequency of the alleles responsible for these conditions may be expected to increase.

Although many congenital defects are known to result in lower marriage rates, in infertility or are associated with low fertility (cf. Reed, 1971; Slater *et al.*, 1971), the effect of modern culture is that, through replacement therapies, mating and reproductive opportunities for those with genetic disorders are improving (Teitelbaum, 1972).

The quantitative effect of selection relaxation depends on several factors: the relationship between mutation pressure and degree of relaxation, the effect of replacement therapy on reproductive fitness, and the mode of inheritance (dominant, recessive, polygenetic inheritance) (cf. Cavalli-Sforza and Bodmer, 1971). Computer simulations show that for all types of inheritance the increase in allele frequency is very slow, especially for recessive alleles or polygenetic conditions, for which most deleterious alleles are hidden in heterozygous combinations.

The possible dysgenic effects of morbidity or mortality control may, in turn, be counteracted by birth control. In the future, it may be expected that the demographic transition, mainly through mortality and fertility control methods, will contribute to shifting the aim of this control from quantitative to qualitative goals and from phenotypic to genotypic concerns.

In comparison with phenotypic care, genetic care of human beings has yet been neglected. Until now, modern culture has had in many respects dysgenic effects on the human gene pool. However, thanks to the development of the science of genetics and its application in genetic counselling on the one hand, and in the development of techniques to compensate for or correct genetic defects on the other, genetic risks can be identified and avoided or genetic disorders can be circumvented. The application of modern genetics has a eugenic effect at the family level and, if applied on a sufficient scale, at a population scale as well.

The contraselective effects of differential reproduction with respect to intelligence

The transition from chance to planned approach to fertility has been accompanied by various phenomena that can affect the genetic composition of the population. An important fact is that, in the countries that industrialised early, a socially differential spread of birth control use occurred. The most developed and prosperous strata of the population generally came to control their fertility earlier and more effectively than the others (cf. Cochrane, 1979; Vining, 1986). The fairly significant correlation between intelligence and socioeconomic status gave rise to the theory of contraselection. In this theory the view has been put forward that modernisation would be attended by a decline in intelligence (e.g. Graham, 1970; Lynn, 2001). Although this is an extremely complex matter, the outcome of which depends upon the degree and duration of coherence between various factors, research has revealed a slight dysgenic effect upon intelligence in the course of the twentieth century, despite the fact that that birth control became a fairly generalised practice (Retherford and Sewell, 1988; Lynn and Van Court, 2004; Lynn and Harvey, 2008).

The substantial positive correlation between educational level and other indicators of SES and intelligence (cf. Jensen, 1981), the positive correlation between intelligence of parents and children, the negative correlation between social status and fertility, as well as the negative correlation between intelligence and fertility (cf. Cattell, 1937; 1950; Vining, 1986; Shatz, 2008) led researchers to develop the theory of the contraselective effect of modern culture on intelligence, predicting that the intelligence level in industrial societies would start to fall. Already in the nineteenth century, scientists noted that intelligent people were having fewer children than those who were intellectually less endowed (Glad, 2003).

Contrary to that prediction, however, the results of large-scale surveys on the intelligence level of children in modern societies have shown either no change or even an increase in measured intelligence (cf. Cattell, 1950; Lynn and Hampson, 1987). According to Flynn (1984) the mean IQ rose by 13.8 points (nearly one standard deviation) in developed countries over a period of 46 years. However, in recent years the Flynn effect has been found to stop or reverse in several countries (cf. Teasdale and Owen, 2008; Lynn and Harvey, 2008).

Although early authors such as Cattell (1937; 1950), and Willoughby and Coogan (1940) suggested quite obvious theoretical explanations for this paradox, it was only in the nineteen-sixties that the paradox was resolved with the investigations of Higgins *et al.* (1962), Bajema (1963), and Waller (1971). They showed that in addition to data on differential fertility, other variables such as mate selection, differential mortality, and generation length have to be taken into consideration in order to assess the net effects of demographic differentials on intergenerational changes in intelligence levels. Moreover, the paradox could also be explained by the fact that phenotypic improvement in IQ overrides temporarily genotypic deterioration (cf. Glad, 2003).

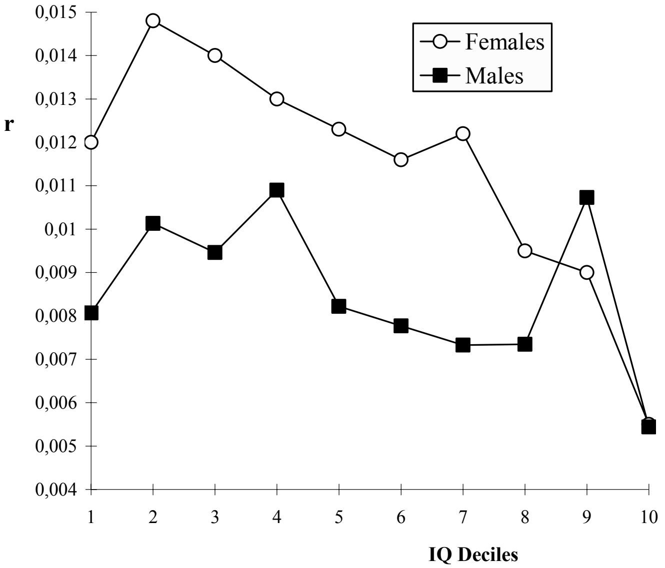

Figure 9.2. The intrinsic rate of natural increase r by IQ deciles and sex, derived from the Wisconsin Longitudinal Study. Source: Retherford and Sewell, 1988.

Taking all of these demographic factors into account, and interpreting them in the light of findings on IQ heritability, using a probability sample of Wisconsin in the United States Retherford and Sewell (1988) calculated that the generational change in measured intelligence was a decline of 0.8 of an IQ point, resulting in a generational genotype decline of about one-third of an IQ point (Figure 9.2). Very rightly Retherford and Sewell (1988) took into consideration the regression to the mean displayed by polygenetically transmitted traits due to factors such as Mendelian segregation, incomplete assortative mating, and environmental influences. The genetic effect of differential reproduction for such traits is always smaller than fertility differentials suggest (cf. Carter, 1966; Cliquet and Delmotte, 1984). After finding negative correlation between IQ and fertility (r = −’0.73) across nations, Lynn and Harvey (2008) estimated that the world's genotypic IQ declined by 0.86 IQ points from the year 1950 to 2000 and they project a further decline of 1.28 IQ points in the world’s genotypic IQ between the years 2000 and 2050.

In some countries the earlier negative association between fertility and SES-indicators has shown the first signs of a possible reversal, supporting Osborn’s

(1952; 1968; Osborn and Bajema, 1972) ‘eugenics hypothesis’, which states that when individuals have freedom to make fertility-related choices, more children will be born in the most favourable home environments. This implies that the end of the demographic transition might be characterised by a positive association between reproductive fitness and socially valuable traits.

Such a positive association was, to our knowledge, first found in Stockholm, Sweden (Edin and Hutchinson, 1935). The findings of Higgins *et al.* (1962), Bajema (1963) and Waller (1971) in some regions of the United States might also be the result of such a shift. In more recent years this phenomenon seems to have been confirmed in countries such as Sweden and Norway (Kravdal, 1992; Hoem, 1993; Fieder and Huber, 2007). In several countries there appears to be a sex difference in this reversing trend: whereas fertility is slightly positively related to men’s educational level, it is still negatively related to women’s educational level (cf. Hopcroft, 2006; Weeden *et al.*, 2006; Fieder and Huber, 2007; Keizer *et al.*, 2007; Nettle and Pollet, 2008). Incidentally, Retherford and Sewell (1988) also found that the contribution of women to the estimated decline in IQ is almost five times greater than the contribution of men. This sex difference in reproductive outcome is probably due to the difficulties career women experience when trying to combine motherhood with occupational aspirations (as Muller predicted already in the 1960s), and perhaps also because of the postponement of childbirth (Hewlett, 2002; Kemkes-Grottenthaler, 2003).

Vining (1982) and Van Court and Bean (1985) explained the positive relationship between intelligence and completed fertility which is found in some studies to cohort fluctuations in fertility, particularly in the post-war baby boom: in periods of rising birth rates, persons with higher intelligence tend to have more children; in periods of falling birth rates, the opposite is the case. Upper social strata are, indeed, often the initiators of new behavioural trends.

Nevertheless, many industrial societies still show a negative relationship between fertility and a variety of SES indicators (Figure 9.3), but the differentials have decreased substantially because birth control became a common practice among lower educational and social status strata (cf. Kirk, 1969). In many countries considerable proportions of highly educated or professional women remain childless (cf. Kiernan, 1989; Rowland, 2007; Konietzka and Kreyenfeld, 2007). For instance, in Germany, a country characterised by a high rate of childlessness in general (circa 25 percent) (Dorbritz and Schwarz, 1996; Dorbritz, 2008), 40 percent of women with an academic degree remain childless (Weiss, 2002; Duschek and Wirth, 2005). In the United States, between one third and one half of all high-achieving women have no children (Hewlett, 2002). Apart from the long-term dysgenic effects that may be expected if this trend continues, such huge proportions of voluntary childlessness amongst the best educated and creative people, who, one might suppose, are most able to provide a favourable social environment for raising children, must also have unfavourable short-term social effects.

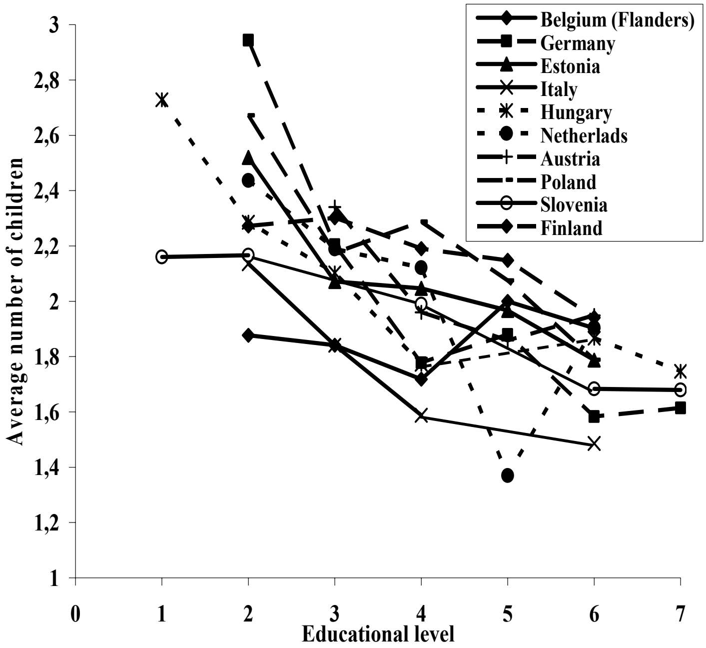

Figure 9.3. Differential fertility by education of 40 to 65 year old women in selected European countries (IPPAS). Source: Avramov and Cliquet, 2008.

Overall, the link between IQ and fertility in modern society seems to have a slight dysgenic effect. However, this is probably only a temporary consequence of a major shift in cultural development and its associated demographic regime. In the near future – namely in the course of this millennium – this dysgenic effect might be neutralised, if not reversed, by future improvements in genetic knowledge and genetic engineering, and the adaptation of norms to the new genetics and demographics. In particular, the low (or deficit) fertility of highly educated working women might be avoided if appropriate measures were taken to better reconcile work and family life for women and to better balance childcare and household chores between men and women.

CRUCIAL CULTURAL DETERMINANTS FOR THE FUTURE

With history as our guide, it is reasonable to expect that the cultural determinants relevant for future intergenerational biological changes include only two major phenomena: the continued advance of modern science and technology, and the ethical goals modern humankind will use to decide his further development and evolution.

Future scientific and technological developments

With the development of modern science, the human species has made a great leap forward and modern culture's historical phase of innovation is far from over. In the material sphere, the curve tracking the number of new inventions still retains its exponential form. Moreover, its downward movement is not at all in sight. Modern culture is characterised by an internal dynamic that justifies hope for the future. Established fields such as biotechnology, informatics, and robotics will continue to develop, whilst quite new technological developments can be expected in sectors such as power generation, production, transport and communication (Scientific American, 1995). As the Chinese delegation said at the United Nations World Population Conference 1974, the future may be infinitely bright (United Nations, 1975).

Ethical goals for the future

Now that humans are acquiring, thanks to the development of modern science, real insight into proximate and ultimate causes of the evolution of life, and our capacity to intervene in ontogenetic and genetic life processes is being enhanced, it can be expected that we will decide for ourselves in which direction we want to evolve, as well as in which direction we will want to steer culture and the environment (Muller, 1967; Stock, 2002).

The impetus to intervene in genetic processes derives momentum from the success of quantitative intervention in fertility and the phenotypic intervention on morbidity and mortality. This success has helped make people aware that we have the means to control the fundamental processes of life, and has made us more sensitive to genetic origins of much biological impairment. Accor-dingly, it is logical that attempts are made to intervene not only in the exogenous but also in the endogenous and, particularly, the genetic causes of features and behaviours that are considered unfavourable or unwanted. Hence, the quantitative and the qualitative – the phenotypic and the genetic – control of life processes, especially with regard to birth and death, align with one another.

Whereas the twentieth century was characterised by a virtual generalisation of quantitative birth control in modernising societies, in this and subsequent centuries, it is likely that qualitative concerns will govern the use of birth control. Phenotypic care will be complemented, if not superceded, by genetic care. Already in 1972 Fraser (1972, 202) formulated this prediction as follows:

> *"As a natural corollary to the control of over-production of human biomass, which will need to be achieved if society as we know it today is to survive at all, quality of offspring will become of increasing importance."*

Obviously, this does not mean that, at least in the near future, the qualitative (particularly the genetic) control of births will become as common as the quantitative birth control of the former century (Galjaard, 1994). Initially, genetic birth control will be a minority phenomenon, concentrated amongst those individuals and families that have a high genetic risk. Moreover, the main task for developing countries is to master their quantitative demographic growth. Nevertheless, changes in mentality and in value and norm systems might, as the recent eugenic legislation in China shows (Dickson, 1994; Bittles and Chew, 1998; Dikötter, 1998; Mao, 1998), evolve faster and in different directions in less-developed nations than in the West[1].

In the first industrialised countries, the quantitative control of births resulted from changes in the behaviour of individual citizens, initially against the will of the traditional religious, social, and political establishment (cf. Van Praag, 1978). Although social reform movements and the mass media may have promoted the spread of birth control, particularly that of efficient contraceptives, the transition largely followed from the decisions of individuals, and married and unmarried couples. This decision resulted from a series of interrelated changes in living conditions such as the transition from a domestic to a capitalist method of production, the decline in high mortality, the necessity of investing more in the quality of offspring, and the possibility of

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[1] In 1994 China promulgated its 'Maternal and Infant Health Care Law', previously referred to as the eugenics and health protection law. In Article 8 the law stipulates that "the premarital physical checkup shall include the examination of the following diseases: genetic diseases of a serious nature, infectious diseases, and relevant mental disease". In Article 10 the law prescribes that "physicians shall, after performing the premarital physical checkup, explain and give medical advice to both the male and the female who have been diagnosed with a certain genetic disease of a serious nature that is considered to be inappropriate for childbearing from a medical point of view; the two may be married only if both sides agree to take long-term contraceptive measures or to get the ligation operation for sterility" (Mao, 1998). Of course, several ethical principles embedded in the western culture make it difficult to depart from principles of informed consent for marriage and free informed decision making for couples to have children.

enjoying a larger variety of leisure activities (Cliquet, 1991). Encouraged by the example of the quantitative control of births and deaths, it may be expected that individual decisions will lead to the qualitative control of births and deaths. Such a change in behaviour is obviously made possible only by scientific and technological innovations. Whilst the shift toward qualitative birth control may be supported by social reform movements, it will probably be resisted, especially by those who were opposed to, and continue to oppose, the quantitative control of births. Consequently, a new and, presumably, even more intense ideological debate and political struggle may be expected about this matter.

In fact, this debate has already started. Thus, the 'Convention on Human Rights and Biomedicine' of the Council of Europe (1997) states in Chapter IV (Article 13) on the human genome:

> *"An intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants*."

According to Rapporteur Plattner (1996) of the Parliamentary Assembly, the aim of this chapter is to protect the human species from interventions affecting its genetic heritage and the individual and society from the establishment of biogenetic hierarchies. Apart from the fact that the rapporteur's justification sounds somewhat obsolete – biogenetic hierarchies cannot be established within Mendelian populations – the Draft Convention takes a very conservative, static and even inconsistent stand. But this is probably inherent in the initial stages of any important innovation.

The same lack of reference to the possible unfavourable genotypic and/or phenotypic effects on descendants appears in the United Nations' current working text on the 'International Convention on the Rights of Persons with Disabilities' which in Art. 23, 1.(c) (United Nations, 2006) asserts:

> *"The rights of persons with disabilities to decide freely and responsibly on the number and spacing of their children and to have access to age-appropriate information, reproductive and family planning education, the means necessary to enable them to exercise these rights and the equal opportunity to retain their fertility."*

Current scientific developments, which are pushing back frontiers, necessitate a thorough reflexion on the future development and evolution of humankind, taking into account not only individual rights, but also the societal implications and consequences for future generations.

Euphenic goals

At any level of phylogenetic hominisation, human-specific features can vary phenotypically. The phenotypic expression of human-specific potentialities can be maximised or minimized. This expression can be differentiated for groups; in other words, some populations or social classes may have maximal opportunities for self-actualisation and talent valorisation, whilst others can be relatively deprived or excluded from such opportunities (Figure 9.4).

Today, universally recognised values support the optimal and socially or nationally undifferentiated phenotypic development of present and future human potentialities (cf. Council of Europe, 1950; United Nations, 1948; United Nations, 1994; United Nations, 1995).

Eugenic goals

Francis Galton (1883; 1905), generally recognised as the founder of eugenics (Gilham, 2001), defined the goal of this field as follows:

> *"Eugenics is the science which deals with all the influences that improve and develop the inborn qualities of a race to the utmost advantage."*

Galton advocated a broad view of eugenics and proposed that the genetic characteristics of a population should be improved and that inborn potentialities should be developed to the utmost advantage. The key question, of course, is what is to be understood by phrases such as 'human inborn qualities', or genetic improvement or enhancement. In the science-based eugenic literature (cf. Muller, 1935; Osborn, 1940; 1968; Sutter, 1950; Blacker, 1952; Bajema, 1976; Lynn, 2001) three major qualities can be identified: cognitive abilities, mental and physical health, and sociability. Some authors also advocate the maintenance of genetic variability as a protection for adaptation to changing environmental living conditions (cf. Osborn, 1940; 1968; Dobzhansky, 1962; Brosius and Kreitman, 2000).

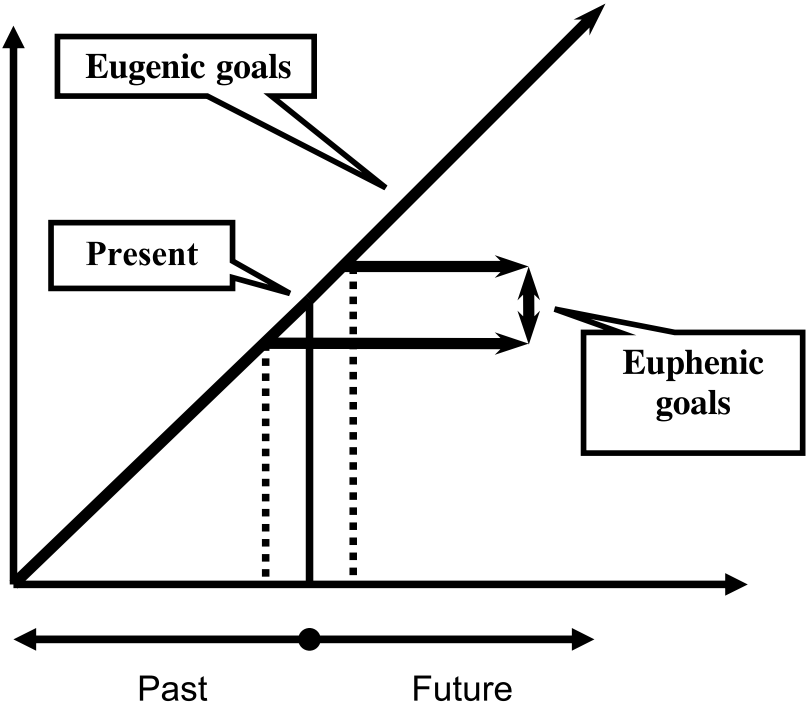

Figure 9.4. Euphenic and eugenic goals for future ontogenetic and phylogenetic development.

This identification of the major human features eugenicists want to promote raises many questions about the degree to which such features should be developed and the degree to which present levels of variation should be preserved or be transcended to a higher level. In order to deal with these issues, eugenic (as well as euphenic) goals should be situated within the framework of the evolutionary hominisation process.

The ultimate aim of eugenics: carrying forward the hominisation process

In his well-conceived book on '*Die biologische Zukunft der Menschheit'* Paul Overhage (1977) warns the reader to beware of long-term predictions and extrapolations of future human evolution which, in his view, are impossible to predict. Scientists should limit themselves to short-term prognoses. The aim of eugenics consequently does not concern the far future:

> *"Die 'ferne' Zukunft der Menschen bleibt der wissenschaftlichen Ergründung verschlossen. Sie kann kein Ziel der Eugenik sein*."[2]

However, the future of mankind can be conceived in the light of its past, long-term evolution, namely the hominisation process. The phylogenetic future of humankind can, in principle, evolve in three possible directions: regression of human-specific characteristics, stagnation of evolution at the present level of development, and a continued process of hominisation.

The third alternative should be the goal for human action. Further hominisation is not just a possible futuristic alternative, but also an ethical principle. This goal implies that humanity should steer its own future evolution through the means of conscious interventions.

The idea of seeking to actively advance the hominisation process is not new. It has, albeit in different terms, been suggested or advocated by other authors. A well-known example is and remains Muller's (1960) 'Guidance of Human Evolution', an extremely well-developed paper that deals in principle with all of the essential issues related to the steering of humankind's future course. It is the idea that the human pilots himself into his future and that he further evolves from '*Homo sapiens*' towards a '*Homo sapientior'* (Overhage, 1977).

The proposition of carrying forward the hominisation process requires some further qualifications.

In bio-anthropology, intelligence (mental abilities), sociability (altruistic proclivities; kindliness, affection and fellow feeling in general, and co-operation within groups larger than the family), and the ability to use symbolic language are usually mentioned as the human-specific characteristics that increased during the hominisation process. Muller (1960) included also: emotional personality characteristics such as quick anger, blinding fear, strong jealousy, and self-deceiving egotism; susceptibility to group experiences of the type called religion which, throughout humankind's history has fostered group solidarity; and predispositions to combativeness, xenophobia and related impulses, "which made inter-group antagonism an active complement to intra-group cohesion". To this list, we might also add some of the psychological features Trivers (1971) considered of great importance in human social evolution such as cheating and self-deceptive behaviour.

The human-specific features to be selected for the future clearly should be concentrated on cognitive abilities (including biological instruments of

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[2] "*The far future of humankind remains closed matter to scientific research. It cannot be the goal of eugenics."* (author's translation)

communication), emotional personality characteristics that facilitate sociability and altruism, and, obviously, physical vigour, health and longevity. In the realm of mental powers, Muller (1960) specified more profound analytic abilities, multi-dimensional thinking, more creative imagination, and the development of new mental faculties such as telepathy; in the physical realm he added qualifications such as reduction of the need for sleep, better management of the effects of sedation and stimulation, and increased physical tolerance and aptitudes in general.

In recent decades, the idea of enhancing human intellectual, physical and psychological capacities by means of modern technologies has been advocated by the 'World Transhumanist Association' (www.Transhumanism.org). Transhumanism, a term coined by Julian Huxley (1957), aims at reaching a 'posthuman' stage characterised by higher-than-current intellectual heights; resistance to disease; increased longevity; unlimited youth and vigor; increased capacity for pleasure, love, artistic appreciation, and serenity; the experience of novel states of consciousness, etc. The 'transhuman' is seen as an intermediate form between the human and the 'posthuman'. Transhumanists strongly promote individual rights and liberties in decision-making about whether to reproduce, how to reproduce, and which technological methods to use in reproduction. They condemn coercion and fiercely reject racialist and classist approaches.

Once the direction of human evolution is set and the social and medical techniques for acting upon that evolution developed, a number of individuals or even entire societies might attempt to genetically programme their offspring as favourably as possible. As we succeed more and more in treating and eliminating diseases and disabilities, it may also be expected that we will be increasingly inclined to take a preventive approach. Moreover, it is entirely possible that genetic engineering will not remain restricted to avoiding pathologic situations, but will be broadened to improve 'normal' characteristics such as cognitive performance, emotional life, sociability, and other desired human characteristics.

However, it is not impossible that some people will try to promote other, socially less valuable features. This raises the question of the relationship between the individual and the population. As a matter of fact, new biotechnologies will enable individuals and families to apply a kind of 'home-made eugenics' (Kevles and Hood, 1992) in which they can decide on the type of children they want to have. Dangers with this ought to be recognised, but there are also arguments in favour of the individual's autonomy in these matters. After all, experience has shown that, on average, governments may make more serious mistakes than individuals.

Rationale for the preservation and advancement of human-specific characteristics

The furthering of the hominisation process implies, as a first obvious step, the preservation, on a short-term basis, of some of the present human-specific characteristics of *Homo sapiens sapiens*. Only in a second stage, over a longer period of time, can we think about the furthering of the process.

With respect to the desirability of preserving some human-specific characteristics, it was explained in Chapter 2 that the human gene pool is continuously undergoing mutations and that many of these mutants are detrimental in their effects on the organism. According to recent studies (e.g. Giannelli *et al.*, 1999; Nachman and Crowell, 2000) the mutation rate in a human zygote is estimated to range between 128 and 175 mutations per diploid genome per generation; one out of three is estimated to be deleterious. Each individual carries five to seven lethal recessive genes (Muller, 1950; Cavalli-sforza and Bodmer, 1971; Larson, 2002). Humans are estimated to have approximately 21,000 genes which can lead to abnormal phenotypes when mutating (OMIM, 2009).

Some of the genetic mutations are relatively minor or are amenable to treatment; others result in death or serious disability. This genetic load manifests itself partly in each generation by genetic impairments, most of which are eliminated in the very early stages of embryonic development as miscarriages or stillbirths. Some five percent of newborns are born with a visible congenital impairment. Some other genetic diseases, such as Huntington chorea, develop at a later stage in the life course. Most congenital impairments are genetic in origin, namely are caused by some defect in the DNA of the carrier.

In pre-modern living conditions, the mutational load was kept constant over generations by natural selection through the immediate or delayed elimination of deleterious alleles. Rare favourable mutations, in contrast, were preserved and spread through increased reproductive fitness of their carriers and resulted in increased adaptiveness which contributed to further hominisation.

As argued above, in modern culture therapeutic practices produce contraselective effects and maintain or even reproductively increase alleles in the gene pool that are less favourable for the physical or mental health or for the social integration of their carriers. These ‘saved’ genes are added, in each generation, to newly arising mutations; thus slowly, but systematically the population’s mutational load increases (Muller, 1960). A primary aim of eugenics, therefore, is to avoid an increase in less favourable genetic variants and to preserve the more favourable genetic variants in the gene pool. In Neel’s (1970, 820) words:

"Protect the gene pool against damage."

In this respect, eugenic action is inevitable (Carlson, 1973). As a matter of fact, in the long run, the accumulation of culturally (medically) preserved and reproduced deleterious genes and the newly arising natural mutations in each generation will lead to a situation in which most, if not all, individuals in the population are endowed with innumerable hidden and conspicuous genetic defects that would require such a scale and variety of medical treatment and social care that it would consume all of society's resources, leaving no surplus for other social or cultural activities (Muller, 1960). In the long run, euphenic correction of the (increasing) genetic load will not suffice to guarantee the maintenance of mental, social and physical health at the population level, and eugenic intervention will have to be undertaken.

Many genetic diseases are caused by recessive alleles that manifest themselves only in homozygous genotype combinations. Eugenics makes it possible to avoid the combination of harmful recessive alleles in homozygote genotypes, either by means of reproductive abstinence, contraception, selective abortion, or change of partner.

Modern culture also manufactures products that contain or emit ionising radiation and some molecules that have mutagenic effects and increase the mutational load in the human gene pool. Eugenics, obviously, aims at preventing the increase of the mutational load due to the use of such harmful products.

Finally, eugenics endeavours to change the trend toward dysgenic differential reproductive practices through which less desirable genetic variants of socially important continuous characteristics, such as low cognitive ability and some negative emotional personality characteristics, succeed in increasing their representation in subsequent generations.

As far as concerns the rationale for the advancement of human-specific characteristics in a longer time perspective, we must be aware of the fact that, historically, human-specific characteristics such as increased cognitive abilities and social cooperation extending beyond narrow family bonds, form the basis for the dramatic, rapid cultural development the human species has been able to achieve. Modern culture, which is based on the development and application of scientific knowledge and humanistic values of individual freedom and equal opportunities for intellectual, social and physical development, has succeeded in partially freeing humanity from the natural causes of high and early mortality and morbidity. It has largely mastered infectious and parasitic diseases and starvation. It has made labour less strenuous and created in many respects a more pleasant physical environment in which to live. It has diminished struggle and exploitation between social classes. It has created, in the most advanced countries, social protection systems that have substantially increased welfare and well being, especially for the more vulnerable members in the population. Finally, modern culture is gradually succeeding in avoiding or controlling inter-group conflicts and war and over time is promoting governance and cooperation at a global level.

All of these achievements have not been realised or sufficiently developed everywhere. Much more work is possible based on the present-day scientific and technological framework and the cognitive and social abilities currently possessed by the human species. Even at current levels of human mental and social capacities, there is certainly room for further cultural and social progress, at national as well as at global levels.

Modern societies must adapt to a rapidly changing environment, in which a high premium has been placed on high intelligence and creativity. On the one hand, modern society requires individuals with high intelligence and creativity in order to adapt to the rapidly changing social and technological environment. On the other hand, individuals require high intelligence and creativity to be able to cope with the challenges of modern culture and to take advantage of the new opportunities for self-fulfilment (Bajema, 1971).

However, the continued development of culture toward levels and depths so far unseen, but conceivable, could be advanced by increasing key human faculties – cognitive abilities, sociability, and interpersonal communication – to still higher levels, beyond the present variation. This would allow the human species to have a deeper insight and understanding of itself and of nature in general, and improve further mastering of its biological, physical and social environment, and to reach higher levels of welfare, well being and happiness, both at the individual and the societal level. Thus, eugenics might contribute to the development of future stages of culture as, for instance, envisaged by Elgin (1993) in his 'Awakening Earth: Exploring the Evolution of Human Culture and Consciousness'.

General societal conditions for implementing a eugenic programme

Eugenics is sometimes labelled as a right-wing, reactionary, conservative ideology that seeks to preserve the prerogatives of the ruling upper classes. It is true that a large part of the early twentieth century pseudo-eugenicist movement was class and race biased. But the later science-based eugenics, as developed in what some historians now call 'reform eugenics' was promoted by socially minded scientists such as Ellis, Haldane, Huxley, Hogben, Jennings, Needham, Muller, Osborn – all of whom advocated the improvement of the stock of the human species through selective breeding (Paul, 1998). Even Galton's principal successor in eugenics, Karl Pearson, was a 'Darwinian' socialist (Kevles, 1985).

Prominent eugenic thinkers such as Muller (1934), Huxley (1936), and Osborn (1940) were even of the view that it would be impossible to achieve eugenic goals in societies that were based on laissez-faire economics or authoritarian regimes. Democracy, guaranteeing personal freedom and a humanistic individual development by means of a generous social protection system, was considered a necessary condition for a sound and humble eugenics (Osborn, 1940). Socially motivated eugenicists also strongly favour female emancipation (cf. Muller, 1960) and the widespread availability of birth control (cf. Osborn, 1940).

Whilst these efforts may be worthwhile, the hominisation process is a transgenerational process that eventually will only progress by means of changing allele frequencies. So far, conscious human genetic intervention has mainly been limited to phenotypic care and improvement, for instance through intragenerational intervention. Intergenerational intervention, more in particular by means of genetic manipulation, requires a generation-transcending ethics and policy.

Such an ethical orientation and policy programme would allow the human species to control not only its demographic growth and phenotypic development, but also its genetic composition – in other words, its future evolution. This proposition may, at the beginning of this century, sound quite daring, if not scary, just as, at the beginning of the twentieth century, quantitative birth control was vigorously opposed. From a longer term perspective, however, it is difficult to imagine that the human, once we have mastered the technical know-how, will not try to avoid genetically determined diseases and promote genetic features that are considered socially desirable or advantageous, such as cognitive ability, sociability, beauty, and mental and physical health in general.

Scientific and social dimensions of eugenics

Eugenics is simultaneously a scientific discipline – a subdiscipline of human genetics, in fact – and a social movement (Bajema, 1976):

> *as science, eugenics "encompasses those scientific studies that are concerned with ascertaining the genetic consequences of implementing or continuing any kind of social program."*

As social movement, eugenics

> *"encompasses all efforts whose goal is the modification of natural selection to bring about change in a particular direction within human populations or the human species as a whole."*

It is striking that eugenicists often emphasise the need to apply eugenics in a 'humane' way. In several of his works Galton (1883; 1905) contrasted eugenics with natural selection:

> *"Man in gifted with pity and other kindly feelings; he has also the power of preventing many kinds of suffering. I conceive it to fall well within his province to replace Natural Selection by other processes that are more merciful and not less effective."*

More recently Bajema (1976, 4) formulated this concern as follows:

> *"The purpose of eugenics as a social movement has not been to copy the blind, wasteful, and inhuman way in which natural selection normally operates, but rather to rationally modify natural selection in such a way that selection produces eugenic consequences while operating in as humane a manner as possible."*

Broad and narrow eugenics

As we have seen, Galton (1883; 1905) defined eugenics broadly. He wanted not only to improve the inborn qualities of the human species but also to develop them to the utmost advantage. This is absolutely sensible. It wouldn't make much sense to favour the spread of particular genetic variants and not care that these potentialities could be phenotypically realised. We should never forget that most of the socially highly relevant human characteristics are polygenetic: in other words, they are determined by several genes and need environmental stimulation to be fully developed.

However, it is true that many eugenic writings mainly focus on eugenics in a narrow sense, namely the improvement of the human gene pool. This does not mean that eugenicists have no concern for the developmental aspects of genetically determined characteristics. A content analysis of the major, more extensive treatises on eugenics (cf. Osborn, 1940; Sutter, 1950; Blacker, 1952; Bajema, 1976; Lynn, 2001) and the major eugenic journals or their successors, such as 'Social Biology' and 'Journal of Biosocial Science', demonstrates that scientific eugenics is usually considered in its broad sense.

Eugenic target levels

Theoretically, eugenics can be targeted at two different levels: (1) the individual or family level and (2) the population level. Recently, Wertz (1998) coined the terms 'individual eugenics' and 'social eugenics' in this respect.

The first is often associated with genetic counselling, as it has been practiced since being developed over several decades at university medical-genetic departments in many countries. The aim is to provide individuals or families who are at high genetic risk with genetic information and/or medical assistance in order to prevent the transmission of a genetic disease or impairment to subsequent generations. In this sense, eugenics plays a role in preventive medicine focused on individual or family care (cf. Kelly, 1986; Kenen and Smith, 1995; Veach *et al.*, 2003; Harper, 2004).

The second considers eugenic action at a higher level of organisation: its ultimate goal is to improve the genetic composition of the entire population's gene pool. The population approach includes, obviously, the individual/family level of genetic counselling in cases of suspected risk for the transmission of a genetic impairment – so-called cascade screening[3]. But the approach aims for an as complete a screening of the population as possible (cf. Godard *et al.*, 2003). In this respect, the distinction between the two levels – individual and population – is quite artificial. However, the population approach may, in addition, include programmes, policies, and actions aimed at changing the distribution of 'normal' characteristics – such as intelligence, sociability, and physical health in general – in the direction of the higher values of the variation.

Eugenic benefits and costs

Eugenics has many benefits. Genetic diseases or impairments may be avoided, mental or physical health may be improved, and specific human features such as intelligence and sociability may be enhanced.

Natural selection may be replaced by scientific selection (Glad, 2003), thus changing the *laissez faire* approach of natural selection into a guided selection, as Galton suggested as early as 1905:

> *"What nature does blindly, slowly and ruthlessly, man may do providently, quickly and kindly. As it lies within his power, so it becomes his duty to work in that direction."*

Both eugenic action (the promotion of a more humane selection) and eugenic effect (the avoidance of the transmission of genetic impairments) enhance individual well being and family happiness and welfare. The mere existence of the option of genetic counselling and eugenic practices such as prenatal screening and selective abortion may considerably reduce individual and family stress and,

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[3] Cascade screening involves the diagnosis of an affected individual followed by the systematic identification and testing of relatives.

ultimately, even result in the formation of a complete family for those who otherwise would remain childless or face the prospect of seriously handicapped offspring.

Eugenically motivated interventions can at the same time have favourable social effects. Sterilisation of mentally retarded persons, for instance, is often especially desirable from a social or pedagogical point of view, because persons who are mentally defective or who suffer from other serious handicaps often are not able to shoulder the responsibilities of parenthood.

At the societal level, eugenics can contribute substantially in reducing the high financial costs of treating, maintaining and caring for genetically seriously impaired persons. Indeed, several case studies suggest that the cost to the public and private sectors of maintaining offspring with serious defects is very high (cf. Rowley *et al.*, 1998; Wildhagen *et al.*, 1998; Murray and Cuckle, 2001). For instance, seven regional clinical genetics centres in the Netherlands that are involved in pre- and postnatal chromosome analysis, biochemical and DNA diagnosis, and genetic counseling and supported by the national health insurers cost circa $50 million per year. As a result, the birth of 800–1600 severely handicapped children is avoided every year. The costs of their medical and psychosocial care would have been 10 to 20 times higher than the cost of running the centres, assuming an average life span of 10 years (Galjaard, 1997).

However, improving a particular biological feature might entail unexpected and undesired side effects. Evolutionary history, indeed, shows that each particular genetically determined biological feature must always be considered in the context of its interaction with the genome as a whole, as well as with the environment in which it operates. For humans, a particularly important aspect in this respect is the social implications of producing an ‘improved’ genotype of an individual. Reiss and Straugham (1996) give a few examples of the problematic social effects of germ-line therapy: enhanced memory capacity might make life more difficult if unpleasant past events continue to preoccupy one’s mind, or genetically engineered children might fall short of their parents’ expectations, thereby imposing psychologically burdens on both the parents and offspring.

Another potential cost of eugenic practices concerns the fact that measures aimed at improving polygenetic features undoubtedly will have statistically positive effects at the population level, but not necessarily for each individual or couple. Due to the segregation and recombination of genes, the offspring of parents with exceptionally high intellectual or physical endowment will tend to exhibit regression and variability; on the other hand, less endowed parents may have children that exceed them in cognitive ability or physical performance.

More broadly, the arrival of groups of individuals with superior capabilities in particular areas – such as intelligence, physical performance, or artistic creativity – might disrupt social cohesion by increasing inter-group competition, jealousy on the one side and contempt on the other (cf. Fukuyama, 2002). From a broader time perspective it is, indeed, not certain whether a '*Homo sapientior*' or a 'posthuman' would be so warmly welcomed by the present *Homo sapiens sapiens*, just as the *Homo erectus* might not have been so fond of the present incarnation of the hominid family.

Eugenic fallacies of the past

In his well-documented 'In the Name of Eugenics', Kevles (1985) distinguishes three major stages in the eugenics movement: the 'Mainline Eugenic Movement' from the end of the nineteenth century until the 1930s, the 'Reform Eugenics starting in the 1930s, and the 'New Eugenics' originating in the mid-1960s.

In general the 'Mainline Eugenic Movement' was strongly oriented toward 'Mendelian' genetics, hereditarily prejudiced, class- and race-biased, politically conservative, antifeminist, strongly against birth control (both contraception and abortion), and in favour of compulsory eugenic measures.

The 'Reform Eugenics' reacted against the unscientific and authoritarian approach of the Mainline Eugenics and its class and race prejudices. Eugenics had to be consistent with what was known about the laws of heredity. A new generation of leaders in organised eugenics, particularly F. Osborn (1940) in the United States and C.P. Blacker (1952) in England, sought to develop a science-based eugenics and tried to oppose it to the dysgenic policies of Nazism. The reform eugenics efforts eventually resulted in the development of modern genetic counselling (cf. Reed, 1974; Petersen and Bunton, 2002).

The 'New Eugenics' – a term coined by Sinsheimer in 1969 – arose on the basis of the dramatic development of the biochemistry of heredity and in particular of molecular genetics and of micromanipulator medicine in general, resulting in totally new fields such as germinal gene therapy and medically assisted reproduction (Khoury *et al.*, 2000; Epstein, 2003).

Thus, the so-called 'eugenic fallacy' applies to the early 'Mainline Eugenic Movement' and its late offshoot in German Nazism. Mainline eugenics is mainly documented for the United States and Britain (cf. Farrall, 1979; Haller, 1984; Kevles, 1985; Paul, 1995; Selden, 1999), but it developed in many other countries as well (cf. Adams, 1990; Wyndham, 2003), in particular in Nazi Germany (cf. Saller, 1961; Klee, 1983; Müller-Hill, 1984; 1988; Kaiser *et al.,* 1992).

The 'Mainline Eugenic Movement' was partly driven by scientists such as Davenport (1911) in the United States, Pearson (e.g. 1909; 1912) in Britain, and Fischer (1933), Lenz (1921-1936), Rüdin (1934), and von Verschuer (1941) in Germany, but the movement was largely usurped by racial theorists such as Grant (1921) and Stoddard (1920) in the United States, Chamberlain (1916) in Britain, and Günther (1927) and Rosenberg (1934) in Germany.

The popular eugenics of the early twentieth century suffered from a distorted view of human genetics, the science of which was yet in its primary stages of development. Mainline eugenicists not only believed in the overarching importance of heredity in human behaviour and underestimated or neglected the role of environmental factors, but thought that complex behavioural traits were transmitted as single-gene Mendelian traits – that is why they are sometimes referred to as 'Mendelian' eugenicists (cf. Selden, 1999). Early popular eugenics, although supported by renowned scientists in anthropology, biology, and psychology who should have known better, became increasingly estranged from the developing field of genetics. Geneticists were virtually absent from the development of these early eugenics movements.

Mainline eugenics was not only hereditarily determinist and alienated from the rapidly developing field of genetics, but was notoriously characterised by racism and/or a social class prejudice. Mainline eugenicists pursued policies that served the interests of their social class and/or their ethnic or racial in-group.

Mainline eugenics pursued both positive and negative eugenic policies, the latter partly by means of compulsory measures. In the United States, the eugenics movement organised 'Fitter Families Contests' in the 1920s, awarding medals to prize-winning families (Kevles, 1985). At the beginning of the twentieth century many US states passed sterilisation laws and enacted restrictive marriage laws for mentally retarded persons or those judged socially unfit. Some states even enforced anti-miscegenation laws, banning the racial intermarriage of whites and blacks. In 1924 the infamous Johnson-Reed Act was passed, virtually eliminating immigration from Southern and Eastern Europe (Kevles, 1985; Selden, 1999).

In 1933, the government of Nazi Germany issued a law for the prevention of progeny with hereditary defects and allowing for compulsory sterilisation in cases of congenital mental defects, schizophrenia, manic-depressive psychosis, hereditary epilepsy, and severe alcoholism ("*Gesetz zur Verhütung erbkranken Nachwuchses vom 14. Juli 1933*"). In 1935 came the notorious Nuremberg law 'for the protection of German blood and German honour', which prohibited marriages and extra-marital sexual intercourse between Jews and citizens of German or related blood ("*Gesetz zum Schutze des Deutschen Blutes und der Deutschen Ehre, 1935*"). In 1936 Himmler initiated '*Lebensborn*', urging members of the SS to father numerous children with racially preferred women (cf. Lilienthal, 2003). This was followed in 1939 by a law promoting euthanasia of the mentally diseased or disabled in German asylums ("*Gesetz über die Sterbehilfe bei unheilbar Kranken, 1939*"). Finally, the systematic extermination of Jews, political and ethical opponents and other 'undesirable' population categories was prosecuted between 1941 and 1945 (cf. Reitlinger, 1953; Hilberg, 1961; Kenrick and Puxon, 1972).

Comparing the Nazi eugenics policy goals and practices with the goals of a scientifically based eugenics, it is evident that Nazism had nothing to do with a genuine eugenic policy. The Nazi rhetoric on eugenics was absolute humbug, a cover for other politically motivated actions that had no eugenic effect at all, and in some cases had precisely the opposite, namely a dysgenic, effect. The indiscriminate sterilisation of people with genetic impairments was scientifically unfounded (cf. Dahlberg, 1948). The euthanasia of handicapped people had no eugenic repercussions. Most of the victims were seriously ill, were institutionalised and had no opportunity to transmit their genes inter-generationally. The aims of this policy were apparently more of an economic than a biological nature. With respect to the promotion of the so-called Aryan race, the Nazi policies were likewise a cheap swindle because this so-called Aryan race does not exist as a biological entity. In so far as the German population was associated with the Nordic variant of the Caucasian race, there was not a single scientific argument or proof for the alleged biological superiority of this population-genetic variant.

Meanwhile, the extermination policy toward the Jews had absolutely nothing to do with eugenics. On the contrary, by driving the more intelligent Jews and other valuable intelligentsia away as emigrants to other lands, or by eliminating them in concentration and death camps, Nazism in fact had a dysgenic effect, comparable to the persecutions of prominent thinkers by the Catholic Inquisition in the late-medieval and early Renaissance eras. The intellectual superiority of the Jewish population was well known to the Nazi geneticists and anthropologists (cf. Lenz, in: Bauer *et al.,* 1936). The Jewish achievements and intellectual capability were apparently a thorn in the flesh of the Nazis. The Shoah (or 'holocaust') was in fact a 'final solution' to the problem of competition with a socially successful population group that was a traditional scapegoat in Christian Europe in times of crisis.

In the 1930s, though scientists succeeded in reorienting the eugenic movement by reintegrating it with the various fields of genetics (human genetics in general, population genetics, cytogenetics, biochemical genetics, and behavioural genetics), and stripped it of unscientific racist and class prejudices, the harm was done to the field's reputation. Mainly through the barbaric and unscientific excesses of Nazism, the notion of eugenics was compromised. Both the American and the British Eugenic Societies changed their names and the titles of their main publications. The American Eugenics Society was rebaptised in 1972 as the Society for the Study of Social Biology and its journal, 'Eugenics Review' became 'Social Biology' in 1969. The British Eugenics Society was reformed in 1989 into the 'Galton Institute' and its journal, 'Eugenics Quarterly', became the 'Journal of Biosocial Science'.

All in all, it is quite odd that some continue to associate the concept of eugenics with the policies pursued by the Nazis, or that 'eugenics' is considered to be a dirty word. The scientific weaknesses and the ideological prejudices of the early popular eugenics movement, and Nazi policies are often seized as a good, albeit unjustified, excuse for opponents (such as environmentalists, individualists, and religious traditionalists and fundamentalists) to reject eugenics as such and even to condemn their advocates as Nazis and racists, or as right-wing conservatives. When one hears some anti-eugenicists, one often has the impression that they have never read a single scientific, *bona fide*, book on eugenics or even human genetics, let alone population genetics or evolutionary biology.

In an excellent recent reassessment of eugenics, Lynn (2001) rightly states that it is quite unusual for a theory that is essentially correct, to be rejected. He sees the increasing precedence accorded to individual rights over social rights as the fundamental cause of the decline of eugenics in the later decades of the twentieth century – a phenomenon which he perceives as causing the rejection of eugenics and increasing the acceptance of individual rights in many other domains of life, such as the right of people with genetic diseases or disorders to have children and the individual freedom of HIV/AIDS carriers to affect others, etc.

Lynn's fundamental explanation for the rejection of eugenics is very important. The same shift from social to individual concerns and rights with respect to quantitative population control and family planning was on display at in the United Nations World Population Conferences of Bucharest (1974), Mexico City (1984), and particularly in Cairo (1994) (Cliquet and Thienpont, 1995).

Nevertheless, at least two other factors are important for understanding the widespread negative attitudes toward the scientific field of eugenics. First, the devastating effect of the atrocities committed against individual citizens or groups of people, in the name of or under the guise of social rights, by a broad variety of authoritarian political regimes – Nazism, fascism, communism, various forms of nationalism and religious fundamentalism, and other forms of authoritarianisms –

should not be underestimated in a knowledge-based and ICT- dominated, globalising world. Second, the shift from biological to cultural determinants of social policy which occurred in the course of the twentieth century has not yet been replaced everywhere by a more multidisciplinary approach in which biological (including genetic) factors are integrated into a more comprehensive biosocial approach.

ETHICAL CONCERNS

Two major issues have to be considered: (1) ethical concerns about the principles and goals of eugenics in general, and (2) ethical issues related to the application of particular eugenic methods or practices.

Ethical concerns about eugenics in general

A variety of ethical concerns have been formulated with regard to eugenics.

To start with, the concept of eugenics is often rejected because, in the past, as discussed above, some ideologies or political regimes have abused and misused the concept, sometimes with dysgenic rather than eugenic consequences for their population as in the case of Nazi Germany. Rejection of the concept on this basis is unjust. One does not reject the message of love in Christianity or the social concerns of Marxism just because horrible crimes have been committed in their name. Eugenics is an ideology aiming at the betterment of the mental, social, and physical health of future generations by means of interventions in the genetic causes of diseases and impairments, and the social and intellectual functioning of individuals.

Reiss and Straugham (1996) distinguish two major groups of objections to eugenics: intrinsic and extrinsic.

Intrinsic objections arise from the conviction that eugenics is wrong in itself. It is considered unnatural, either because it is believed that nature knows best (the naturalistic fallacy), or because eugenics is thought to show a lack of respect for life, the biotic community, the environment, or – most importantly – because nature is conceived as the work and will of God(s) (i.e., ‘don’t play God, leave well alone’). Eugenics is obviously condemned by traditional fundamentalist religions because they reject such human intervention in God’s creation. It is a position that results from pre-scientific beliefs and that is at right angles to the essential acquisitions of modern culture (cf. Pius XI, 1930; John Paul II, 1995).

But, as argued earlier, many advocates of modern ideologies, such as liberalism or socialism, reject eugenics, or at least social eugenics, because they don't like the social or population approach and its ideological foundation. Individual eugenics as practiced in present-day genetic counselling, where the welfare of individuals or individual families is the central focus, is considered 'good eugenics' whilst social eugenics that concerns the welfare of the population or the gene pool is labelled 'bad eugenics' (Paul, 1998). For instance, strong criticism has been expressed against the recent eugenics law in China (1994), as it was also voiced against the eugenics policy of former Singaporean Prime Minister Lee Kuan Yew (in 1987). Although some criticism may be justified from a technical scientific point of view, the major obstacle appears to be the different ideological orientations toward the primacy of societal over individual concerns and/or the use of coercive methods (cf. Bittles and Chew, 1998; Knoppers, 1998; Dikötter, 1998).

Another aspect of individual-societal antagonism concerns the ambivalent attitude that exists in many societies with respect to society's responsibility to provide phenotypic care for the individual on the one hand, and the individual responsibility toward societal continuity, quantitatively as well as qualitatively, on the other hand. Regarding the latter, Muller (1960, 436) formulated a pertinent response decades ago:

> *"Although the mores of our society approve the extension of society's aid to individuals for the purpose of saving their lives and thereby enabling them to reproduce, they do not yet, reciprocally, recognise the duty of individuals to exercise their reproductive functions with due regard to the benefit or injury thereby done to society."*

The individual freedom (right) to produce genetically impaired children or to transmit harmful genes to future generations, for whatever reason (e.g. religiosity, sexual machismo, or lack of responsibility), might, indeed, need to be limited or denied, not only because of the societal costs involved, but for the sake of the impaired offspring themselves. Thanks to a variety of procedures now available in modern medically assisted reproduction, the birth of genetically impaired offspring can, in an increasing number of cases, be avoided and compensated for by the birth of healthy children.

Some people accept eugenic interventions to prevent the intergenerational transmission of genetic diseases or impairments, but fiercely oppose some aspects of positive eugenics, in particular efforts to improve offspring by endowing them with exceptional qualities (cf. Hanson, 2001), or to favour the transmission of particular features such as sex, hair colour, complexion, etc. As a matter of fact, new biotechnologies will enable individuals and families to produce ‘designer babies’ (Holland, 2003) or to apply a kind of ‘home-made eugenics’ (Kevles and Hood, 1992) in which they can decide on the type of children they want to have.

It is evident that most of the intrinsic objections against eugenics are based upon one or another philosophical, religious, or ideological conviction that considers some aspects of reality as irrelevant or unimportant. The acceptance of individual-focused eugenic practices but rejection of the socially oriented goals of eugenics is a good example of a partially or lopsided approach to the facts of life, as if life consists only of individual phenomena and individual acts have no social or intergenerational consequences.

Extrinsic objections arise from the belief that eugenics is wrong because of its assumed negative consequences. Some are of the opinion that eugenic practices are too risky or may even be catastrophic for the biological future of the human species. Others fear that intervening in the germ-line will reduce the genetic variability in the population. Another objection is that eugenics might be abused by dictatorial regimes to control people or by the genetics profession. Hanson (2001) even argues that reproductive technologies might be used by men to reinforce their control over women or used by women to liberate themselves from male dominance. In a similar vein, Bohrer (1992) warns against the danger of the creation of social inequalities through application of new bio-technological methods: wealthy citizens would have greater possibilities to apply such ‘expensive’ techniques, thereby increasing the differences between the haves and the have-nots. Also, the differences between generations would be enhanced (Stock, 2002).

Whilst most – if not all – of these extrinsic objections are not well founded, and certainly do not offset the advantages of eugenics, it is still important to keep in mind that “no activity or process can ever be guaranteed to present no risk whatever and to be 100 percent safe” (Reiss and Straugham, 1996).

Eugenic changes in the population’s gene pool might increase rather than decrease genetic variability, with the exception of course of deleterious variants. The fear of dictatorial abuse of eugenics belongs to the realm of science fiction. Nazism has shown that dictatorial applications have dysgenic rather than eugenic effects. Reiss and Straugham (1996), moreover, rightly argue that dictators have had, have now, and will have far more effective ways of controlling people. As far as concerns the fear of abuse by the genetics profession, it is unimaginable that all or even a substantial minority of genetics professionals would morally misuse their genetic knowledge for purposes other than the betterment of the human condition. The combination of increasing female emancipation with generalising informational and educational opportunities, including in the fields of human and medical genetics, forms a sound guarantee against any gender abuse of genetics, in whatever direction. Bohrer (1992) has a point in warning against the possible rise of social inequality due to the application of eugenic methods, leading to a kind of 'liberal eugenics' (cf. Agar, 2001). Empirical data show that the use of or access to genetic services is strongly class-based, favouring families at the upper end of the income scale or educational training (cf. Sokal *et al.*, 1980). However, this is a phenomenon that is not limited to eugenics, but applies to all domains of medicine and even social life in general, and can be managed by socially equitable policies.

Ethical issues in eugenic practice

The application of both major types of eugenic methods – biotechnological interventions and differential reproduction – is guided by some general ethical principles, in particular with respect to the question of (individual) rights of choice and decision making. Coercion versus free choice in the application of eugenic measures is one of the oldest debated ethical issues in the history of eugenics. It is a problem that is not specific for eugenics, because it applies to many other areas of social life, especially medical practice, but in the case of eugenics, it always entails intergenerational implications.

An ethical dichotomy – free choice versus the compulsory application of eugenic practices – is too simplistic a view of the ethical approach towards eugenics. In fact, it is possible to see a broad spectrum of gradually differentiated positions between these two extreme positions. At the one extreme – free choice – individuals may receive non-directive genetic counselling and make autonomously informed decisions about their future reproductive behaviour. The role of the genetic counsellor is defined as that of a neutral, non-judgemental information provider rather than a decision maker – a definition that would, according to Pilnick (2002), enjoy a widespread agreement amongst genetic counsellors in the United States. At the other extreme – compulsory eugenics – individuals (identified as having a genetic risk) are required to participate in genetic counselling or screening and are, in cases of a diagnosed individual or family risk, obliged to follow legal provisions such as sterilisation or abortion.

In between these two extremes, a variety of other, more nuanced positions are possible. For instance, whilst leaving the ultimate choice, in principle, to the patient, genetic counsellors could exert 'soft coercion' in convincing the patient to follow the counsellors' advice or decision. In this view, counsellors should positively interfere in the decision-making process in the interest of the patients, their families, and society overall (cf. Bajema, 1971; Staatscommissie voor de Ethische Problemen, 1975).

Compulsory rather than individual free choice might, but should not necessarily, be more common where the approach to eugenics is more socially oriented than individually or family oriented. In principle, however, all possible ethical positions regarding eugenic practices could be applied both in individually and socially oriented eugenics.

A particularly difficult issue arises in cases where patient(s) are (develop)mentally or socially incompetent to make a 'free and responsible' decision about having children if there are high genetic risks. However, this question applies not only to cases where there are genetic risks, but also and more generally to cases of making the choice to have more children.

Another disputed issue is the question of whether parents have the right to choose the sex of their offspring. Sex, indeed, is not a disease, but why should parents who have already one or more children of the same sex not be allowed to satisfy their 'king's wish' and have a child of the opposite sex? At the social level, this issue is obviously more a question related to sexual relations and demographics, and may, in some societies where discriminatory attitudes toward girls are still prevalent, result in serious distortions of the sex ratio, as is, for instance, currently experienced in China and India (cf. Johansson and Nygren, 1991; Arnold *et al.*, 2002). It is understandable that many feminists fulminate against the practice of sex selection.

Another series of ethical problems in eugenics concerns the question of informing the patient about his or her risks of developing a genetic disorder (for example, with regard to Huntington's chorea, see Elger and Harding, 2003) or his or her risks of transmitting the disorder to offspring. An even more tricky issue concerns the question whether relatives should be warned, possibly against the patient's wishes. Whereas the first issue (informing the patient about his/her own risk of developing a genetic disorder) is a matter that is not really specific for eugenic counselling but rather of medical ethics in general, his risks of transmitting the disorder to offspring and the question of whether relatives should be informed about their risks of transmitting the disorder are definitely eugenic issues and should be dealt with as such. However, in the current stage of the development of modern culture, the effects of the ideology of individualism on education, medical practice, and attitudes toward eugenics, cause disputes amongst professionals and the public at large.

Related to the issue of the right to genetic privacy is the question of informing third parties, for instance with regard to job recruitment. Employers, both in the public and private sectors, have an interest in recruiting healthy employees who have a low risk of suffering from a long-term disease. Already a medical examination is a common part of the normal selection procedure for many long-term jobs. With the increasing possibilities of identifying the presence of genes which, in time, could cause unfavourable phenotypic effects, the question arises whether genetic screening procedures should be included in recruitment medical examinations (e.g. Draper, 1991; Rothstein, 1995).

It is understandable that germinal engineering often meets with more opposition and requires a more cautious approach than somatic engineering. Eugenics not only plainly contradicts the traditional conception of the creation of human life, but it also has implications for the genetic composition of future generations (Stock, 2002).

Implementing demographic selection poses several delicate problems, mainly related to the type of demographic method used to achieve the aims – such as partner choice, fertility, length of generation, and mortality. Whilst expanding personal freedom and opportunities in partner choice could have positive genetic effects (Epstein and Guttman, 1984), the increasing claims for sexual and reproductive rights for all, including people with handicaps (United Nations, 2006), might have adverse effects if these rights are not combined with responsibilities, especially in the realm of reproduction.

Genetic selection by means of mortality involves the delicate problem of abortion. Although a majority of countries in the world have already adopted laws liberalising pregnancy interruption for therapeutic reasons, including foetal indications, abortion will for some time remain a controversial issue, at least in those countries that have not yet modernised their legislation (United Nations, 1995) or in countries where pro-life lobbyists actively try to reverse the existing pro-abortion legislation.

Achieving a differential fertility raises the problem of the methods to be used: free choice, education or coercion. In a value and norm system that prizes the enhancement of individual emancipation and autonomy, only free choice and education can be advocated. But what if free choice and education cannot help? What if the most-educated and best-trained citizens prefer to practise art or science, or to pursue still other lifestyles, rather than raise children? What if mentally retarded persons cannot learn to realise that fertility limitation contributes to their own well being and the well being of society? Some have expressed the opinion that in a number of cases soft coercion cannot be excluded (Bajema, 1971) or that the active intervention by educational authorities, welfare workers, and public health workers is necessary (Staatscommissie voor de Ethische Problemen, 1975).

Now that opportunities for the qualitative control of births and deaths are increasing with the development of biotechnology, a societal debate on the limits to the use of these powers is inevitable and absolutely necessary. It is to be expected that the initial discussion of this will include a profound ideological debate and political struggle. Though biotechnology is still in its early stages, it has already given an enormous impetus to the development of bio-ethics.

Attitudes towards eugenics

The study of current attitudes toward eugenics and reproduction in general is interesting but tricky. Such attitudes must be researched in order to understand policy decision-making, though measures of popular attitudes are not necessarily a sound basis for making policy. Moreover, attitudes can and do change, sometimes astonishingly quickly.

The history of birth control is highly illuminating in this respect. In the earliest industrialised countries, birth control practices were initially based mainly on changes in the reproductive behaviour of individual families, and were opposed by virtually all important sectors of the 'establishment' (e.g. churches, governments, political parties, trade unions, industrial leaders, the medical corps, the military, etc.) (cf. Van Praag, 1979). Even individuals who secretly practiced birth control often denied indignantly the use of such practices, as early researchers of birth control practices experienced in their surveys (e.g. Cliquet, 1972). Sometimes people practice and eventually approve of certain behavioural patterns, even when they are publicly considered politically or ethically incorrect.

Though eugenics may often be seen in an unfavourable light – largely due to the obvious humbug of ideologies and regimes such as Nazism – the fact is that the average human thinks and acts in strongly eugenic terms – at least when she or he has real possibilities to make the choice. This is revealed for instance with regard to partner choice (Epstein and Guttman, 1984), and can also be seen in the reproductive behaviour of many married and unmarried couples who are faced with a hereditary genetic risk and have access to genetic counselling and intervention (cf. Evers-Kiebooms, 1994; Press and Browner, 1997). For instance, 65 to 95 percent of mothers who learn that their baby might have Down syndrome choose to abort (Royal Commission on New Reproductive Technologies Canada, 1993; Glover and Glover, 1996; Roberts *et al.*, 2002).

The overwhelming majority of people are very sensitive to eugenic issues, both in their choice of a (healthy) partner (cf. the 'good genes' theory in Chapter 5) and in the desire for genetically healthy children (cf. Dice, 1952). Well known are the difficulties in finding a partner faced by young men, who have been declared medically unfit for military service. Equally well-known is the fact that, in the old days, gynaecologists saw few pregnant women '*in blijde verwachting*'

(Dutch = 'blisfully expecting') due to their fear of giving birth to an abnormal child.

Even though individualism seems to have become a predominant moral principle in Western societies (cf. Birnbaum and Leca, 1986), eugenic attitudes and behaviour, at least regarding the desire to avoid the reproduction of genetic impairments, are widespread amongst Western populations and their medical professionals, as shown in international comparative surveys (cf. Wertz and Fletcher, 1989; Wertz, 1998).

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CHAPTER 10

ETHICAL AND POLICY CONSIDERATIONS REGARDING THE BIOSOCIAL FUTURE OF HUMANKIND

INTRODUCTION

Making the transition in a discussion from facts to values and norms is not a simple matter. Biological knowledge can help immensely to identify and affirm particular values and norms as they relate to basic needs and individual phenotypic development. However, due to the biological specificity of the human being which results from bio-cultural co-evolution, many value-based choices must be made in order to complement our evolutionary-biologically based needs regarding the future of humankind, particularly at individual-transcending levels.

Discussing the policy implications of trajectories and choices always entails scientific and philosophical and/or ideological assumptions, and intellectual honesty requires clarity about the assumptions from which one departs. This is particularly necessary for the themes dealt with in this treatise, which has demonstrated important discrepancies between humanity's evolutionary-biological background and the opportunities offered and demands made by modernity. Therefore, this final chapter begins with a brief discussion of the essential ethical options relevant to the biological future of the human species in a world that continues to modernise.

BASIC ETHICAL OPTIONS RELEVANT FOR THE BIOSOCIAL FUTURE OF THE HUMAN SPECIES

When analysing the relationship between human evolutionary-biological specificity and the opportunities and exigencies of modern culture, it is possible to identify six major ethical dilemmas relevant to the future evolution of humanity, in particular regarding its major biosocial sources of variation. Each of them is bipolar with a continuous variability between the two extreme poles: (1) intervention versus non-intervention; (2) quality versus quantity; (3) equality versus inequality; (4) cooperation versus competition; (5) out-group versus in-group relations; and (6) intergenerational versus intragenerational challenges. We will position ourselves on each one of these continuities.

All of these ethical dilemmas are relevant to the different sources of biosocial variation dealt with in this treatise. However, some are more or less specific to the topics addressed in each chapter: the cooperation-competition polarity mainly relates to individual sources of biological variation; the in-group/out-group polarity applies mainly to group sources of biosocial variation, and in particular to between-group variation; and the intra- versus intergenerational polarity obviously is of primary importance for intergenerational variation (Figure 10.1)

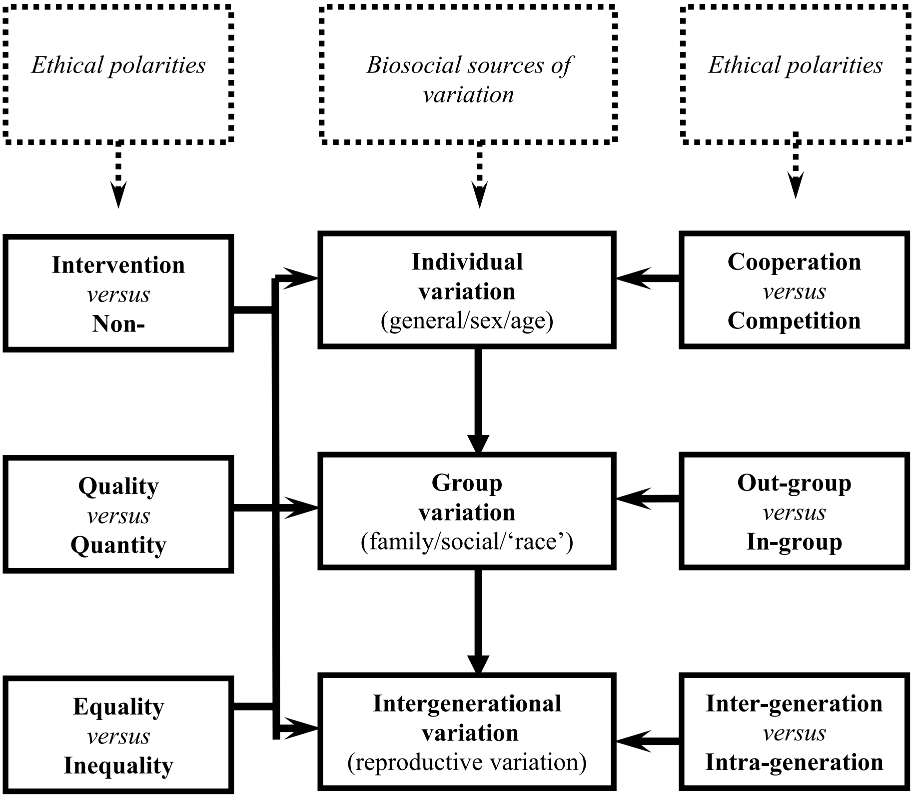


Figure 10.1. The relations between basic ethical polarities and sources of biosocial variation.

Intervention *versus* non-intervention

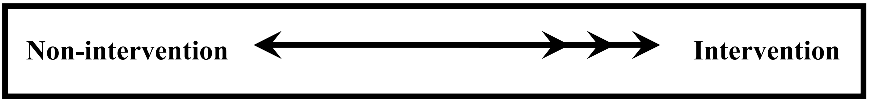
One of the principal features of modernity is society's extremely increased capability of intervention, including into human life itself. However, intervening in the organic existence of human beings is neither accepted by everyone, nor in all circumstances. Some ideological groups advocate prohibiting intervention into human life or in certain aspects of life, or the use of certain methods thereto. This attitude is strongest amongst people with religious convictions, since they typically believe that life is sacred, is created by God(s), and that humans are not entitled to usurp this supernatural power to themselves. Intervening in human life, and more particularly in the creation of life, is a form of '*autopoiesis'* (Greek = self-creation), and is considered the supreme form of '*hubris'* (Greek = arrogance) (cf. Malherbe, 1981; Zycinski, 2006). Advocates of the principle of the sanctity of life hold the view that human life starts at conception and doesn't end with death. Consequently, they usually are opposed to interventions such as contraception, induced abortion, and euthanasia.

Those who question the principle of the 'holiness of life' usually stand for the principle of 'quality of life', which defines human life instead in terms of psychological, cultural, intellectual, moral, and relational indicators of personality (cf. McFaul, 1978; Holland, 2003). Here, the choice to intervene in life is assessed not so much on the basis of the meanings given to conception and life after death, but rather on the basis of the extent to which intervention promotes quality of life.

The negative attitude toward intervention is not always free from some considerable inconsistencies. This is most noticeable amongst the different attitudes taken toward somatic and germinal interventions. It is very rare that people, even religious believers, raise opposition to the fight against disease or death. Instead, objections are more often made to the intervention in fecundity, both regarding limitation (contraception, abortion) and extension (insemination by donor, in vitro fertilisation, embryo transplant). Particularly negative are reactions regarding the genetic engineering of sex cells (cf. John Paul II, 1995).

This inconsistency in the approaches to somatic and germinal intervention is illogical and ahistorical in several respects, as life is a complex and vulnerable system that came into being and continues to exist through, *inter alia*, the combined action of factors such as mutation and selection. Once interventions are introduced into that system, it is necessary to carry on with them in a consistent way, in the light of principles such as the promotion of the quality of life and human dignity. A one-sided or partial intervention by combating natural selection without compensation, by only intervening in death and not in births, for example, inevitably leads to a disturbance of natural balances. However, it must be said that not everyone sees a glaring contrast between the belief in 'the holiness of life' and in the acceptability of promoting 'quality of life'. Many people, including some religious believers, see room in the application of biotechnology for joining both these principles (cf. Cohen-Almagor and Shmueli, 2000).

The dynamics of modernisation, indeed, do not leave us with much choice. The preceding nine chapters have shown that there can be no doubt that modernisation forces us to opt for intervention rather than non-intervention on the intervention/non-intervention scale; but we must do so in a coherent way, and with the aim of promoting the quality of life. But this brings us to the next controversy.



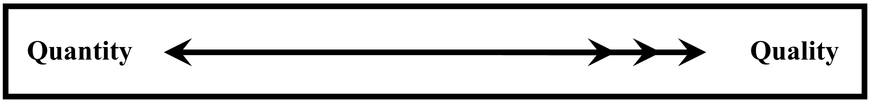
Quality *versus* quantity

The promotion of quality of life should be weighed not only against the holiness of life, but also against the quantity of life. Due to the scarcity of resources that humans have almost constantly had to cope with in the course of our evolution, the pursuit of high quantity was often a guarantee for promoting quality. We see this pattern repeated throughout history: high fertility was a protection against high mortality, and provided a large number of workers in family businesses and more security for parents in their old age. A bountiful harvest preserved people from dreaded starvation in winter. A large number of soldiers were a barrier to possible conquerors or formed an instrument for the acquisition of new territories.

The development of modern culture threatens to turn the former positive association between quantity and quality into a negative one: with the achievement of efficient mortality control, high fertility leads to a demographic explosion that, ultimately, will lead the population to exceed the carrying capacity of the environment and create intolerable conditions for humans. The human predisposition to maximise inclusive fitness and the related drive toward greed can lead, in modern living conditions, to over-consumption with results that may include epidemics of obesity, traffic accidents, pollution, and depletion of resources.

Assuming that modern culture will keep on developing, it can be argued that the relationship between quantity and quality will have to be reconsidered and, especially, be redefined in the light of concern for sustainable growth. From such a perspective, it is not impossible that, whilst in the past quality was formerly promoted by quantity, in the future quality will have to be achieved at the expense of quantity. Given the finiteness of the planet and its limited capacity to sustain life, the exploitation of the earth's resources will eventually reach a point at which the further improvement of quality of life will become inversely proportional to the growth in population size. After all, quality and quantity both require escalating use of the restricted amounts of available raw materials, space, and energy, which imposes a growing burden on the environment – a relationship stated in Ehrlich and Holdren's (1974) well-known formula: $I = P \times A \times T$.[1]

The Dutch futurologist Polak (1968) developed the theory that the rise or fall of a culture is preceded by the presence or, respectively, the absence of positively idealistic visions of the future. Contemporary Western culture is largely dominated by negative ideas of the future. Therefore, Polak and other futurologists hold that one of the major assignments of the social sciences ought to be to create and spread utopian views of the future that can serve as models for social improvement. One example of a positive vision that could favourably influence the future of humankind is the prospect of individual citizens improving their quality of life through a qualitative control of births and deaths, thus steering the human species toward future improvements. Such a vision unequivocally promotes the improvement of the quality of life, if necessary at the expense of quantity:



Equality *versus* inequality

As argued in Chapter 2 on 'Individual Variation and Individualism', biological variation/diversity is, from an evolutionary-biological point of view, an extremely significant phenomenon. In the long term, it guarantees the species' adaptation to changing environmental living conditions; in the short term, biological excellence is the motor for cultural performance and innovation. However, there is another side of the coin: unfavourable genetic mutations, ontogenetic accidents, infectious diseases, and natural disasters all can produce psychophysical inequalities in individual potentialities, competences and performances. For many individuals, such traumatic events lower their quality of life, their life satisfaction, and their chances for happiness. From an egalitarian ethical point of view, biological variation is, in many respects, a nightmare!

Most value systems, more particularly in modern times, try to reconcile the facts of biological diversity with the ideals of equality and equity by promoting equality between citizens without completely excluding diversity. In modern

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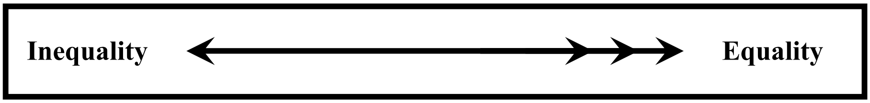
[1] I = impact; P = population; A = affluence; T = technology.

democratic societies, the concepts of equality – likeness or sameness in quality, status, or degree – and equity – encompassing ideals of justice, fairness, and/or equality – are usually understood as equality of opportunity. Given individual differences in abilities and work effort, it is generally assumed that equality of opportunity provides each person, regardless of such ascribed characteristics as family background, religion, ethnicity, race, or gender, the same chance of acquiring a favourable socio-economic position (cf. Parelius and Parelius, 1987; European Commission, 2006).

However, the establishment of equal opportunity does not necessarily imply that people will end up socially or economically equal, since differences in abilities or work effort are usually differentially valued and rewarded. In order to safeguard people who, because or genetic heritage or life course events, are in a more vulnerable situation – such as the mentally retarded, physically disabled, seriously ill, old, and unemployed – from social exclusion or misery, modern advanced democracies have developed social protection systems (Deleeck, 1992; Avramov, 2003).

As a consequence of increasing knowledge and its dissemination via education and modern means of communication, it is no longer possible to maintain, let alone to initiate, extreme forms of social inequality such as patriarchy, slavery, proletarisation, or apartheid. Wherever such social forms of inequality still exist, they are vehemently challenged, and it can be expected that they will soon disappear, especially as the societies modernise. Nevertheless, even in the future human societies will have to deal with the discrepancy between biological diversity and the necessity to create equal opportunities for all and avoid the social exclusion and misery of people with weaker abilities, potentialities, or competencies:

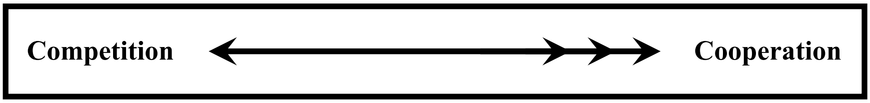


Cooperation *versus* competition

Humans are endowed with drives toward both competition and cooperation. Although human social life originally developed to aid in the survival of the individual and it still continues to serve that purpose, human societies gradually developed, via cultural creation and accumulation, as complex autonomous entities in which cooperation increasingly became an increasingly crucial instrument for the survival of individuals and society.

However, as was argued in Chapter 2, modern societies are, due to their internal dynamics as well as external pressures, also characterised by increasing levels of individual competition in many domains of social life – the economy and politics in the first place, but also in many other areas such as science, sport, and even the arts.

Because it can be anticipated that the future development of modern culture will further intensify the tension between individual competition and societal cooperation, increasing efforts will have to be made to find a viable balance between both, thus avoiding hyper-individualism and absolutist groupism. All this entails an ever-increasing need to shift from competitive toward cooperative efforts:



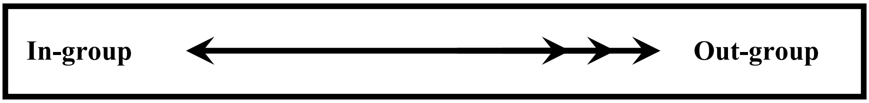
The value of the existing forms of social protection will need to be continuously affirmed and reaffirmed.

Out-group *versus* in-group

As explained in Chapter 8 on 'Racial Variation and Racism' sociobiological theory explains humanity's strong in-group reflexes and their offshoots such as nepotism, ethnocentrism, xenophobia, and racism, as a result of the drive to protect and spread one's own genes. Together with the drives toward greed and demographic expansion, the in-group syndrome is responsible for much of the pronounced between-group enmity that characterises human beings.

Modern culture is characterised by a number of features and trends that caused the in-group syndrome to become too dangerous or inadequate of a behavioural pattern: the development of ABC (atomic, biological and chemical) weaponry is so life threatening that the in-group syndrome has largely lost its adaptive advantage. Furthermore, the exponential increase in scientific knowledge as well as the improvement of between-group communication by means of ICT (information and communication technologies), international commerce, travel, and tourism together fundamentally undermine the in-group syndrome by breaking through group isolation and eroding one of its basic breeding grounds – ignorance.

Separated human populations and nations are growing toward a singe world community, the components of which show an increasing mutual dependency. This globalisation requires the in-group/out-group relations to be guided by alternatives to the traditional aggressive pattern. Modernisation requires a shift from in-group toward out-group relations:



Intergenerational *versus* intragenerational care

By tradition, human intergenerational concerns have been limited to the generations living simultaneously – children and grandchildren, parents and grandparents. The mutual care of various generations was practically evenly balanced: parents took care of their growing children and the latter reciprocated as soon as their parents were aged. According to Caldwell (1982), wealth flow from children to parents was even larger than that of parents to children, but this was presumably the price to be paid to produce a sufficient number of children to ensure intergenerational continuity.

According to Caldwell (1982), the intergenerational flow of wealth reversed with the development of modern culture as parents now invest more in children than what they receive back from them. Fertility surveys and investigations of the value of children in modern culture actually show that parents, more than ever before, invest heavily in their children and that they receive nothing in return directly from their children other than emotional satisfaction. This personalised reversal of intergenerational investment has important implications for the replacement of generations.

It is no longer sufficient for individuals to make big investments in their own children and grandchildren. As a matter of fact, the impact of modern culture on individuals, society, and the environment is so radical that it influences not only presently living younger generations, but also more distant generations that have yet to be born. This impact morally obliges us to think of and provide for generations in the remote future.

An even more fundamental argument in favour of a broad interpretation of intergenerational ethics (Whitehead, quoted in Slaughter, 1994) can be derived from the fact that life is an intergenerational process, of which currently existing generations constitute only a single link. Humans ought to realise that they are able to live on into the future, in a sense by reproducing their genome into new individual combinations provided that we do not irreversibly mortgage that future.

The development of an intergenerational ethics that takes future generations into consideration would have implications not only for population size and growth, environmental protection, and the careful use of natural resources on this planet, but also for more specific demographic issues, such as the preferable strategy for lifespan extension.

In modern culture, the intra- versus intergenerational dichotomy should definitely tilt toward the latter:

Intra-generational care ←——⋙ **Inter-generational care**

COMMON FEATURES AND CHALLENGES OF BIOSOCIAL SOURCES OF VARIATION IN MODERN SOCIETY

In the analysis of the biosocial interactions which can be observed in the process of modernisation, all sources of biosocial variation discussed in this treatise – be it at the individual, the group, or intergenerational level of organisation – were found to struggle with one or more discrepancies between the evolutionary-based human genetic endowment and the exigencies of the novel living conditions created by modern culture:

- At the individual level, humans in modern society struggle to relate to huge numbers of unrelated persons and groups;
- Relations between people of different ages in modern culture are challenged by the considerable increase in life expectancy on the one hand, and rapidly evolving technological innovation and increasing economic competition between generations on the other. This discrepancy raises problems to maintain the social inclusion of older adults, particularly in the labour force;
- A broad spectrum of cultural innovations has drastically changed the psychological and social relations between the sexes, making the sexist ideologies and attitudes of the past completely obsolete;
- The forces of modernisation have also eroded many of the traditional, derived social functions of the family, reducing modern family life more strongly to its original biosocial functions regarding sexual partnership and biological parenthood, and making the institution more vulnerable to psychological satisfaction and individual decision-making;
- In the field of reproduction, mortality control has created the need for fertility control, profoundly challenging traditional values and norms regarding reproductive behaviour;

- Modern culture requires that the social position of individuals be based upon individual abilities, competences, and merits, rather than on old-fashioned nepotistic family and social-class positions;
- The biological drives that helped instigate traditional in-group/out-group antagonisms have in several respects become maladaptive in the modern world;
- Evolutionary-biological knowledge has fundamentally changed the insights about and possibilities of intervening in intergenerational processes, allowing the human species to steer itself consciously toward its future evolution.

These discrepancies and challenges are basically due to the fact that the human genome is still largely adapted to the living circumstances and conditions of the 'Environment of Evolutionary Adaptedness' (EEA) in which people neurologically adapted to living in small groups, were endowed with strong kin and 'in-group' drives to protect themselves from other human groups, embraced the imperative to resource acquisition because of the scarcity of resources, were subject to high mortality, and were endowed with a high fecundity and sexual specificities adapted to raising slowly maturing offspring.

In modern culture, in contrast, people must adapt to live and work with very large numbers of conspecifics, are much more confronted by others (different individuals or groups), enjoy widespread affluence and low mortality, and must limit their fertility whilst raising offspring that take ever longer to mature. In particular, modern humans are compelled to adapt to ever more complex forms of scientific knowledge and its application in technology, and have more time to enjoy nature and culture. In a nutshell, modernity forces us to bridge ever increasing discrepancies between our biological endowment and cultural development (Kitahara, 1991).

However, there is not only a discrepancy between biological endowments and the opportunities and exigencies of modern culture; in addition, many of the cultural value and norm systems that were inherited from pre-modern eras, in particular from the agrarian stage in cultural development, are not yet adapted to modern living conditions. The clash between the 'traditional' value and norm systems and modernisation is often as vehement as the incongruity between our biological potentialities and the cultural and social demands of modernisation. In some respects, people are more biologically adaptable than some of the value and norm systems that were developed under earlier cultural and ecological living conditions.

ADAPTIVE REQUIREMENTS FOR SUSTAINED AND SUSTAINABLE PROGRESS

Individual variation

In Chapter 2 on ‘Individual Variation and Individualism’, two major issues were addressed: (1) the origins of differences between individuals and (2) the relations between individual and society. The first mainly raises problems of equality and inequality, whilst the second mainly relates to the cooperation versus competition polarity.

Difference ≠ inequality

Individual differences can be due to genetic factors, environmental influences, or the covariance or interaction between both. From an evolutionary-biological point of view, genetic variation is to be positively valued – it is a long-term safety valve against important changes in environmental living conditions and provides the opportunity to adapt to them. This is a principle well addressed by Albert Jacquard (1978) in his book on genetics and human beings:

“*Éloge de la différence*”[2]

Obviously, not all genetic variants are to be evaluated as equal. However, the change of the genetic composition of a population is a matter of intergenerational relations and will be discussed below.

Environmentally induced differences are a matter of intra-generational management. From an ethically egalitarian point of view, environmentally induced inequalities, understood as the consequence of unequal opportunities for ontogenetic development, obviously ought to be avoided or at least reduced as much as possible.

In general, policies aimed at managing life course events or processes in domains such as education, employment, and welfare and health care, should take into account individual differences. This is not always done to a sufficient degree or in an adequate way, even not in the most advanced modern democracies. Two examples will illustrate this shortcoming – the first one relates to educational policy, the second to employment policy.

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[2] “In praise of difference”

In the domain of education, both brilliant and less gifted children and adolescents may have problems performing in and adapting to an 'average' learning environment.

In a scientifically, technologically and culturally ever-progressing modern society, particularly less-gifted people or persons with weak family-based social and cultural capital have increasing difficulties meeting the rising standards of learning and intellectual performance. They need well-designed personalised attention and individually tailored learning assistance to avoid falling behind or becoming early school dropouts, thereby entering adult life with additional, environmentally induced problems (cf. Persell, 2003). Schools must develop to the fullest the potential of individual students with different backgrounds and talents. Torsten Husén (1972, 26) referred to this vision of equal educational opportunity in these terms:

"every student should have an equal opportunity to be treated unequally."

Intensive personalised guidance of intellectually or socially vulnerable children (coupled with the involvement of their parents) obviously requires that much larger material and human resources be given to schools (cf. Arnove and Clements, 2002). It is necessary to rethink teaching methods and educational programs to help prevent students from falling behind, getting tired of school, and dropping out early (e.g. Lee and Burkam, 2003; Marks, 2007). This will involve giving students opportunities to move on through subsequent levels of the educational system and switch between different study orientations.

In the same way, brilliant children and adolescents need extra attention in order to avoid losing their interest and motivation, or risk under-using their great potentialities that are so much needed for the further evolution of modern culture (cf. Freeman, 2001; Howe, 2001; Davidson *et al.*, 2005). The acknowledgement of their mental or physical excellence should at the same time be accompanied by intensified training in social ethics in order to increase their awareness of their larger social responsibilities.

As far as concerns employment, modern societies appear to be systematically troubled by relatively high unemployment rates (cf. Nickell *et al.*, 2005; Weil *et al.*, 2005; Lee and Chang, 2008). Those people with reduced personal abilities, limited skills, or weaker family background or social or cultural capital and having experienced unfavourable life course events or chosen unfavourable life course options, are more prone to unemployment or irregular or temporary work. They are also more vulnerable in times of crisis, or at stages in life where they are more susceptible to health hazards (cf. Mastekaasa, 1996; Schuring *et al.*, 2007; Alavinia and Burdorf, 2008).

The vast scientific literature on social inequalities in the domains of education, income, and health shows that, in recent decades, there has been a tendency toward an increase in social inequality in many developed countries.

In the domain of income distribution there has been a fairly widespread increase in inequality, with a slight increase in poverty rates amongst socially more disadvantaged groups (cf. OECD, 2008). In the domain of education, there appears to be stagnation in the democratisation of higher education in the sense that there is no more progress in the recruitment of talented youths from socially disadvantaged social strata (cf. Haveman and Smeeding, 2006). In the domain of health, notwithstanding a general improvement of many health indicators in all social strata, socially disadvantaged groups in modern societies seem enjoy fewer benefits of the progress in health science, resulting in a widening of the social differentials in morbidity and life expectancy (cf. Valkonen, 2002).

These increasing inequalities have hit several population categories and are the results of a variety of causes. A fundamental determinant of the increase in social inequality in the domains of education, work, and health is the disconnect between the meritocracy of modern societies, which is driven by technological innovation and ICT and the diversity of the population which is defined by differences in personal abilities, family background and social capital, life course events, and personal life choices. The combination of meritocracy and technological innovation make it increasingly difficult for some sections of the population to remain fully integrated in society by performing meaningful tasks and occupying social positions that suit their capabilities and aspirations.

An aggravating factor is the contemporary global politico-economic climate with its increasing economic competition and destandardisation and delocalisation of work on the one hand, and, on the other hand, the regression or insufficient evolution of public policies which results in the weakening of public safety nets, exacerbation of existing disparities, and causes the disadvantaged to fall even further behind. Other problems include the shift from mandatory public pensions to voluntary private pensions and insufficient compensatory redistribution to mitigate the increasing income differences (cf. Hines, 2003; Kenworthy and Pontusson, 2005; Dreher and Noel, 2008).

In response, employment policies in modern democratic societies should take into account the wide diversity in innate abilities and acquired skills and competences in the population. In ideal circumstances, everybody would have equitable opportunities to acquire appropriate skills or higher qualifications, either via existing educational programmes, part-time education or adult education, or traineeships in enterprises or public services. But even then, there will still be part of the population that, due to its genetic endowment or unfavourable life course events, has difficulties adapting to the ever-increasing educational or technological exigencies in modern society. Efforts should be made to improve their skills and qualifications and jobs adapted to their capacities should remain available so that they can be protected from permanent unemployment and social exclusion.

Adjusting individual aspirations to societal demands

Modernisation is characterised by the remarkable phenomenon that the individual becomes more dependent upon social structures but at the same time gains greater independence from his or her immediate kin ties. As shown in Chapter 2 on 'Individual Variation and Individualism', many sociologists believe that a key feature of modern culture is the gradual increase in individualisation, a phenomenon that became possible when traditional familial tasks such as education, protection, health care, and employment were taken over by more anonymous societal structures, such as schools, social security, the police and army, medical services, enterprises, and public administration. However, genetically, individual humans remain highly dependent on the population, as the Hardy-Weinberg law shows. Ontogenetically, this dependency has even increased due to the higher expectations set by modern culture for individual emancipation. At the same time, human societies in which individuals function are becoming ever larger and more complex – much larger and more complex than the original hunter and gatherer populations in which the human genome emerged and to which it is genetically adapted.

Policies in the domains of education and justice should pay much more attention to the phenomenon of sociability, emphasising the importance of mutual dependence and social cooperation. This emphasis is not at all in contradiction with the earlier stress on individual emancipation and independence, but rather is complementary to it. Individuals should be made more aware of their dependence on a much larger number of individuals than just their immediate kin, and of their responsibilities to the larger community on which they depend (Singer, 1999).

Age variation

In Chapter 3 on 'Age Variation and Ageism' we saw that modernisation is characterised by a substantial increase in life expectancy. Improvement of the health conditions and educational levels of the aged, at least of the younger old, allows them to work up to a much higher age than in the past. Despite these favourable developments, in many respects, modern societies still foster ageist attitudes as is most clearly illustrated by the development of policies in recent decades fostering earlier instead of later retirement, resulting in the ever-decreasing labour force participation and increasing occupational exclusion of older adults. Biological and societal trends in ageing have clearly evolved in opposite directions.

The decline in mortality at higher ages, together with the ageing of the post-World War Two baby boom generation and, on top of that, the sustained dejuvenation of the younger age cohorts, is leading to a considerable increase in population ageing, thereby inverting the population pyramid and raising fears that these trends will threaten the financing of pensions and health and welfare care of the elderly.

Can policies be conceived that enable the full fledged social inclusion of older people whilst at the same time resolving the problems caused by increasing population ageing?

Active ageing – sense of reality or lip service?

The final decades of the twentieth century were marked by the mismatch between gains in longevity, improvement in the health of older people, especially of the younger old, and generational shifts towards higher educational attainment acquired in youth by older workers and pensioners, on the one hand, and the trend toward early retirement, on the other hand. At the same time, the policy discourse started to focus on the notion of activating the elderly in response to the ongoing population ageing process and expected acceleration in the growth of the number and proportion of elderly people in highly developed countries in the first decades of the twenty-first century. The pursuit of effective ‘active ageing’ policies is related to working longer and activating the inactive elderly, and providing an environment for healthy life, income security, and general social protection. These policies are expected to build on a rights-based approach that acknowledges the capacities, needs, and preferences of older people (Avramov and Maskova, 2003).

Contrary to what might be supposed, the idea of active ageing is not so recent (cf. Kleemeier, 1961; Mayence *et al.*, 1977; Butler and Gleason, 1985). However, the concept of active ageing was only adopted by the World Health Organisation in the late 1990s and was meant to convey a more inclusive message than the previously embraced concept of ‘healthy ageing’, and to recognise factors other than health that affect the ageing process (Kalache and Kickbusch, 1997). The World Health Organisation (2002) has defined active ageing as

> *"the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age."*

The International Plan of Action on Ageing 2002 of the United Nations Second World Assembly in Madrid (2002), strongly promotes the active participation of older people in society. Paragraph 27 explicitly states:

> *"Older persons should be enabled to continue with income generating work for as long as they want and for as long as they are able to do so productively."*

At the European Union level, the concept of active ageing is interpreted as prolonged economic activity to be achieved by working more years, retiring later in life, and engaging in socially productive activities such as voluntary work or caregiving after retirement, as well as practicing healthy life styles. The goal of activating the elderly, and in particular economically activating people at higher ages, has gained a firm foothold in recent years (cf. Commission of the European Communities, 1999; 2002).

The concept of 'active ageing at work', developed in the context of objectives and requirements designed in support of policy development, aims at improving the employability, working conditions, and balance between work and life of older workers. Making a special effort to enhance the ICT skills of older people is identified as an important component of active ageing at work.

Combating ageism – adapting to ageing

In the reality of things, modern societies do not know what to do with their aged population and the perception that older people are a cost is reflected in many ageist practices. Although there are many initiatives to change attitudes and behaviour of people toward seniors, and to activate elderly people, more senior-friendly policies need to be developed in the domains of education, employment, and health and welfare care.

One of the key challenges is the need to ease the pressures of increasing population ageing, and a critical area of action is policies that enable employment. Here, both 'ageism' and 'ageing' concerns could be dealt with in mutual coherence. Two major aspects of employment policy toward people in later stages of their life course need to be addressed: (1) the age at retirement and (2) variation in age at retirement.

Increasing age at retirement

If the recent rate of increase in life expectance experienced in the most advanced countries – three months per year – continues in the course of this century, the average life expectancy will be 10 years higher by mid-century and some 20 years higher by the beginning of the twenty-second century, exceeding by a few years the conservative estimations of the average potential human lifespan. If such an increase in life expectancy were accompanied by a similar increase in years of good health and a further compression of morbidity to higher ages, active age could, on average, be extended to 75 years of age or even 80. The active period in the life course, which amounts in many countries to about 45 years in principle but often about 35 years in reality, could thus be increased by some 15 to 20 years – taking into account the fact that the start of active life would probably be somewhat postponed due to extended education and training. In summary, by the end of this century the active age period in the life course in advanced countries could increase from 35 years (from age 20 to age 55) to 50–55 years (say from age 25 to ages 75–80).

Modern societies are definitely underutilising the younger aged population, either by maintaining mandatory retirement ages that are now obsolete or by introducing free or forced early retirement schemes that make healthy and productive adult people socially redundant.

Despite recent attempts in some countries to restrict early retirement because of the imbalances that it creates in pension systems, there is still an overall tendency toward an early exit for men. Women, in contrast, are increasing their labour participation in middle age, but the exit age for women is still lower than that for men. Early retirement is a consequence of the combined effect of chance and choices. Bad health is the major reason given for early retirement. Another less frequently reported important factor is the difficulty many elderly workers experience in coping with stress at work, whether due to physical strain or the demands made by new technologies (cf. Blanchet and Debrand, 2008). When comparing the disadvantages of work and advantages of retirement, for many the prospect of a new lifestyle after early retirement, with more free time, leisure opportunities and family networking, plays a significant role.

Many scholars are of the view that the earlier trend of decreasing the official age of retirement should be reversed and that the pre-pension schemes developed in recent decades should be gradually be phased out (cf. Legaré and Desjardins, 1988; Vaupel and Loichinger, 2006). Governments are advised to raise the age of retirement and to reverse former retirement policies (cf. Cliquet and Vanden Boer, 1989; Lesthaeghe *et al.*, 1998; Lacomba and Lagos, 2006). Simulation studies show that increasing the retirement age has a positive effect on public spending (Bogaert and Festjens, 1993), compensates, at least partly, for the increasing pension burden, and maintains the labour supply at an adequate level into the coming decades (Blanchet and Marchand, 1991).

However, polls in industrial countries show that public opinion runs counter to expert opinion. The large majority of people appears to be strongly opposed to an increase in the age at retirement and seems to prefer to pay increased financial contributions in order to maintain the existing legal system that includes the possibility for early retirement. On average, respondents hope to retire at an age that lies considerably below the traditional statutory age of retirement and say they are willing to sacrifice income for early retirement (Pestieau *et al.*, 2000; Avramov and Cliquet, 2008).

At the same time, surveys of individuals about their preferences for their own labour force status indicate that considerable numbers of those above age 65 would prefer a full time job to part time work or complete economic inactivity. The vast majority of elderly people would prefer to have some kind of job to no economic activity whatsoever. Elderly workers and retired people are by no means homogeneous groups in their willingness to work, but surveys on preferences and attitudes do suggest that there is a significant pool of elderly people who would welcome opportunities or incentives to continue gainful employment. Obviously, the desire to continue working in later stages of life decreases with age, particularly amongst the oldest of the old.

Varying age at retirement

Efforts aimed at increasing labour market participation rates at higher ages do not necessarily have to be coercive and consequently do not have to contradict values of personal choice and self-determination (cf. Petersen, 1989). Measures aimed at relieving the pension pressure can be combined with the introduction of greater flexibility in timing and variability in labour participation by type (full-time versus part-time), and by differentiating the accrual patterns of pension benefits for the purpose of encouraging and discouraging work at different times during the life course.

Indeed, a uniform mandatory age at retirement is at odds with present scientific knowledge about individual variability in the physical and psychological ageing process. Consequently, improving health conditions and educational levels, as well as taking into account inter-individual variation in biological potentiality at higher age, will help in developing flexible and diversified policies with respect to retirement and labour participation at higher ages (cf. Karpansalo *et al.*, 2004). This is not an easy task for several reasons.

First, there is the dominant egalitarian ideology in modern democracies that is strongly averse to acknowledging individual variability in some spheres of social life. In some countries this ideology has even resulted in the prohibition of minimal amounts of paid work after retirement under threat of forfeiting one's normal pension rights. At the same time, the lack of self-awareness of many individuals about their ability to continue paid work after a certain age should be taken into account. The decision to continue working beyond the average age of retirement should certainly not be left to the individual alone. Society should and can devise reasonable selection procedures that can accommodate individual aspirations and societal interests.

Death control

As argued in Chapter 3 on 'Age Variation and Ageism', modern culture not only extends life expectancy, but is also able in many cases to prolong the dying process or keep individuals alive, thanks to sophisticated medical technology. However, the prolongation of life often takes place in conditions that many consider an inhuman quality of life.

Given the ideological pluralism in modern societies, there can be no doubt that, for quite some time to come, fundamentally different and incompatible views will continue to be debated about end-of-life decision-making and care for terminally ill or dying patients.

There is a wise solution to this contentious societal problem, namely to adopt euthanasia legislation of the type that was enacted in pluralist countries such as Belgium and the Netherlands, which allows but does not oblige people to freely decide whether to terminate their own life in case of hopeless and unbearable suffering. As a safeguard, the legislation provides a number of rigorous requirements so that both patients and the medical professionals are protected against abuse or legal insecurity.

Sexual variation

The confrontation between the ethical principle regarding equality and equity and the scientific analysis of human sexual dimorphism and the relations between women and men in modern society, dealt with in Chapter 4, leads to both general and sex-specific policy options.

First, scientific knowledge about human sexual dimorphism shows that the application of universally recognised principles of equality and equity to this source of biological variation in modern society requires policies that guarantee both sexes the same rights and opportunities in all domains of social life. This does not mean that equality and equity can only be achieved when both women and men perform, proportionate to their numbers in the population, the same tasks and roles in society. The reality of between-sex biological variation leads one to expect that, for a number of tasks and roles, both sexes will be partially differentially assorted – as can already be observed in a number of countries where equal opportunities are really available to both women and men.

However, scientific knowledge about sexual dimorphism also shows that the equitable application of the above-mentioned principle requires sex-specific measures. Modern society has made considerable progress in realising sex equality and equity in education and working conditions, but there is still a long way to go. Action, often subtle in nature, is required in many domains of family life and social life in general. However, there are a few domains which deserve special attention, either because they are fundamentally important, or because they have repercussions in many aspects of life. The discussion will be limited to three major areas calling for policy action: (1) the reconciliation of productive and reproductive functions; (2) the empowerment of women in all domains of social life; (3) the mastering of the masculine drive for competitive behaviour.

All three of these domains require a variety of policy measures related to material as well as ideal aspects of social life. In other words, the organisational restructuring of society will not suffice to achieve the above-mentioned goals. Reforms will have to be accompanied by and supplemented with changes in values and norms allowing for the establishment of a genuine emancipation of both men and women.

Reconciliation of productive and reproductive functions

The first issue – reconciliation of reproductive and productive functions – concerns mainly, though not only women. It must be acknowledged that women still have a larger biological share in reproduction than men, and are biologically as well as socially more vulnerable in this respect. The principle of equality and equity requires that women continue to enjoy, or should be granted, social prerogatives which facilitate fulfilment of their specific reproductive functions, and to combine these functions harmoniously and equitably with other life options.

Equity of this sort is difficult to achieve in modern society, which is still largely conceived and constructed on the model of the male-dominated pre-modern society. Many women are still obliged either to limit their career aspirations or to limit their fertility below the level of their desired family size. Labour arrangements – working hours, vacation regulations, work interruption, work resumption, promotion opportunities, pension systems, etc. – are largely conceived and implemented according to male sensibilities and do not sufficiently account for the specific needs of women and children.

In modern culture, women's reproductive role need no longer be realised at the price of their general economic, social, and cultural role (Bernard, 1974). However, to make this possible requires a more active and equitable contribution by men in caring for, minding, and educating children. For a few decades now, these principles have been accepted by the world community, as can be seen from the following passage of the World Population Plan of Action (WPPA) which was accepted by general consensus at the United Nations World Population Conference in Bucharest, 1974:

> *"Women have the right to complete integration in the development process particularly by means of an equal participation in educational, social, economic, cultural and political life. In addition, the necessary measures should be taken to facilitate this integration with family responsibilities which should be fully shared by both partners."*

At more recent United Nations world conferences, such as the International Conference on Population and Development, held in Cairo in 1994, and the International Conference on Women, held in Beijing in 1995, similar recommendations have been endorsed or have been made even more explicit:

> *"The full participation and partnership of both women and men is required in productive and reproductive life, including shared responsibilities for the care and nurturing of children and maintenance of the household." (Cairo Programme of Action, 1995).*

Empowerment of women

The second major issue for policy action concerns empowerment of women in all domains of social life. As a matter of fact, one of the most striking differences in sex relations, historically and also in modern societies, concerns the more or less explicitly subordinate position of women in the family, the economy, state bureaucracy, and politics. If we really want to implement the principle of equality and equity in the field of sex relations, then we will have to increase women's position of power in all of the relevant domains in social life.

An extremely important, though in itself insufficient, measure to be taken is to expand the participation of women at all levels of politics. Universal suffrage – one of the major successes of the first wave of feminism – was an important step forward in women's emancipation, but it did not translate into a sufficient increase in women's sharing in political decision-making. Therefore, universal suffrage should be supplemented by more subtle measures which will have this effect. One could be given women proportional representation in the various bodies of policy making – ranging from municipal and provincial councils up to national parliaments and governments. A transitional step might involve the gradual introduction of demographically proportionate female representation in various policy making bodies over a limited period of time. This would give new generations of women the opportunity to prepare themselves for taking up political jobs. Worldwide, gender representation in national parliaments is currently 84 percent men and 16 percent women (United Nations, 2005). This could change by a swap of ten percent of positions in each successive election, resulting in a demographically proportionate sex representation within less than one generation. If only non-selective measures are used, such a result will probably not be reached within the same time period.

The same policy could be developed for public administrative bodies, again at all levels of government. Of particular importance here is that women should not only be represented proportionally in the staff – which in some sectors (e.g., education, health) is already the case – but also represented at all hierarchical levels of decision making. Again, a gradual, selective process of recruitment and promotion could be devised. Procedures could be designed so that the recruitment or promotion of female applicants has priority in case of equal qualification – a principle that is recognised in article 141.4 of the EU Treaty of Amsterdam (1997), which stipulates that

> *"equal treatment shall not prevent any Member State from maintaining or adopting measures providing for specific advantages in order to make it easier for the underrepresented sex to pursue a vocational activity or to prevent or compensate for disadvantages in professional careers."*

A particular problem is the private sector, especially in this era of privatisation of public services and expanding international economic competition. In market economies, private firms function on the basis of the profit motive, but should they function only on that basis? Many will demonstrate that firms have other social functions – such as the production of goods, providing leisure, health care, etc. – yet it is still common that people are fired en masse, the environment is polluted in every possible manner, and planetary resources are being abused and consumed in an unsustainable way. No wonder, then, that the empowerment of women is the least of the market's concerns. But perhaps in this context, just as with respect to employment and ecology, public intervention may be useful and policies can be devised that strengthen the position of women in the private sector.

Mastering male competitive behaviour

The presence of secondary sexual characteristics in the human male, oriented toward competitive, agonistic, and dominating behaviour – ‘the masculinity syndrome’– has been identified as a major source of energy that can, in particular conditions, easily lead to the social subordination or even physical harassment and harm of women. In modern culture, with its technological means such as fire arms and fast motor vehicles, the ‘masculinity syndrome’ has also become a much greater threat to men’s health and survival, both at the individual and societal levels.

Since the genetic basis of the ‘masculinity syndrome’ (male potentiality for aggression) cannot be changed in the short term, all efforts should be concentrated on conditioning, imprinting and teaching men to avoid such behaviour and to orient their male-specific drives toward ethically and socially useful goals.

At the individual level, physical harassment or harm, especially of women, can be combated by a variety of preventive actions as well as by more severe criminal prosecution.

At the societal level, culturally acquired capabilities have been developed which threaten the quality of life, if not the survival, of the human species, either directly via war, or indirectly via ecological pollution or destruction. These capabilities should not be guided by traditional norms and patterns of behaviour, which are oriented toward excessive competition and performance, and the exploitation and domination of humans and nature. It is well known that warfare is ideologically and institutionally founded on the male superiority complex (Divale & Harris, 1976). The masculine approach has become too dangerous and too destructive, both for the human species and its ecological base. It has become maladaptive. It has to be replaced by another approach that is more moderate, socialised, and balanced ... a more feminine approach. For an ecologically well-balanced and socially peaceful future, modern culture must encourage behavioural patterns that are humanistic rather than power oriented, that have a global rather than tribal orientation, are aimed at cooperation instead of competition, and produce harmony and equilibrium rather than exploitation and destruction.

Given that genetic changes in basic drives can occur only on a very long-term time frame, the male-specific potentialities for competitive and aggressive behaviour will have to be strictly socialised or directed toward socially useful and ecologically sustainable goals.

Family variation

Identifying the policy implications of ideologically sensitive questions such as the future of the family depends on the objectives set to deal with very diverse but interlinked issues such as general societal goals, individual human rights, sex equality, intergenerational solidarity, and, last but not least, population and family models. Modernised countries are characterised by ideological pluralism related to family structures and processes: the family concept itself, to start with, and – obviously – the goal of family policy; the policy target (e.g., individuals, children, women, families, populations); the role of the state; the desirable economic model and situation; and attitudes toward issues such as sex equality, intergenerational solidarity, and the role of citizens and the state in society's intergenerational continuity. Ideological pluralism and competition in Western societies is the prime reason for the lack of clear policy goals with respect to the family, and the lack of comprehensive action to promote sex equity and better employment arrangements. This is particularly true with respect to policy goals regarding macro-level phenomena such as population dejuvenation due to below-replacement fertility levels and to the way employment can be modelled.

Two broad topics of family structures and dynamics have been dealt with in this treatise: partnership and parenthood. A comprehensive family policy will have to deal with both of them and their interrelations, but what is their ultimate commonality? The answer to this question lies in the biological origin and foundation of the family that, ultimately, has to do with the social facilitation of intergenerational continuity. The ultimate objective of family policy consists of creating or promoting conditions that contribute to or guarantee, quantitatively and qualitatively, the process of childbearing and childrearing at the various relevant levels involved – the individual, familial, and societal.

Scientific literature shows that it does not suffice to support family policy objectives in principle, but that it is also necessary to implement effective policy measures. Today's extremely low fertility levels in the Mediterranean countries, which historically had a strong family-oriented ideology, is a textbook example of the discrepancy between family policy objectives and a lack of effective family policy (cf. Chesnais, 1996; Golini, 1998). Literature also shows that, for a variety of reasons, few countries have an explicit, comprehensive family policy (cf. Kaufmann *et al.*, 1997; Kamerman & Kahn, 1998).

McDonald (2002) rightly pointed out that one shouldn't expect isolated policy measures to have satisfactory effects on family life. It is not single policy measure that is important, but the nature of society as a whole. The efficacy of specific family policies depends on the larger context in which they are implemented. That is probably the reason why family policies developed in Northern Europe, with fertility rates around replacement levels, are successful whereas in Southern Europe there are extremely low fertility levels (e.g. Chesnais, 1996; McDonald, 2000; Hantrais, 2004; Hoem, 2008; Frejka *et al.*, 2008). The reasons for positive outcomes in the north is probably a combination of modern family planning policies, universalistic and generous public welfare policies towards children and parents, and especially sex emancipatory and egalitarian policies, backed up by successful general economic and welfare policies.

Comprehensive family policies can be developed without compromising the many benefits of modernisation such as mortality and fertility control, sex equality, and individual emancipation.

With regard to partnership, modern societies could move from the traditional juridical approach, which favours particular forms of partnership (such as marriage) whilst prohibiting or discriminating against other types of unions (such as consensual unions, LAT relations, and homosexual relations) and preventing or hampering marriage dissolution, toward a more educational and social policy oriented approach. This would favour the development of enduring and high quality relationships. Indeed, this is an important condition for the positive development of parenthood, which brings us to the next topic, namely reproductive variation.

Reproductive variation

Policies concerning reproductive behaviour are controversial and a source of heated ideological and political debate in modern culture. Ever since the beginning of the demographic transition, questions of fertility control, family planning, and population growth have been in the air, nationally and internationally.

A clear example of this ongoing debate can be found in the events surrounding the organisation and final outcome of the United Nations World Population Conferences in Bucharest in 1974, Mexico in 1984, and especially in Cairo in 1994 (cf. Cliquet and Thienpont, 1995). In Bucharest, a bitter struggle was waged so that the ‘World Population Plan of Action’ would include the following recommendation:

> *“all couples and individuals have the basic human right to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so.”*

In the discussions over what finally became the 'Cairo Programme of Action' in 1994, a whole series of vitally important principles or action fields had to be strenuously defended against sustained efforts of the Holy See and Islamic fundamentalists and their adherent delegations to weaken or even delete the Secretariat's or the majority's draft proposals. These included the need to stabilise population growth, develop sustainable economies, take into account the plurality of family forms, empower women, promote sexual and reproductive rights and health, address adolescent sexual and reproductive health issues, and deal effectively with the abortion issue.

From a theoretical sociobiological perspective, it isn't a surprise at all that reproductive issues are ideologically and politically sensitive. At the individual level, reproduction has to do not only with proximate matters such as having children, providing for one's old age, or guaranteeing one's immortality, but ultimately it has to do with the transmission of one's genes to future generations. At the population level, it is a question not only of intergenerational balances, but it has also to do with territorial integrity and national identity. In the past, and perhaps today as well, population size was a critical weapon in the dynamics of the intergroup balance of power.

Policy implications of fertility control

In demographically post-transitional societies where the population explosion linked to the asynchronic development of mortality and fertility decrease, is over and population growth is largely stabilised around a stationary level, questions of fertility control focus mainly on issues of quality of life for individuals and families and on questions of equality of opportunity amongst different groups in society.

In developing countries that are still in a demographically transitional stage, the population dimension of fertility control is, of course, of crucial importance for their societies' future prosperity and sustainability.

Policies regarding contraception

In a demographically post-transition situation with its strong and successful mortality control, fertility limitation is a *sine qua non*. There seem to be no major ideological or political disputes about this principle any longer (cf. United Nations, 1994), although there are still religious fundamentalists in many countries who deliberately disregard or even oppose birth control policies in order to enhance their demographic weight and spread their faith, and are mindful of the blunt statement made by the late Algerian president Houari Boumédienne at the United Nations in 1974:

"Nous vous vaincrons par le ventre de nos femmes."[3]

In addition, ideological differences still exist with respect to the use of particular contraceptive methods. The most notorious case in this respect is the ongoing opposition of the Catholic Church to the use of so-called artificial contraceptives (Paul VI, 1968; John Paul II, 1995).

Politically, the use of contraceptives is quite generally accepted and legalised in industrial countries, although in many countries the political debate and decision-making over their acceptability and availability lies only a few decades, and in some cases only a few years, behind us. Between-country differences, nevertheless, still exist with respect to the acceptability of particular methods (such as sterilisation), or the acceptability of particular strategies to inform people about contraception (such as the inclusion or absence of courses on sexual and reproductive health in formal education), or to make particular contraceptives easily accessible (such as the presence of condom vending machines in public places) (Drife, 1993; United Nations, 2003).

Policy implications regarding abortion

In many countries the legalisation of induced abortion has been – or still is – the subject of a grim ideological debate. The ideological principles of the advocates and opponents of the legalisation of induced abortion are obviously irreconcilable. The former advance arguments about quality of life or individual freedom whilst the latter invoke the sanctity of (unborn) life or other religiously founded principles.

Scientific evidence unquestionably shows that the only way to reduce the numbers of induced abortions to a residual and irreducible minimum is to liberalise the practice in the context of a good contraceptive policy, allowing pregnant women themselves to make well-informed and free decisions, accompanied by a good follow-up of the pregnancy interruption in order to avoid recidivism. Advocates of the sanctity of life principle, however, are immune to such reasoning, even if they know that the strict legal prohibition of induced abortion leads to a higher abortion rate and involves a higher rate of maternal mortality as a consequence of the application of non-medical interruptions (cf. Faúndes and Hardy, 1997; Henshaw *et al.*, 1999). The legal prohibition against induced abortions maximises the frequency of abortion and perpetuates the use of non-medical abortion techniques with their fatal consequences for maternal health.

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[3] *"The wombs of our women will give us victory."*

Legalisation of induced abortion is sometimes presumed to result in an increase in the abortion rate. However, this might be true only in the absence of an appropriate contraceptive policy. The incidence of induced abortion is clearly inversely related to the presence of a modernised contraceptive profile in the population (Requena, 1968; David and Skilogianis, 1999). What is probably observed early on after legislation takes effect is that abortions that would have formerly been hidden become visible, not that the total number of abortions increases.

In the 1990s, the ideological conflict over abortion overshadowed the much more important global issues concerning the interrelationship between population growth and socio-economic development that were discussed at the last United Nations World Population Conference, held in Cairo in 1994 (United Nations, 1994). The influence of the Holy See, a number of conservative Catholic governmental delegations, as well as a few delegations from fundamentalist Islamic countries, resulted in the inclusion of diluted and ineffective recommendations on the abortion question in the final Cairo Action Plan. Making matters even worse, the opposing delegations afterward made reservations to the watered-down Cairo Plan of Action that was accepted by general consensus (Cliquet and Thienpont, 1995).

Policy implications regarding fertility

Fertility levels are of crucial importance for the middle- and long-term development of population size and age structure. Policy implications regarding fertility are consequently of particular importance in low fertility countries where fertility rates have reached substantially below-replacement levels. The implications of this concern in the first place policy goals. Next, there is the question of the feasibility of fertility-influencing policy measures. Finally, we will look at possible approaches that might contribute to secure fertility at or around the replacement level.

Policy goals regarding fertility

Whereas policy goals regarding fertility control have been evolving toward virtual unanimity in the developed world, at least with respect to its acceptance and legalisation, policy goals concerning fertility itself, particularly at the population level, continue to show considerable diversity, both within and between societies. Modern societies are characterised by a prominent ideological pluralism in attitudes and views of several crucial family and population issues, and this is probably one of the reasons for the absence of clearly defined population goals, or for the vagueness of policy statements at the national and intergovernmental levels (Demeny, 2007).

Advocates of population decline (cf. Ehrlich and Ehrlich, 1990; 2008), out of either ecological or humanitarian concerns, do have strong arguments for their position: a decrease in human numbers would help relieve the pressures on the environment, it would help to reduce global inequalities, and it would enhance the quality of life in demographically overstressed regions and countries. However, ecologists and humanists in favour of population decline never concretely define at what level or speed the population decline should take place. Demographers, in contrast, have many times developed scenarios showing how rapidly pronounced below-replacement fertility levels dejuvenise a population or make it dwindle away (cf. Bourgeois-Pichat, 1988; Prinz and Lutz, 1993; Demeny, 2003). Obviously, population decline cannot go on indefinitely without dire consequences. At some point in time, when global population size and density are reduced to ecologically acceptable levels, population stationarity will have to be established with fertility rates at or fluctuating around replacement level.

Feasibility of policy measures regarding fertility

Many scholars have expressed serious doubts about the feasibility of redressing fertility at or around replacement level by means of specific policy measures (cf. Ekert, 1986; Höhn, 1988; Schwarz, 1989). They are of the view that such measures have had only modest positive effects on the number of children people want and finally produce, but at the same time admit that absence of such measures might have resulted in even lower fertility levels than those that have been achieved (cf. Leeuw, 1984; Vortmann, 1992; Calot, 2006). Fertility period effects, due to changes in the localisation of births in the life course, do not always result in an increased final descend.

Scepticism about the feasibility of positively influencing fertility behaviour, as well as uncertainty about the time needed for policies to produce effective results, has led some policy makers to look to immigration from developing countries as an easy solution that would circumvent the fertility challenge and quickly produce effective results. Although it is true that immigration can compensate for population size losses, immigrants soon adopt the reproductive behaviour of the native population and in the long term do not resolve the ageing problem (cf. Blanchet, 1988; Lesthaeghe *et al.*, 1988). Compensating for the demographic consequences of pronounced below-replacement fertility – which include population dejuvenation, labour shortage, and population decline – would require huge numbers of immigrants, as has been shown by the well-known United Nations Population Division (2000) study about replacement migration. Moreover, massive immigration from developing countries can provoke many other societal problems – for instance, selective migration, in-group/out-group conflicts, problems with socio-cultural and socio-economic integration, ethnic replacement, and the creation of an ethnically stratified and residentially segregated society (cf. Teitelbaum and Winter, 1985; Avramov and Cliquet, 2005).

The scepticism about the possibility of influencing fertility in a positive way may not be fully justified. First of all, the measures taken so far may not have appropriately addressed the fundamental causes and concealed background factors behind current reproductive patterns, or they may have been insufficient to remedy the inequalities deriving from differences in family size (Cliquet, 1991). Second, as discussed above, there are the striking differences in fertility levels between the Nordic countries and the Southern European countries. The higher Nordic fertility levels are related to the policies that promote women's emancipation and provide generalised social protection (cf. Hoem, 1990; 2005; Sundström, 1992; McDonald, 2000). The number of children people want or produce is partly dependent on their individual needs and aspirations, but also on the socio-cultural, socio-economic and political contexts of their society that either does or does not provide an enabling framework.

Policy measures for redressing fertility at or around replacement level

After population size has fallen to ecologically acceptable levels, and immigration flows are contained or the immigration pool exhausted, demographic continuity can only be guaranteed by redressing fertility at or around replacement level. This may require a comprehensive and well-integrated policy, encompassing a much broader and diversified course of action than has been covered so far.

Major components of such a comprehensive fertility-focused policy are: (1) increased involvement of men in child care and household chores; (2) the reconciliation of work patterns and family life; (3) societal support for the financial costs of children; (4) creation of a more child-friendly environment; (5) rebalancing individual and societal values with respect to intergenerational continuity; and (6) rethinking the entire life course perspective regarding education, employment and retirement (Avramov and Cliquet, 2005).

Whereas the first four policy aims are conceptually well established in professional and policy quarters – though not necessarily equally well implemented! – the last two are not as well addressed within the professional literature and deserve to be discussed at somewhat greater length.

Rebalancing individual and societal values with respect to intergenerational continuity

If all of the above-mentioned policy initiatives are effective in eliminating inequities and, consequently, help people beget the number of children they want without being deprived of the privileges and advantages adults without dependent children can enjoy, the number of children may not necessarily increase to such an extent that long-term generational replacement at the population level is guaranteed. Indeed, as shown in Chapter 6, in most countries, the current frequency distribution of desired family size does not guarantee long-term population replacement. Increasing the average number of desired children means bridging the gap between individual parental needs and societal reproductive needs. This is, however, mainly a matter of changing values, necessitating the extension of the principle of reciprocal altruism between individuals to the relationship between individuals and society. Low fertility might also require the valuation of behavioural variation in reproduction. In the absence of substantial and continuous immigration flows, long-term generational replacement can only be assured when a large number of women have more than one or two children in order to compensate for those who cannot or do not want to have children or who have only one child.

Rethinking the entire life course perspective regarding education, employment and retirement

The current policy toolbox of family-friendly measures, as well as the more comprehensive strategies used to date, appears, in the end, to be insufficient to resolve the dilemmas faced by individual women and men and by modern society as a whole. Individuals must cope with questions regarding life chances, choices, opportunities, work, partnership, parenthood, and old age, whilst society must deal with the redistribution of resources between generations, the sustainability of institutions, social cohesion and trans-generational continuity.

It is therefore necessary to rethink the entire life course perspective for individuals regarding education, employment and retirement in order to craft public policies that will redistribute free time and resources in a more age-friendly way. More free time during the course of the work day or over several years might be a key asset for expectant parents and for young families. In contrast, many years of free time in old age, long after children have gained autonomy, can be an obstacle to active ageing. One solution is to create more options for work at older ages, as well as giving people the flexibility to drop in and out of work according to individual abilities and preferences in old age. Obviously, if people are to make choices, risk-reducing policies and social security safety nets are necessary. Rethinking the life course redistribution of time, activities, and resources has to do with enhancing the quality of life and changing the normative standards about the type of society in which we wish to live in (Avramov and Cliquet, 2003; Vaupel and von Kistowski, 2008).

In developed countries, the major biosocial phases in human life – infancy, adolescence, adulthood, and old age – underwent important changes in the course of the twentieth century. The infant period has decreased a bit due to the secular acceleration in the pubertal growth spurt. The adolescent period moved a bit forward, but for many individuals the period of education continued far beyond the age of biological adolescence. Consequently, social adulthood starts at an increasingly higher age, well beyond the age of biological maturation. Biological old age advanced considerably due to decreasing mortality at higher ages. Contrary to what one would expect, the onset of social old age did not move upward in the same way, but instead moved to a lower age since more and more people, mainly men, retired from active life at ever younger ages.

If it is true that, at some point in time, it would be desirable to redress fertility at or close to replacement level, defined as an average total fertility rate of 2.1 children per women, it would be useful if the maternal age distribution which now peaks in the age group of 30–34 years, would expand to the ages of 25–34 years (Figure 10.2).

Although it would be incorrect to understand today’s low fertility rate only as a function of the widespread postponement of births to later ages in the reproductive life course of women, the way in which people in modern societies organise the life course is certainly a factor which contributes to low fertility, or at least leads people to encounter more difficulties – biological, psychological or social – in realising the number of children they want.

Indeed, in modern culture, more and more young adults are confronted with the desire or necessity of prolonging their formal education into their early twenties. Then they struggle to find and secure a job in the labour market.

They seek decent accommodation and to enjoy the rich variety of leisure activities offered by modern culture. Eventually, they establish a family with a few children. All in all, the twenties are becoming a quite crowded phase of the life course.

In order to decrease the stress of people in their twenties, modern societies may need to reconcile formal education and employment in such a way that young adults have more time to acquire their education and have more secure employment opportunities but fewer working hours, so that both education and work can be more easily combined with establishing a family and parenthood. Much could be done to assist in the employment of young adults: creating more secure jobs, lowering the number of working hours, setting up more facilities where work can be combined with studies, childbearing, and childcare. Young adults should also have more options to finance the costs of equipping an accommodation, and possibly even to acquire a dwelling. Society should, in other words, direct considerably more resources to this phase of the life course.

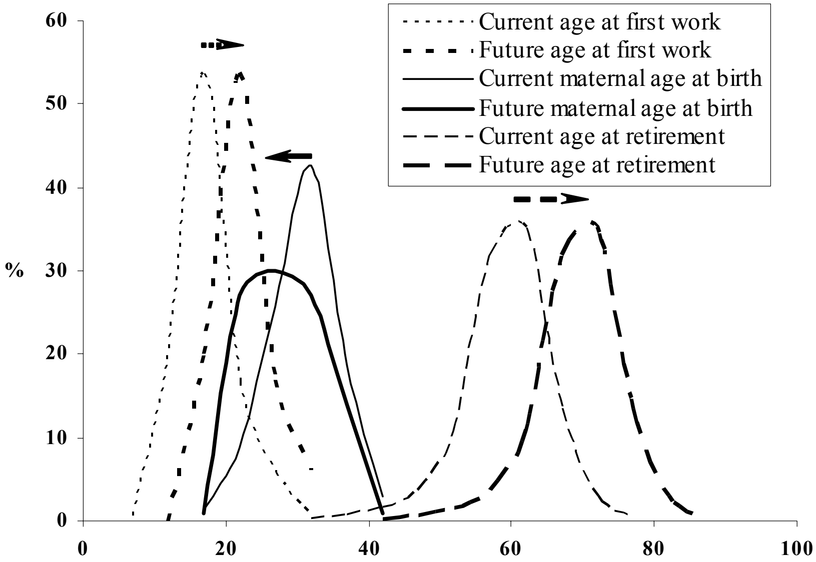

Figure 10.2. Possible changes in life course events concerning work, childbearing, and retirement. Source: Avramov and Cliquet (2003).

The question of where to find the required extra resources to invest in people at the stage where they are just starting a family is not easy to answer. But from an all-embracing life course perspective, perhaps people could pay back society for the benefits they received, once they are older and the child-rearing phase is largely over.

Activating younger elderly people could generate huge resources in terms of time, human capital and finances. More people could continue occupational activities up to old age than the present formal retirement systems foresee, and early retirement could be scaled back. The official retirement age could be gradually increased, albeit in a variable and flexible way. Such a policy would not only relieve the burden on pension budgets, but would also free more resources to be channelled to young adults.

By redistributing the time spent studying and working over the life course, a general redistribution of other resources would inevitably occur. This would boost the potential for life-long quality of life and satisfaction, bring about a meaningful reconciliation between education, work and parenthood, and create a population-friendly social environment conducive to greater gratification through parenthood and possibly stabilising fertility close to replacement level.

Within-population group variation

In Chapter 7 on 'Social Class Variation and Classism' it was argued that, in modern culture, the positions of social status or prestige occupied by individuals increasingly depend on innate personal abilities and acquired competences and skills instead of family ties, social origin, wealth, ideological beliefs (religious or political), or other traditional aspects of groupism. With its strong functional differentiation and imperative for creative innovation, modern culture must be based on contemporary meritocratic principles, not on obsolete nepotistic preferences.

In Chapter 7 it was also shown that individual differences of social class can be associated with differences in opportunities experienced whilst growing up, due to differences in the availability of proper nutrition, health care, education, social capital, and living conditions in general. Socially induced inequalities in developmental opportunities can hinder intergenerational social mobility. However, there is also ample evidence that modern culture increasingly succeeds, through a multitude of policies supporting democratisation and welfare in reducing, though not yet completely eradicating, the historical environmentally induced social class differences by eliminating differentials in opportunities to obtain appropriate nutrition, health care, education, and other welfare supporting resources.

What modernisation cannot change is the intergenerational segregation and recombination of genes, resulting in the fact that children do not always exactly resemble their parents.

The policy implications of these observations are quite straightforward. On the assumption that modern societies remain intergenerationally functional and creative, implying that people should be allocated particular tasks and functions on the basis of their innate abilities and acquired competences, it is evident that modern societies (1) should continue their efforts to eliminate environmental causes of social-class differentiation and (2) should facilitate, in each generation mobility between various social categories, in order to conform the social positions of individuals to the segregation and recombination processes of Mendelian genetics.

Both policy strategies – the equal opportunity strategy regarding environmental aspects of individual emancipation, as well as the social mobility strategy regarding the genetic transmission of innate abilities – run counter to the impulses to nepotism and other in-group conservatisms that aim to intergenerationally preserve in-group features, or social advantages and prerogatives. They challenge, in many cases, the ‘rights’, ‘freedom’ or ‘autonomy’ of parents to bar their children from obtaining a qualitatively or quantitatively better education. For example, the brilliant daughter of an Islamic immigrant or the gifted son of an unskilled labourer should have, even against the will of their parent(s), the opportunity to study at university, just as the intellectually less endowed children of well-to-do parents should have the opportunity to choose and obtain schooling that is better adapted to their capacities and aspirations. The rights and opportunities for the emancipation of youngsters should prevail over the rights of parents, and society should impose them if necessary.

Inter-population variation

Chapter 8 on ‘Racial Variation and Racism’ dealt with two themes that are highly relevant for policymaking: (1) the causes of differences in functionally important features such as health and intelligence between populations, and (2) the biological background of the in-group/out-group syndrome that leads so easily to various forms of intergroup enmity under particular circumstances.

Reducing between-group inequalities

As far as the environmental causes of inequalities between populations are concerned, it is self-evident that the same principles apply to this policy topic as for environmentally-caused social inequalities within populations. In this case, however, efforts may have to be more vigorous because in-group-specific disadvantages often have a long and tenacious history grounded in group discrimination, cultural customs or religious beliefs, lack of modern social capital, and feelings of inferiority.

Between-group specificities in genetically determined diseases – for instance, the high incidence of Tay-Sachs disease amongst Ashkenazi Jews, sickle cell anaemia, prostate cancer, and hypertension amongst some Negroid populations, lactose intolerance amongst non-European populations, and cystic fibrosis amongst populations of European ancestry – require special health care attention in such populations.

As far as the policy implications of between-group differences in features such as measured intelligence and scholastic achievement are concerned, Jensen (1969; 1973; 1998), Loehlin *et al.* (1975), and many others have argued that social policies should be developed independently of group identification; in other words, analysts should pursue methodological individualism (= individual merits are attributed independent of group characteristics) rather than methodological collectivism (= individuals are evaluated only with regard to their group identity) (Havender, 1987).

Jensen (1973, 369), for instance, formulated this view pertinently:

> *"It is important not to evaluate persons in terms of group membership if we are to insure equality of opportunity and social justice. All persons should be treated as individuals in terms of their own merits, if our aim is to maximize opportunities for every person to develop his abilities to their fullest capacity in accord with his own interests and drives. But the result of individual selection (for higher education, better jobs, etc.) makes it inevitable that there will be unequal representation of the parent populations in any subgroup that might be selected whenever there are average differences between parent populations."*

However, this viewpoint raises a serious problem, particularly from the point of view of population groups that perform poorly on intelligence tests, underachieve scholastically, are underrepresented in high-level occupations, or who experience higher levels of social exclusion. Particularly in pluri-racial or ethnic societies, such differences between the sociologically dominant and subordinate groups are a source of continuous frustration, social strife, and lack of social cohesion.

Taking into account the heritability and modificability coefficients for characteristics such as measured intelligence ($h^2 \approx 0.5$), scholastic achievement ($h^2 \approx 0.4$), and occupational inheritance ($h^2 \approx 0.3$), there is ample room for social engineering. Situations of social inequality can be largely remediated by means of selective policy measures. In many cases, targeted policies succeeded even in relatively short periods of time in reducing the social stigma of disadvantaged groups. Efforts should concentrate on the better targeting of education and training to the learning needs of cognitively weaker individuals, as well as the provision of adequate job opportunities, especially since work is becoming more complex and competitive in this era of globalisation and technological progress (Gottfredson, 2002).

However, even genetic conditions that contribute to a group's social unfavourable status are not immune to change, though this may take more time. Reproductive behaviour in disadvantaged groups is often characterised by dysgenic outcomes – the less endowed and/or less educated strata often has a higher fertility rate and intrinsic rate of increase than the more endowed and/or better educated in the group. Such is the case with the fertility differentials between the populations of African and European ancestry in the United States (Vining, 1982; 1986; Lynn, 1996; Lynn and Van Court, 2004). Reversing these dysgenic reproductive patterns might have a positive social and educational effect in the short run, and a positive genetic outcome in the long run.

Socially dominant groups in pluri-racial and ethnic societies obviously have a huge responsibility to ensure all members and groups in society have equal opportunities for development, emancipation, and social inclusion, especially if their ancestors suppressed and exploited the socially subordinate groups. At the same time, the spokesmen, representatives, and elites of the disadvantaged groups have a great responsibility to design and implement policies and actions that improve the conditions of their compatriots. Instead of selectively refuting scientific analyses of the biosocial condition of their population, they should carefully consider all available knowledge and develop policies and practices aimed at changing in-group behaviours that perpetuate the unfavourable in-group conditions. This may include dysgenic reproductive patterns, irresponsible sexual and family behaviour, and other socially detrimental forms of conduct such as absence in school, drug use, and criminal behaviour. In one word, if disadvantaged racial or ethnic groups want to shake off their subordinate position, they must be willing to fully adapt to modern cultural and technological requirements for development, emancipation, and social inclusion instead of resisting the so-called 'majority culture'. One may regret the disappearance of pre-modern culture and value systems, but cultural values and practices that were adaptive during the eras of hunting-gathering or agrarianism are incompatible with the values and practices of living, cooperating and competing in modern societies.

Combating the in-group/out-group syndrome

In Chapter 8 it was argued that the in-group/out-group syndrome, grounded in deep-seated biosocial drives to protect and expand one's own genes, has become a maladaptive strategy in the novel environment of modern society. It lost its adaptive value with the globalisation of human relations and through science, improved means of communication, commerce, tourism, and politics, as well as the dangers linked to weapons of mass destruction.

Paradoxically, the modernisation process may be accompanied by a resurgence of some ancient in-group/out-group conflicts, because the globalisation of modern values and norms corrodes established state nationalisms in which discrimination against ethnic minority groups was common. Ethnic groups now see a new opportunity for full emancipation in the modern world. Of course, the danger exists that emancipatory ethnic movements may be, at least temporarily, usurped by fundamentalist or counter-reformatory actions against the inexorable modernisation process.

In all cases, education and socialisation efforts will have to be bolstered substantially to neutralise or counteract the innate human drives toward the in-group/out-group syndrome, with its various manifestations such as nepotism, tribalism, patriotism, ethnocentrism, xenophobia, and racism.

In modern culture, individuals' talents and competences should become much more important than markers of group identity – such as kinship, religious, political, ethnic, or racial identity – for being selected as sexual partner, obtaining resources, or achieving social success. This emphasis on individual abilities complements community development and social solidarity, since both individual emancipation and societal progress greatly depend on community coherence.

Exposing the false notion of multiculturalism

In Chapter 8, the currently fashionable and much propagated concept of multiculturalism was exposed as a pseudo-belief for group emancipation**.** The notion is used either as camouflage to cover up the preservation of the dominant population group's cultural, economic and political position in pluri-ethnic or -racial societies, or as an instrument for preserving pre-modern values and norms that are incompatible with the ethical orientation and human-rights achievements of modern culture.

A genuine multiculturalism can only mean that society is institutionally fully organised on a multicultural basis, with all rights and privileges given to all ethnic constituents of a country.

With regard to immigration, the multicultural paradigm is unachievable, because it would require provision of comprehensive language and cultural institutional support for every immigrant from whatever ethnic origin. Immigrants need to learn the language of their host country and have access to channels for social mobility so that they can take advantage of all of their rights and prerogatives in their new country. Since ideological (political, philosophical, religious) pluralism is a fundamental human right in advanced democratic and secularised societies, immigrants can practice their original religious beliefs, as far as they compatible with universally accepted basic human rights, particularly with respect to individual emancipation, freedom of speech, and sex and gender equality. Concretely, this implies for instance that pre-modern practices such as the social exclusion of non-believers, forced marriages, female sequestration and enforced veiling, female genital mutilation, honour killings, corporal punishments, and fatwãs against free speech are unacceptable.

Intergenerational variation

In Chapter 9 on ‘Intergenerational Variation and Dysgenism’, it was argued that in matters of generational replacement modernisation is characterised by a double shift, from quantitative to qualitative concerns, and from phenotypic to genotypic care. In terms of intervention, two topics are to be considered: (1) euphenic engineering, and (2) eugenic engineering.

Euphenic engineering

One of the greatest successes of modern culture consists of the improvement of the phenotypic condition for human beings. Scientific advancements can be expected to substantially enhance the possibilities of influencing the phenotypic expression of human genetic potentialities. In this respect three major domains must be distinguished: ethical, educational, and medical engineering.

Probably the most important factor is a reorientation of values and norms toward the further enhancement of quality of life. This is the prime condition for and major instrument of the improvement of the human phenotypic state. Many medical problems could be prevented, and the related morbidity and mortality could be decreased by means of conscious behavioural changes to combat social discrimination or marginalisation, insufficient physical activity, the use of tobacco and drugs, inappropriate sexual behaviour (in order to avoid sexually transmitted diseases such as HIV/AIDS), unhygienic behaviour in general, reckless driving behaviour, aggressive and competitive behaviour, inadequate diet, and stressful work schedules (e.g. Olien, 1978).

The increasing knowledge in scientific disciplines such as neurology, psychology, and pedagogy could be used to enhance educational engineering, resulting in better academic performance, superior cognition, and improved management of emotions.

Great progress can be anticipated in the biomedical field. Advance in disciplines such as pharmacology, surgery, and somatic gene therapy will make it possible to enhance the mental and physical capacities of many individuals. This applies not only to the treatment of pathological conditions, but also to improvements in behaviour and physical performance or other features which fall within the normal variability (cf. Thibault, 1972). Somatic gene therapy is a molecular genetic technique through which the phenotypic effect of a gene in somatic cells is modified. Two approaches can be distinguished: gene-activation therapy by which the action of a harmful gene is replaced by activating a sleeping gene that has an identical function, and gene replacement therapy by which the defective gene is replaced by the introduction of appropriate DNA into the cell (e.g. Wheale and McNally, 1988; Friedmann, 1998; Niewöhner and Tannert, 2006).

Eugenic engineering

Genetic engineering (a term coined in 1965 to describe a cluster of micro-manipulations of the reproductive or hereditary process) comprises two facets: (1) interventions that have only a somatic effect and thus only an intragenerational impact, and (2) interventions that are of a germinal character because they act upon the sex cells and thus involve intergenerational genetic alterations. In reference to the latter, some use the term ‘eugenic engineering’. Future genetic engineering will indeed be eugenic in character, but in certain cases (for example, in the selection of the sex of one’s offspring, or in the choice of definite physical features for aesthetic or fashionable reasons) we can hardly speak of an improvement in heredity. Consequently, for many applications a more precise term might be ‘intergenerational genetic alteration’.

The idea of improving the genetic composition of the human species (Galton, 1883) can, in the future, be realisable by various groups of methods of eugenic engineering. These methods can be classified into two groups, namely (1) the historical demographic methods, through which carriers of different alleles reproduce differentially, and (2) the new biotechnological methods through which the transmission of genes to the next generation or future generations is influenced via techniques such as medically assisted fertility or germinal gene therapy.

Both groups of methods are based on the Darwinian selection mechanism, but in the first case, use is made of differential demographic behaviour, and in the second, biotechnological interventions are applied. The distinction between both the methods is, however, less simple than seems at first sight.

Today, fertility-related demographic behaviour is successfully codetermined by medical technology thanks to modern contraceptives – such as the pill, IUD, and sterilisation – and the techniques used to terminate pregnancy (such as vacuum aspiration, mefipristone or RU 486), by which births can be selectively restricted in an extremely efficient way.

The biotechnological methods consist of micro-engineering medical techniques, the distinguishing feature of which is that they promote the transmission of certain genes positively. Whilst the behaviour component seems to prevail in differential demographic behaviour, it is also involved in biotechnological interventions: the application of reproductive biotechnology is chiefly based on a strong motivation for (selective and, generally, eugenic) parenthood.

Whereas traditional family genetic analysis (pedigree analysis) succeeded only in estimating the risk of having children with a particular genetic disease, new methods of detection (such as karyotype analysis, biochemical tests, and especially DNA fingerprinting) can increasingly identify with certainty the presence of a genetic factor (allele, genotype, or chromosome) that is responsible for the development of a genetic impairment.

Biotechnology

Modern biotechnological techniques which can be used in eugenic engineering can be classified into two categories, namely (1) medically assisted fertility, and (2) germinal gene therapy.

Medically assisted fertility now already comprises a number of techniques which positively intervene in the generation of an embryo: artificial insemination by donor (AID), ovum donation, in vitro fertilisation (IVF), embryo transplant, embryo selection, and sex choice (cf. Mashiach *et al.*, 1990; Robertson, 1994; Gardner *et al.*, 2004). Whilst some of these methods may be intended for countering infertility – a disorder that is, however, not always genetic – all of them can be used to produce genetic effects.

The discovery of the structure of the organic molecules responsible for genetic transmission (DNA) by Watson and Crick in 1953, together with the emergence of molecular genetics with its applications in biotechnology, undoubtedly provides the means for the future development of germinal gene therapy. This is the technique in which sex cells are treated with recombinant DNA in order to genetically alter germ-line cells to replace unfavourable genes with wanted genes (cf. Wheale and McNally, 1988; Friedmann, 1998; Stock and Campbell, 2000; Stock, 2002). Whilst changes to somatic cells affect only specific cells within a given organ system and are not passed on to future generations, germ-line changes affect every cell in the body and are passed on to future generations.

The genomic era of medicine began in 2003, fifty years after the first description of the structure of DNA, when the Human Genome Project completed the sequencing of the human genome (Guttmacher and Collins, 2003). Knowledge about the normal and pathologic variation for all human genes will allow the diagnosis of genetic diseases and will in the future lead to effective treatments for them, particularly at the level of the genes themselves, as was recently reported in the case of gene therapy for Parkinson's disease (Feigin *et al.*, 2007). It is generally acknowledged that, at the present stage of development of applied human genetics, human germ-line therapy is still too risky. It will probably take several more decades of somatic-gene therapy before the new technologies will be applicable to changing genes in germ cells (cf. Reiss and Straughan, 1996; Stock and Campbell, 2000; Stock, 2002).

Genetically differential demographic behaviour

Despite biotechnological progress, demographic selection – the differential reproduction of carriers of various alleles – remains the most efficient and cheapest procedure for influencing the genetic composition of a family and for modifying the genetic composition of a population. Even in the more remote future, when currently unavailable, sophisticated methods of germinal gene identification and therapy will have been developed, genetically differential demographic behaviour will continue to be the most important vehicle for desired family and population genetic changes.

It is obvious that selective behaviour of this kind can only modify the gene pool within the limits of existent variability. Current variability can be transcended only if new favourable mutants intervene.

Individual and family-oriented eugenics

Individual or family genetic testing and counselling for those with a high risk of the intergenerational transmission of a genetic disease or disorder traditionally includes giving advice about or assistance with birth control, either via contraception or (selective) abortion. Such practices were formerly classified under the term 'negative eugenics'. However, as has already been explained, selective abortion may lead to positive eugenics when the abortion(s) are replaced by screened pregnancies that show no genetic impairments. Experience with this type of counselling has shown that families with a high genetic risk can, thanks to selective abortion, nevertheless produce healthy offspring (cf. Evers-Kiebooms, 1994; Evers-Kiebooms and Welkenhuysen, 2005). Modern genetic testing and diagnostic techniques will extend the powerful sorting influences of modern culture to the realm of genetics (Skene and Thompson, 2008).

Individual and family-oriented eugenics is currently practiced by genetic counselling services, which are usually located in university medical departments. According to Kevles (1985), the first genetic counselling service was created in the United States in 1940 at the University of Michigan, under the direction of James Neel. In Britain, the first genetic advisory clinic opened in 1946 at the London Hospital for Sick Children, under the direction of John Frazer Roberts.[4] Reed (1974; 1955) coined the expression ‘genetic counselling’ in 1947. Originally, genetic counselling consisted mainly in advising individuals and families on the risk of transmitting genetic diseases. Nowadays, genetic counselling obviously also includes the use of or referral to many of the previously discussed biotechnological methods that complement the earlier negative eugenic practices with positive eugenic interventions.

In the future, molecular genetics will push forward changes in the discourse about health because, through genetic testing and screening, it will make possible the classification of people as being healthy, predisposed to an illness, probably at risk, at risk, or carriers of certain risks (Betta, 2006). It will also raise serious ethical and social questions concerning the right to communicate knowledge about genetic risks to others – including family members, employers, and insurance companies (e.g. Buchanan *et al.*, 2001; European Commission, 2002; Skene and Thompson, 2008; Baily and Murray, 2009).

Population-oriented eugenics

Individual and family testing and counselling take on a population dimension when systematic efforts are made at the population level to identify individuals or families with high genetic risks and to provide them with genetic counselling and assistance (cf. Khoury *et al.*, 2000; Davey and Halliday, 2001; Sharpe and Carter, 2006; Skene and Thompson, 2008).

Genetic screening is the systematic search within a population for persons possessing particular genotypes that are associated either with disease, a predisposition to disease, or the transmission of disease in descendants. Screening can be premarital or prenatal. Mandatory screening could result in the coercion of individual behaviour in order to avoid risks, or could be designed simply to raise awareness about risks, leaving the ultimate choice to the individual or couple (Van den Daele, 2006). So far, only the latter approach

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[4] The practice of genetic counselling may have started earlier in countries such as Denmark and Switzerland. In Denmark a genetic-hygienic register covering all the patients in the country afflicted with a serious hereditary condition, together with their families, was started already in 1938 and maintained at the University Institute for Human Genetics in Copenhagen (Kemp, 1951).

is in actual practice. There is a general consensus that informed choice, protecting individual autonomy, is the basis of every genetic screening programme (Godard *et al.*, 2003).

In many advanced societies, multiple prenatal screening tests for single gene disorders, chromosomal abnormalities, and structural birth defects are now routinely offered to pregnant women (cf. Khoury *et al.*, 2000; Roe and Shur, 2007; Norton, 2008). Given the rarity of serious genetic conditions, the development of genetic screening programs will not necessarily lead to the testing of all individuals, but special attention will be given to people or groups who are at relatively high risk, such as older parents, people with a family history of genetic impairments, genetically closely related people, and ethnic or racial groups with a high prevalence of particular genetic diseases (Godard *et al.*, 2003).

Examples of premarital genetic screening programs include the national thalassemia prevention programmes in Cyprus (cf. Cao *et al.*, 2002; Cowan, 2008) and Iran (cf. Najmabadi *et al.*, 2006). Thalassemia is a group of inherited autosomal recessive blood diseases resulting from a reduced rate of synthesis of one of the globin chains that make up haemoglobin, causing the formation of abnormal haemoglobin molecules resulting in thalassemia anaemia. If both parents carry a thalassemia allele, there is a 25 percent chance with each pregnancy of producing an affected child.

Another example of premarital population screening for particular genetic disorders concerns the *Dor yeshorim* genetic testing programme (Ekstein and Katzenstein, 2001; Prainsack and Siegal, 2006). The Ashkenazi Jews are traditionally an inbreeding group that carries a dozen recessive genetic diseases with relatively high frequency. The most important is the autosomal recessive disorder called Tay-Sachs disease. The disease is caused by the lack of a crucial enzyme which normally breaks down fatty waste products found in the brain. Children who are homozygous for the gene become hypersensitive to sound and eventually become deaf, blind, mentally retarded, and unresponsive to external stimuli. Death results by age five. In 1985 Rabbi Joseph Eckstein founded the international genetic testing programme called *Dor yeshorim* ('generation of the righteous') with the goal of preventing more children from being born with the illness. Orthodox Jewish students are tested to determine if they carry the gene. When they get engaged, if both partners test positive, they are advised to choose a different marriage partner. An alternative policy would be to advise such couples to screen their pregnancies and apply selective abortion in case of a homozygote foetus. Since such couples have only a 25 percent chance of producing recessive homozygotes, they could have normal offspring.

In the United States, all 50 states and the District of Columbia now require that every baby be screened for 21 or more of the 29 serious genetic or functional disorders listed on a uniform panel recommended by the American College of Medical Genetics (ACMG) and endorsed by the March of Dimes (www. marchofdimes.com/nbs).

Where prenatal or premarital genetic screening programmes exist and are well organised, the participation rate is generally high and the procedures succeed in considerably reducing the prevalence of the targeted genetic impairments (cf. Liu *et al.*, 2002; Godard *et al.*, 2003; Scotet *et al.*, 2003).

Despite opposition from extreme individualists, religious fundamentalists, activists for the rights of the disabled, and even some feminists who complain about the use of prenatal diagnostic technologies, the acceptance of genetic screening in modern society is unstoppable. There can be little doubt that the rapidly evolving and advancing field of molecular genetics will promote the spread of population genetic screening and genetic risk management. Population genetic screening will become part of public health genetics (Khoury *et al.*, 2000; Heyman and Henriksen, 2001).

A more difficult and more delicate issue concerns the differential reproduction of socially important biological features that show a normal frequency distribution, such as cognitive ability and socially important emotional personality characteristics such as sociability. These characteristics are mostly, but not solely determined by polygenes (also referred to as QTL, quantitative trait loci). So far, the individual genotypes of the polygenes have not been identified, and their phenotypic expression can, moreover, be influenced by environmental factors.

The difficulty with polygenetic features – at least in view of the present state of genetic knowledge – is that differential reproduction has selective results that can only be obtained at the group level and not necessarily at the individual level. Sexual reproduction means that phenotypically assorted categories in the population show up in offspring with a greater variability. There is evidence that non-modally assorted categories regress toward the population mean.

Nevertheless, all eugenic authors consider the differential transmission of socially relevant polygenetic characteristics to be of great importance (cf. Galton, 1883; Sutter, 1950; Blacker, 1952; Bajema, 1971; Lynn, 2001). Features such as cognitive ability, sociability and physical performance played a crucial role in the evolution of mankind and may be considered of even greater value for the future development and evolution of mankind.

Differential reproductive success in traditional societies was quite universally positively related to social status, wealth or other features of social power (cf. Betzig, 1986; Retherford, 1993; Hill and Kaplan, 1999). The culturally most successful individuals achieved the highest reproductive success (Irons, 1979). Indirect evidence points to the fact that social status, wealth, and cultural success in general were all positively related to socially important features such as cognitive ability, sociability and health.

As was shown in Chapter 9, in modern society, the relationship between socio-economic status and some of those traits, particularly cognitive ability, has been reversed (cf. Vining, 1986; Essock-Vitale, 1984; Pérusse, 1993), prompting development of the theory of the contraselective effect of modern culture.

Eugenicists advocate a positive relationship between reproductive performance, or more broadly, inclusive fitness, and socially important biological traits such as cognitive abilities, emotional personality characteristics and health characteristics (cf. Bajema, 1971). This would imply that intelligent, altruistic, and healthy people should have an above average family size, whereas mentally less gifted, socially less driven, and physically less healthy individuals should have a below average family size. The same would apply to those at high risk of transmitting deleterious genes for a serious mental or physical deficiency.

The socially delicate and extremely sensitive aspect of differential reproduction of socially important biological features is that they are partially related to socio-economic status differences. Hence, eugenic proposals in this domain are immediately associated with class prejudice (cf. Buchanan *et al.*, 2001). This reaction reflects a typical pre-Mendelian view of biological inheritance. In reality, phenotypically assorted social categories in the population show a greater variability in their offspring (Galton, 1883; 1886; 1889; Pearson, 1896; Li, 1971). Non-modally assorted categories, moreover, show evidence of a regression, a genetic outflow toward the population mean. This means, as was explained in Chapter 7 on ‘Social Class Variation and Classism’, that social mobility occurs – must occur – in each new generation. From a eugenic point of view, it is, consequently, very important that social conditions be created that allow upwardly mobile people to be socially and reproductively successful. Empirical data about the reproductive behaviour of upwardly mobile people, however, show that exactly the opposite is the case. The pursuit of upward mobility often requires individuals to make major efforts to overcome social class barriers, such that social success occurs at the price of reproductive success. This is particularly the case for upwardly mobile females (cf. Blau and Duncan, 1967; Hope, 1971; Westoff, 1981; Sobel, 1985; Van Bavel, 2006).

How to achieve differential reproduction?

Several methods can be applied to achieve differential reproduction, most of which are mutually reinforcing. A first broad topic of population-oriented eugenic policy concerns education and information. Assuming that people are very motivated to have mentally and physically healthy children, all societal sectors – educators, health and welfare care workers, the mass media, and ideological and political leadership – play roles in informing and educating people about how to produce healthy children, genetic issues, and the ways to achieve eugenic goals.

A second important issue is the availability and accessibility of genetic counselling and other medical services that can perform specialised interventions in the domain of reproduction.

Extremely important as a general background condition is the universal availability and accessibility of birth control (contraception and abortion) for all strata of the population. The idea that voluntary birth control must be a major component of any comprehensive social policy designed to achieve eugenic goals was already advanced by the earliest birth control advocates during the nineteenth and the first part of the twentieth century (Clapperton, 1885; Ellis, 1917; Stopes, 1920; Sanger, 1922). Believing that the end of the demographic transition would be marked by the general acceptability and availability of birth control, Osborn (1940) formulated the 'eugenic hypothesis' which assumed that the most successful individuals would want and have the most children, thereby increasing the frequencies of genes underlying the traits most desirable to society (Bajema, 1976). As we have seen, data on differential reproduction in some of the most advanced countries or regions point in that direction, although in most countries there is still a slightly negative relationship between indicators of social success such as education and number of children per family. The latter relationship seems to support the hypothesis of C.G. Darwin (1953) and G. Hardin (1968) which states that reproductive freedom will ultimately have dysgenic effects. But the present situation in many countries might be an indication that the demographic transition is not over yet.

Another issue for eugenicists is the detection of relatively common harmful genes at the population level by a general screening and registration of all couples and/or newborn children, followed by genetic counselling where appropriate (Teitelbaum, 1972).

Several suggestions have been made to encourage people of low intelligence or with a high risk of transmitting deleterious genes to forgo parenthood through a system of financial incentives (cf. Boulding, 1964; Bajema, 1971). The transmission of deleterious genes can be prevented by exerting 'soft coercion' (Bajema, 1971; Staatscommissie voor de Ethische Problemen, 1975), to convince carriers of deleterious genes to adapt their reproductive behaviour in a eugenic way, either by reproductive abstention (celibacy or sterilisation) or by applying one or another of the available biotechnological reproductive replacement therapies (such as artificial insemination by donor, ovum donation, in vitro fertilisation, embryo transplant, or gene therapy). The same strategy can be pursued by means of compulsory measures through what Hardin (1968) called 'mutual coercion', namely the promotion of reproductive responsibility via social arrangements that are in some way coercive, mutually agreed upon by the majority of people affected. This is a common strategy in many other domains of social life – education, health, taxation, aggression, drug trafficking, and pollution control. The idea is that the individual right to reproduce must be restricted in order to protect the rights of individuals (as yet unborn) to be free from genetic handicaps and to defend the further advancement of society. Several concrete proposals have been made to put such principles into practice, for instance assigning birth rights by contest, mandated eugenic testing of a couple's first two children before permission is granted for additional offspring, and requiring eugenic tests before any individual is allowed to become the parent of any genetic offspring (Bajema, 1971).

Whilst many of these suggestions might be considered utopian in societies that currently give precedence to individual rights over social rights, they should be seriously considered if we want to bring individual and social rights into a better dynamic equilibrium.

THE FAR FUTURE?

The ethical and policy considerations discussed so far largely pertain to the relatively near future. These considerations concern the various biosocial sources of variation dealt with in this treatise – at individual, between-group, and intergenerational levels. They are conceived keeping in mind the background of the developmental, demographic and ecological problems at the global level and the necessity to resolve them if we want to survive, and possibly even evolve to higher stages of biological and cultural development.

But what about the long-term future? In the previous chapter we defined the far future as the time span beyond 100 years, but in fact here we are thinking of many thousands, even millions of years – the prolongation of the past hominisation process.

Religious ideologies usually conceive the far future as a righteous idyllic eternity. The creation and evolution of humanity is considered to be the result of the will of God(s). Modern scientific knowledge, in particular evolutionary biology, however, has undermined the foundations of these belief systems. We know when, where, and how the human species emerged and evolved. We have insight in the evolutionary mechanism and processes that resulted in the emergence and evolution of *Homo sapiens sapiens*, and his culture, including his needs for life-supporting and -reproducing value and norm systems.

Explanations of when, where and how still leave unanswered the question of why life emerged, and this marks the area scientific knowledge still needs to enter. For those in quest of easy answers dogmatic thinking has been at hand a long time as it refers to an omnipotent will and design of a supernatural power.

The present state of knowledge in (bio)anthropology, and in science in general, has resulted in the awareness that the near as well as the far future of humanity depends on three major factors, namely (1) our phyletic heritage, (2) the future physical state of our planet, and (3) the ethical goals we will ourselves set to guide our further development and evolution.

Our phyletic heritage, as well as the physical future of the planet, pose many challenges which escape our control, but the values and norms that can shape our future (ontogenetic) development and (phylogenetic) evolution are to a large extent in our own hands. The knowledge that neither our evolutionary past, nor our evolutionary future depends on some creationist moral authority, and the insight that we gained through modern science in the ontogenetic and phylogenetic mechanisms of intergenerational continuity and change, imply that humanity itself bears and needs to assume responsibility for its future, short-term as well as long-term.

This responsibility applies both to the conceptualisation and implementation of the values and norms that will direct our future existence and evolution. Indeed, intergenerational intervention, in particular by means of genetic manipulation, requires a generation-transcending ethics and policy. Such an ethical orientation underpinning future policy choices would allow the human species to master not only its demographic growth and phenotypic development, but also its genetic composition – in other words, its future evolution.

In the previous Chapter on ‘Intergenerational Variation and Dysgenism’ we have defined the goal for the long-term future of humanity as the active advancement of the hominisation process. Further hominisation is not just a possible futuristic scenario, but also an ethical aspiration. This goal implies that humanity should steer its own future evolution through the means of conscious interventions.

Ultimately, the long-term evolution of humankind can take four possible directions, largely dependent upon how humans do or do not consciously and responsibly try to act upon that future: extinction, regression, stabilisation, or progress (Figure 10.3).

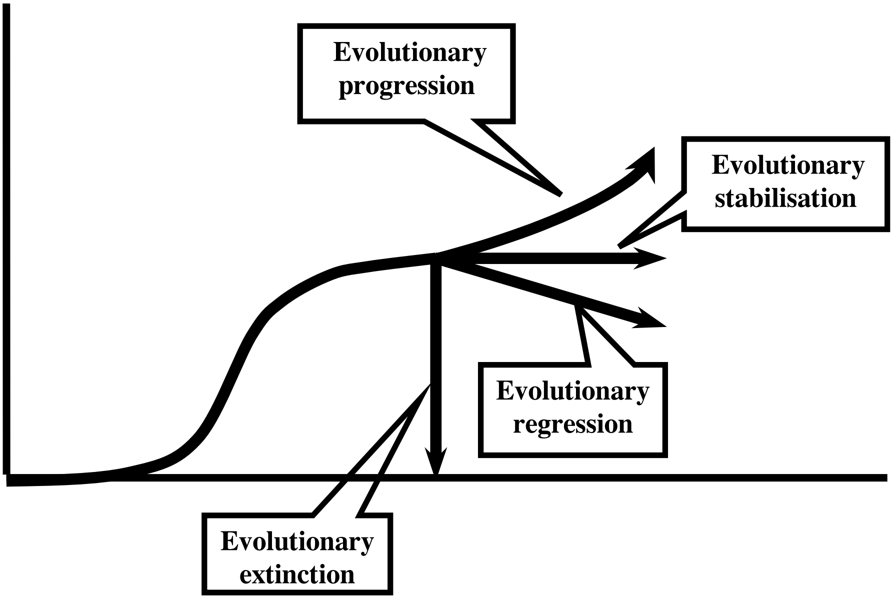

Figure 10.3. The long-term genetic future.

Evolutionary extinction

Evolutionary extinction is not an uncommon phenomenon. Catastrophic events are menacing events which can extinguish a species, examples include the impact of a giant meteorite 65 million years ago in the Chicxulub region (Yucatan Peninsula, Mexico) (Hildebrand *et al.*, 1991) which led to the extinction of the dinosaurs, and the major eruption of the Toba volcano on Sumatra some 70,000 years ago which produced an important demographic bottleneck for *Homo sapiens sapiens* in the Upper-Pleistocene era (Ambrose, 1998).

But human-induced catastrophes, caused for instance by the use of atomic, biological, and chemical (ABC) weapons of mass destruction, anthropogenic climatic change, or world-wide environmental pollution, may also endanger the future existence or evolution of our species. Modern scientific knowledge and technological capability may perhaps help us prevent or postpone such events, or even allow humans to adapt to them.

Evolutionary regression

The knowledge that we have about the hominisation process and the evolutionary mechanism suggests that, in the absence of conscious human intervention, in the future humanity will experience a number of regressive phenomena that are consistent with the loss-mutations experienced in the past for features in which a functional loss occurred. Humans retain features such as rudimentary ear muscles, the appendix, regressing wisdom teeth, and a reduced coat of hair. Continued evolution along these lines could lead to atrophied lower limbs, non-lactating mammary glands, weakened auditory and visual powers, a further reduced and degenerated set of teeth, and an increase in all possible other physical and mental disorders for which replacement therapies are developed or selection relaxation is made possible (Glass, 1966).

Evolutionary stabilisation

The avoidance of evolutionary regression, namely of the accumulation of mutations which are considered to be unfavourable, can in the first place be achieved by preventing culturally induced mutations. Mutagenic radiation or chemicals now found in many products and production processes are to be avoided or applied in such a way that they cannot have a harmful effect on the human gene pool. In the second place, the reproductive behaviour of the carriers of genes that are regarded as unfavourable can be restricted or regulated in such a manner that unwanted genes are not transferred to future generations. Such strategies would maintain an evolutionary stabilisation of the human species.

Evolutionary progression

An entirely distinct future is possible if humankind instead consciously steers its own long-term evolutionary future, namely by promoting human-specific features directed at a continuing hominisation.

It is beyond all doubt that in the future, perhaps within the next few centuries, but doubtless in the following millennia, this will actually be done (cf. Muller, 1960; 1967; Overhage, 1977; Zimmerman, 1984; Stock, 2002). As argued in previous chapters, the quantitative birth control that became available in the last century will in the future be extended to include qualitative birth control.

Human-specific features obviously find their highest expression in the singularity of the human brain, which is responsible for humankind's high cognitive performances, its refined emotional life, and its strong sociability. The active advancement of the hominisation process will not just aim at preventing the spread of evolutionary regressive phenomena, but also orient future human evolution in the direction of an improvement of the human-specific features – cognitive performance, emotional life, sociability – and other desired human characteristics such as beauty, athletic ability, sexual arousal and orgasm, euphoria, and longevity.

A human-specific characteristic that, in the future, will have to be decreased instead of increased is aggression, both at the inter-individual and inter-group level. Both individual and societal aggression have historically been important factors in the within- and between-group competition for resources (including additional living space), which is the proximate condition for maintaining or increasing reproductive fitness. At the societal level, as argued earlier, the traditional strategy for obtaining, preserving, or increasing available resources – aggressive competition – has become a maladaptive strategy in modern culture, with its potential for mass destruction by means of ABC weaponry. The continued development of modern culture requires increased intergroup cooperation at the global level.

Just as within-group cooperation needs to increase, between-group aggression needs to decrease. The current increase in between-group economic competition due to unfettered globalisation runs counter to the need for increasing inter-group and inter-individual cooperation. Linked to between-group and even within-group aggression is the human predisposition to in-group favouritism and the related phenomena of nepotism, xenophobia, ethnocentrism, and racism.

All in all, it is highly necessary to rethink societal values and norms to promote the future evolution of humankind and further harmonise the well being of individuals, families, and societies in general. These values and norms must be buttressed by a thorough assessment of the pros and cons, based on a broad and deep scientific and societal reflection.

Scientific thinking opens visions of alternatives, but it comes with the weight of responsibility of humankind for choices about the future.

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NAME INDEX

SUBJECT INDEX

- Some general concepts such as age, children, culture, economy, education, environment, evolution, gene, fertility, sex, which appear throughout the text, are not indexed but printed in bold.
- Page numbers printed in bold refer to main sections in the book where the subject is dealt with.

Biosocial Interactions in Modernisation examines a range of major societal problems resulting from the clash between humanity's evolutionary heritage and the biosocial challenges of modern life. The book is organised with reference to the foremost sources of biosocial variation: individual variation, age variation, sexual variation, family variation, reproductive variation, social variation, racial variation, and intergenerational variation.

The analysis of each source of variation begins with a discussion of its biological evolutionary background, followed by an investigation of its variability-specific biosocial interrelations, and concludes with consideration of lessons to be learned about the confrontation between humanity's evolutionary heritage and the challenges and adaptive pressures of the novel modern living environment.

Special attention is given to the links between these sources of variation and maladaptive modern social practices such as individualism, ageism, sexism, familism, pro/anti-natalism, classism, racism, and dysgenism.

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Robert Cliquet is emeritus professor of biological anthropology and social biology in the Department of Population Studies at the University of Ghent, where he has taught courses in the social and behavioural sciences. He has also served as honorary general director of the multi-disciplinary Population and Family Study Centre (CBGS) in Brussels, a Flemish governmental scientific institute, where he participated in research on reproductive behaviour and various issues related to population policy. Since 1999 he has served as senior advisor to Population and Social Policy Consultants (PSPC) in Brussels.

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ISBN 978-80-210-4986-4

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