

New Frontiers in the Future of Aging: From Successful Aging of the Young Old to the Dilemmas of the Fourth Age

Paul B. Baltes Jacqui Smith

Max Planck Institute for Human Development, Berlin, Germany

Key Words

Successful aging · Young old · Oldest old · Fourth age · Berlin Aging Study · Aging mind

Abstract

We review research findings on the oldest old that demonstrate that the fourth age entails a level of biocultural incompleteness, vulnerability and unpredictability that is distinct from the positive views of the third age (young old). The oldest old are at the limits of their functional capacity and science and social policy are constrained in terms of intervention. New theoretical and practical endeavors are required to deal with the challenges of increased numbers of the oldest old and the associated prevalence of frailty and forms of psychological mortali-

ty (e.g., loss of identity, psychological autonomy and a sense of control). Investigation of the fourth age is a new and challenging interdisciplinary research territory. Future study and discussion should focus on the critical question of whether the continuing major investments into extending the life span into the fourth age actually reduce the opportunities of an increasing number of people to live and die in dignity.

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During the last decades, gerontological science, social policy and cultural-medical-economic advances have formed a powerful political coalition that resulted in major increases in longevity and the quality of human aging, especially for the young old (third age). These advances have contributed to a spirit of scientific and social policy optimism. However, new scientific evidence about the oldest old gathered in recent years indicates that some general recommendations that presently predominate in the politics of aging may be based on inappropriate assumptions. Specifically, theoretical arguments [1-5] and empirical findings [6, 7] suggest that the process of optimization of the fourth age is inherently more difficult than that of the young old (or third age). Increasingly, the scientific news about prospects of survival into very old age is shifting from a focus on aspects of gain to aspects of loss. As gerontologists plan the future of

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Fax +41 61 306 12 34
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Paul B. Baltes
Max Planck Institute for Human Development
Lentezeallee 94
D-14195 Berlin (Germany)
Tel. +49 30 824 06 255, Fax +49 30 824 99 39, E-Mail sekbaltes@mpib-berlin.mpg.de

research and practice towards optimal aging [8], we propose that they need to recognize the two faces of human aging: the gains and losses. This review summarizes our arguments and provides supportive research.

The two faces of human aging are captured elegantly in the following vignettes. The first is a story about the world-famous cellist Pablo Casals who, as an 80-year-old, was asked by a young student why he continued to practice so hard. 'Why?', Casals answered. 'This is simple. Because I want to get better!' This story illustrates a gain perspective on old age: in particular, the idea that old age has much latent potential which awaits activation through a better material, medical, social and psychological culture of old age.

The second story, an ancient Greek saga, is helpful in highlighting the risks associated with sheer extensions of the life span. The saga is about Eos, the Greek goddess of the dawn, who fell in love with the mortal earthling Tithonos, the prince of Troy. True to her own immortality, Eos wanted to go on living with and loving him forever. In this spirit, the goddess begged the master of all Greek gods, Zeus, to make her lover immortal. Zeus granted Eos this wish and bestowed eternal life on Tithonos. Not included in the gift of Zeus, however, was another condition that Greek gods enjoy, namely eternal youth and vitality. Despite immortality, Tithonos aged like a human: he became frailer and frailer and although his body remained alive, his mind died. With much pain in her heart, Eos decided to move her former lover into a separate chamber where, according to the Greek saga, he continued to live mindlessly.

Two important issues are highlighted in the ambivalent spirit of this Greek saga. First, pushing the limits of aging and its health-related support structures further into advanced old age may actually decrease rather than increase the state of human dignity for many older persons [9–11]. In this context, we argue that the extraordinary needs and vulnerabilities of the fourth age potentially require some reorientation of aging policy. One critical question is whether the continuing major investments into extending the life span into the fourth age actually reduce the opportunities of an increasing number of people to live and die in dignity.

The second issue addresses the idea that a social policy of aging needs to be placed into the larger frame of the common societal good and the life course as a whole. Continuing to define gerontological policy as a call for more and better societal resource allocation on behalf of the older population may decrease the overall economic, physical, social and psychological health of future socie-

ties, including the amount of resources available to care for the elderly. In other words, there may be some danger inherent in pushing an exclusive old-age focus. Such a focus potentially limits the resources necessary for improving the state of earlier phases of life, namely childhood and adolescence. These early life phases lay the foundations for subsequent life span development and for future resources necessary to support old age. Perhaps the time has come to think about the younger ages in order to serve old age.

For gerontologists, highlighting the need for a modulation of gerontological policy is not an easy emotional task because the effort involves critical reflection and is not fully consistent with the dominant geropolitical movement. However, it is our belief that in the long run, gerontology and the older population will benefit most if their respective agendas are part of an overarching frame, one that considers policy implications for all stages of life and for society as a whole.

The Third versus Fourth Age Distinction: Some History and Definitions

Several authors have asserted that in order to understand the future scenario of an aging population, it is useful to distinguish between a third and a fourth age [1, 2, 6, 12–15]. The third versus fourth age script is a further elaboration of the young old versus old old distinction introduced by Neugarten [14] and the historian Laslett [13]. Laslett and Neugarten were key instigators of the basic idea of multiple ages of old age and, in particular, highlighted the uniqueness of a third age. The third versus fourth age script also has some similarity to distinctions between normal, pathological, successful and optimal aging [16–18] and the associated notion that very old age is characterized by much pathology.

What specifically is meant by the distinction between the third and the fourth age? To begin, it should be emphasized that, like most phenomena in human evolution and science, the idea of the third and fourth age itself is undergoing changes and strictly speaking is not tied to a specific age range. As phenotypic expressions, the third and fourth age are dynamic and moving targets and are themselves subject to evolution and variation. Examination of the differences in population aging between developed and developing countries makes this point of historical-cultural contingency. In today's developing countries, the period of old age begins and ends at younger chronological ages than is the case in developed countries.

In general, there are two ways to define the third and fourth age. The first is population-based, the second is person-based. Both modes of definition, in our view, are necessary to capture the essence of the distinction and to direct interpretations and research inquiries to directions that highlight the discontinuity and qualitative differences between the ‘ages’ of old age.

Population-Based Definition

First, regarding the demographic population-based way of defining the third and fourth age: The transition between the third and the fourth age can be thought of as being the chronological age at which 50% of the birth cohort are no longer alive. Having such a criterion increases the likelihood that people beyond that cutoff age are indeed subject to aging processes. This definition would put the transition from the third to the fourth age in developed countries at around 75–80 years of age [4, 19, 20]. In developing countries, the current age range for the third and fourth age is clearly much lower.

A more differentiated, but still demography-based definition is to further delimit the 50% criterion by excluding from the calculation those people who died at younger ages. Thus, we could speak of the transition from the third to the fourth age as the age at which 50% of the people who attained age 50 or 60 have died subsequently. For developed countries, this definitional strategy would put the beginning of the fourth age closer to 80–85 years. It is this latter definition of the fourth age, as beginning on average at 85 or so, that we currently use when presenting empirical evidence based on data from developed countries.

Person-Based Definition

The second mode of differentiating between the third and the fourth age is an individualized one. Theoretically, the aim of this approach is to estimate the maximum life span of a given individual rather than the average of the population. Based on present-day evidence, for instance, and excluding specific illnesses that prevent a longer life to begin with, such an individual maximum life span is thought to vary between 80 and 120 years. In this view, individual transitions to the fourth age could begin at rather different ages, for instance, around 60 for some or around 90 for others [21–27].

There are scientific precursors to the person-based definitional approach of a third-fourth age distinction as well. For example, the distinction can be seen as a correlate of Kleemeier’s [28] and Riegel and Riegel’s [29] concept of terminal decline associated with processes of death

Table 1. Recent news from gerontology

<p><i>The good news: the third age (young old)</i> Increase in life expectancy: more older people live longer Substantial latent potential for better fitness (physical, mental) in old age Successive cohorts (generations) show gains in physical and mental fitness Evidence of cognitive-emotional reserves of the aging mind More and more people who age successfully High levels of emotional and personal well-being (self-plasticity) Effective strategies to master the gains and losses of late life</p>
<p><i>The not-so-good or bad news: the fourth age (oldest old)</i> Sizeable losses in cognitive potential and ability to learn Increase in chronic stress syndrome Sizeable prevalence of dementia (about 50% in 90-year-olds) High levels of frailty, dysfunctionality and multimorbidity Dying at older ages: with human dignity?</p>
<p><i>Prospects for the 21st century: the era of chronic incompleteness of mind and body?</i></p>

and dying. However, many normal changes of aging are not directly related to mortality. The concept of the fourth age espoused here includes such aging changes. Morbidity and mortality are two related but conceptually independent constructs.

The distinction between the third and fourth age is also one that is characterized by a focus either on a predominantly positive versus negative view of the future potential to sustain and improve life quality during the period of old age. The background to these two viewpoints is reviewed in the next sections.

The Scientific Good News: The Third Age

Predominantly to prevent a misunderstanding of our central message, we begin with the positive news about aging. In our view, this information was generated primarily from research with persons and groups which represent the third age, the young old (refer to table 1). The prevailing optimism among many gerontologists is based on this news.

Increases in Life Expectancy: More Older People Live Longer

One of the first pieces of good news is the continual rise of life expectancy rates in developed countries [4, 19, 20, 30–33]. What is new is that these projections now include

80- and 90-year-olds and even centenarians. Although there is still no conclusive evidence that the maximum life span has increased beyond 120 years, it is clear that 70-, 80-, 90- and 100-year-olds will live longer than those age groups have in the past.

Vaupel [31], for instance, shows that current octogenarians in the developed world have a mean additional life expectancy of almost 8 years, 4 years longer than 80-year-olds could have hoped to live some 30 years ago. Centenarians also live longer after they have reached 100. Currently, as suggested by Vaupel, there is an annual increase of 8% in the number of centenarians in developed countries. In part, this especially rapid increase of centenarians is due to the fact that, to begin with, there are more people reaching the oldest ages. The increase is also intrinsic to the improved environmental and social-technological life conditions of the oldest old.

Successive Cohorts or Generations Show Gains in Physical and Mental Fitness

Additional positive findings about the expressions of aging originate from cohort-comparative work on physical functioning and mental health status. Some recent research on cognitive plasticity, originally from the Göteborg studies in Sweden [34, 35] and now from the Swedish Twin Study [36] and Schaie's Seattle Longitudinal Study [37] as well as our own work [38–43], shows that today's 70-year-olds are comparable to 65-year-olds who lived 30 years ago. This suggests that in the past 30 years or so, same-aged older people in developed countries have gained approximately 5 'good' years of life [44]. There is also some initial evidence from national surveys in the USA [27, 45, 46] that on the whole today's over-65-year-old North Americans have fewer physical disabilities (e.g., affecting competence in everyday functioning) than earlier cohorts of the same age range.

When explaining these findings, it is important to remember that this progress in life expectancy and overall physical and mental fitness is not the result of genetic improvement, but of contemporary social and cultural forces. In concert, better material environments, more advanced medical practice, the improved economic situation of older persons, more effective educational and media systems, increased psychological resources such as reading, writing and computer literacy, and many other related factors allow older persons to approach their own maximum life span in healthier and more vital conditions. When the physical body declines in old age, the environmental systems supporting the aging of the mind and the body become especially important [47]. Without

doubt, a good policy of aging requires attention to such factors as the social roles allocated to older adults and the general availability of intelligent-support systems including computers, better housing, access to health care and better transportation.

Longitudinal Evidence on Cognitive Reserves of the Aging Mind

Perhaps the best evidence of the positive potential of the aging mind comes from longitudinal and intervention studies in which individuals are exposed to extensive practice, better health conditions or favorable life conditions associated with work and leisure. From such research we know, for instance, that in developed countries most people maintain their level of everyday intelligence or mental achievement until around age 70 [37].

Moreover, the aging mind has a sizeable potential for new learning [47–49]. This is especially true if areas such as language and professional expertise are considered, where mental activities involve products of culture and experience rather than products of basic brain fitness [50, 51] and where everyday activities such as those associated with work, education and leisure collaborate and are apt to generate or maintain various forms of expertise [52–56]. In some instances, culture- and practice-nurtured functions can be maintained into the late 80s as was shown in the Berlin Aging Study (BASE) for the case of language-based competence [57]. This longitudinal finding of stability of one major cognitive function into the age range of the late 80s is most impressive.

Expert Knowledge Systems: Emotional Intelligence and Wisdom

There is more evidence on positive facets of the mind of older persons in the third age. Older adults are at the top of all age groups in such categories as emotional intelligence and wisdom [58–61].

Emotional intelligence represents the ability to both understand the causes of emotions (e.g., hate, love or fear) and to develop strategies to avoid emotional conflict situations or to modulate their negative correlates and consequences. Older people's high levels of functioning or even improvements in emotional intelligence are especially evident when it comes to difficult life problems between people [59–64].

Wisdom is the prototypical example of the potential that old age holds in store [65]. It represents an ideal combination of mindfulness and virtue. We have been conducting research on this topic for more than a decade and define wisdom as an expertise in matters of the conduct,

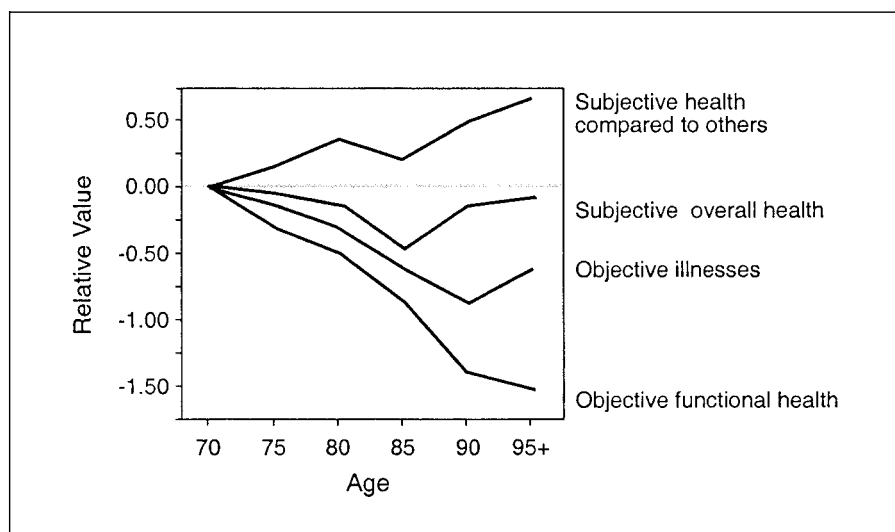


Fig. 1. BASE data. With age, the discrepancy between subjective health assessments and the objective status increases [74].

meaning and interpretation of life [58, 64, 66–69]. In our work, older adults are among the best performers in wisdom tasks. Such findings lend support to the notion that older adults have specialized forms of knowledge and skills that can be brought to the task of creating a society with a strong sense of intergenerational connectivity and coproduction.

Regulatory Adaptive (Pragmatic) Capacity on the Subjective Level: Self-Plasticity

Equally optimistic findings concerning the potential of the aging mind come from research on personal (psychological) adjustment to changed conditions of life, including losses in health. Such research is conducted to understand the mechanisms that people use to nurture their sense of well-being and life satisfaction and to maintain a positive sense of control and optimism [59–61, 70–73].

In the BASE [6], for instance, researchers demonstrated the remarkable ability people have to regulate the subjective impact of health-related losses [74] (see fig. 1). The older people get, the greater is the discrepancy between subjective evaluations of their health and the objective medical status. The result: Subjective estimates of health do not differ with age. Of course, this does not mean that objective health does not decline. The finding illustrates the psychological capacity of individuals to transform reality. This capacity appears to remain intact during old age, whereas the health of the body itself declines.

In the spirit of this remarkable self-plasticity of older persons, research has demonstrated that most human

beings are masters of internal adaptations and reconstructions. When people have to deal with an illness, they compare themselves with others who have similar or even worse illnesses. The power of plasticity of the self and the ability to transform beliefs amount to some of the best insurance policies for well-being in old age one can have. However, we need to be aware of the fact that such findings about the adaptive power of the self also make clear why self-report data on well-being are not the best indicators of actual life quality in old age. People report positive well-being even though their objective life circumstances are negative.

Taken together, this kind of news is what makes some of us into so-called ‘happy gerontologists’ to quote an Italian philosopher, Bobbio [75]. Furthermore, this news is rightfully at the forefront of political action agendas like that of the second World UN Assembly on Aging [76]. We emphasize once again, however, that this evidence has been accumulated primarily in developed countries for the period from age 60 to 80. The good news about aging is the news of the third age.

The Not-So-Good Scientific News:
The Fourth Age

One question that follows from the news that people are living longer is whether the exciting findings on the plasticity and adaptivity of the young old can be generalized to the oldest old (fourth age). Several major projects are now underway, for example in the USA, China and

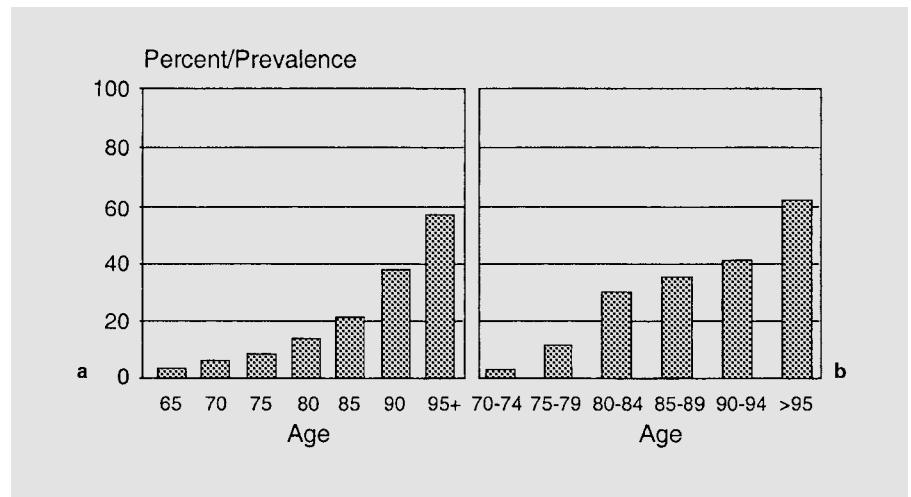


Fig. 2. Dementia prevalence increases with age. a Canadian data [102]. b BASE data [84].

Europe, to explore the characteristics of the oldest old and to address this question [1, 12, 15, 20, 27, 36, 77]. Research on the different ‘ages’ of old age is one of the new frontier topics of gerontological research.

Based on this recent work distinguishing between ‘ages’ of old age, the positivity of the news about human aging begins to crumble (refer to lower half of table 1). Findings from the BASE [6] serve as an illustration. Despite their optimistic reports on young old age, BASE researchers have also uncovered some of the dilemmas and dysfunctionality of very old age. In contrast to the young old, data on 90- and 100-year-olds clearly show many of the negative consequences of living longer into the fourth age. Living longer seems to be a major risk factor for human dignity [9–11]. BASE findings on the marked decreases in physical and mental health in the fourth age (outlined below) are all the more significant as they apply to subgroups who are behaviorally and biologically positively selected and represent those few who survived into very old age and were able and willing to continue as study participants [78]. Thus, if anything, our observations underestimate the actual plight of the oldest old.

Sizeable Losses in Cognitive Potential and Ability to Learn

The first piece of evidence for a major loss in the mind’s potential of the oldest old comes from cognitive training research with participants of BASE. Singer et al. [79], for instance, conducted an extensive memory training study. The memory training program used had been shown in the past to be rather effective with the young old

[80, 81]. At the ages above 85, and this did not include persons diagnosed with dementia, many individuals were not able to acquire this memory technique. Moreover, there were practically no instances where perfect solutions were attained, including the test conditions where a high performance was possible in principle. Even in the ‘healthy’ oldest old, new learning was severely impaired.

The Self Is at Its Limits of Functioning in the Fourth Age

BASE data on measures of subjective functioning in the area of self, personality and emotionality also yielded evidence on losses of functioning in the oldest old [7, 72, 82, 83]. In particular, for aspects of emotion and well-being associated with no decline in the young old (e.g., life satisfaction, positive affect, aging satisfaction, loneliness), losses in the oldest old become prominent especially when multiple indicators were considered.

Dementia Prevalence in the Fourth Age

The perhaps best-known indicator for a sizeable negative shift in the mental health status of the oldest old is the dramatic increase in the prevalence of dementia (see fig. 2 [102]). Findings of the BASE confirmed this trend. Almost half of the 90-year-olds suffered from some form of dementia [84].

Dementia is a condition characterized by a gradual loss of many of the fundamental qualities of *Homo sapiens*: intentionality, autonomy, independent forms of living, personal identity, social connectedness, to name just a few. Note that these qualities are fundamental to defining human dignity and the opportunity of individuals to exer-

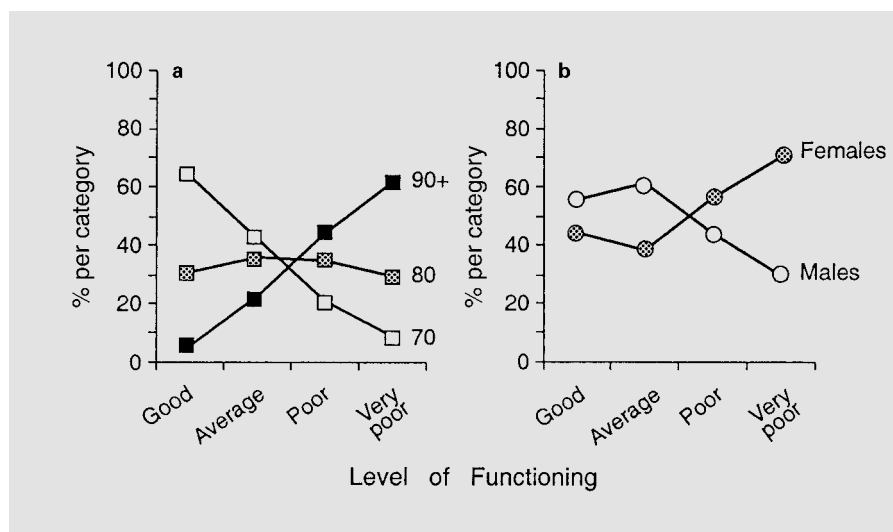


Fig. 3. BASE data. Age (a) and gender (b) are risk factors for belonging to groups with poor and very poor functional status. Groups' profiles were classified by a joint consideration of 23 physical, mental health, psychosocial and social indicators [2, 85].

cise their human rights in an agentic manner. Effective treatment of dementias is extremely limited. Indeed, because of the complexity of biogenetic-cultural causation, it will be difficult to find an effective medical solution in the near future, except for some dementias with well-defined genetic etiologies. It may be a sad commentary, but dying before reaching the oldest ages is currently the only way to avoid succumbing to Alzheimer-type dementia!

Wholistic-Systemic Indicators (Profiles of Functioning) in the Fourth Age

The most comprehensive picture of the fourth age is obtained when analyses are conducted in which a large number of physical, medical, psychological and social indicators are considered together [12]. Such an approach permits looking at the person as a whole. This potential of a systemic-wholistic analysis is perhaps the greatest strength of the BASE because this study, more than any other, is based on many sessions of intensive observation including medical, psychiatric and psychological assessments as well as social, life history and economic information.

When taking such a wholistic, multivariate and profile view, sizeable aging losses are revealed as individuals reach the oldest ages. Figure 3 summarizes the BASE findings. The probability of classification as a group characterized by many chronic life strains (i.e., multidysfunctionality and multimorbidity) was almost 5 times higher for the oldest old than for the young old [7, 82]. This increase in dysfunctionality afflicts especially women

[85]. Our impression is that the years gained in very old age often approximate levels of functioning that may justify their designation as 'bad' years. Irrespective of the validity of such a label, there is little doubt that the fourth age tests the boundaries of human adaptability. When the fourth age is considered, then living a long life has its costs, medically, psychologically, socially and economically.

Here, it is useful to ask whether these findings are in opposition to research, for instance by Manton [27] and Crimmins [86], which presents the more optimistic message that the average level of vitality and health is increasing over cohorts so that today's older North Americans have fewer physical impairments than their parents' generations. There is no contradiction. Both facts can be true at the same time. Historical cohort or generational improvements in physical and mental fitness, however, are typically much smaller than the general aging effects that are central to the present report. Comparatively speaking, the effect of old age is the dominant one, and in current times it outweighs by far the magnitude of historical cohort improvements in health.

Living and Dying in the Fourth Age

Human dignity and human rights become especially critical when conditions of testing the limits prevail such as is often true in the case of living and dying in the fourth age (see table 2). One research question is whether the process of death and dying differs by age. In other words, what is the behavioral-mental status of individuals who die at 80, 90 or 100 years of age?

Table 2. Living and dying in the fourth age (findings of BASE)

Behavioral observations

Chronic life strains accumulate in the fourth age: 80% experience losses in 3–6 areas (multimorbidity), e.g. vision, hearing, strength, functional capacity (IADL-ADL), illness, cognition

Increased systemic breakdown in psychological adaptivity

Increased losses in the positive side of life (happiness, social contacts)

Profile of functioning 2 years prior to death is increasingly negative from age 85 to 100+

Losses in cognitive functions

Losses in identity (greater loneliness and psychological dependence)

Social context

The oldest old are mostly female

The majority of women are widowed and live alone (if not institutionalized)

The majority are hospitalized at some time in the last years of life

The majority die alone in a hospital or institution

The age-comparative results on living and dying from the BASE give rise to the conclusion that the years prior to death are more dysfunctional in older ages especially where the aging mind is concerned [87]. When looking at many indicators from the cognitive and self-related domains of psychological functioning, it is the oldest dying persons who have the lowest profile 2 years prior to death. Most likely this increase in dysfunctionality with age represents the superimposition of terminal-change trajectories associated with the process of dying onto normal aging trajectories.

In general, it appears that the overall desirable profile of findings for the third age shifts to being less desirable in the fourth age. In the fourth age, BASE data suggest that all behavioral systems change concomitantly toward a more and more negative profile. Few functions remain robust and resilient to negative change. The rate of negative change is larger if aging is superimposed by pathology.

Such data provide grounds for reflection. Increasingly, philosophers, social scientists and citizens alike ask the question of whether survival into the oldest ages is desirable to begin with, especially given evidence that many of the oldest old live their lives in a condition where a strong expression of human rights and human dignity – as expressed in a sense of psychological control and personal identity – is increasingly infringed (see below).

Bobbio's [75] 'happy gerontologists' are not ready to accept these conclusions. For instance, they will say that this more negative evidence about the fourth age is a transitional phenomenon. They argue that, in the long run, research and better social policies will produce more positive results. Scientists ought to be careful with predictions. Keeping the uncertainty of prognostications in mind, in the following, we present our own assessment.

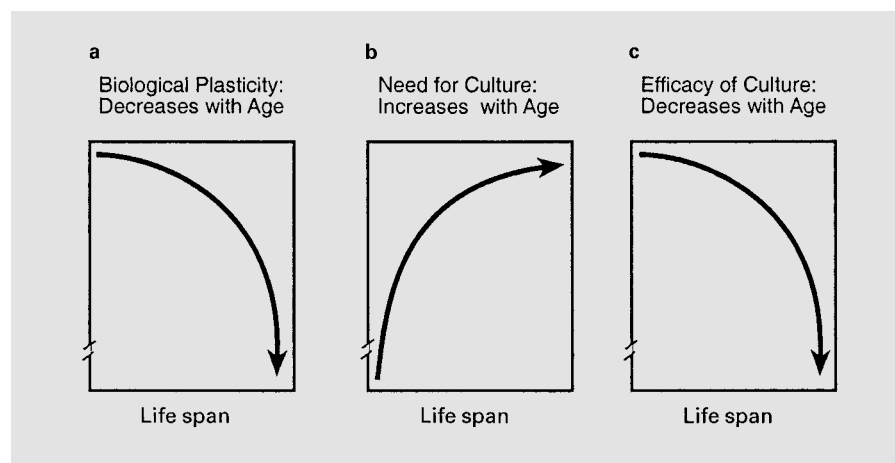
Meta-Theoretical Propositions about the Biocultural Architecture of the Fourth Age

What about theoretical considerations concerning the fourth age and its associated dysfunctionality? Baltes and colleagues [2, 48, 88] outlined an ensemble of meta-theoretical propositions that offer an interpretative framework for empirical findings that the fourth age is highly vulnerable and change-resistant. In essence, the proposal is that the biocultural architectural plan of ontogeny is incomplete for the oldest ages. Moreover, the biologically prefabricated 'house of life' has little of the beautiful incompleteness that many appreciate in Schubert's unfinished symphony. Instead, the life course architecture reflects a frustrating incompleteness that becomes the more evident in its radical implications at the oldest ages.

Figure 4 summarizes the three principles addressed in the meta-framework contributing to the incompleteness of the biocultural architecture of the life course and their implications for the fourth age [2]. First, figure 4a refers to biologically based age functions and reflects the fact that evolutionary selection pressure has operated primarily during the first half of life to ensure reproductive fitness and effective parenting behavior [21, 25, 26, 89]. As a consequence, compared to younger ages, the orchestration of the human genome in older age groups is more likely to be characterized by deleterious genetic expressions and interactions. Much of this decrease in genetic reliability follows from random-event processes rather than a genetic plan of aging [90]. The essence of the story is as follows: because evolution operated primarily on the first half of the life span, 'evolutionary biology was not a good friend of old age'.

Figure 4b deals with the biology-culture interactions. It suggests that, across the life span, it takes more and more culture-based resources and practice to exploit the biological potential that is inherent in the human genome. The argument for an age-related increase in the need for culture has two main parts. First, for human development to

Fig. 4. Schematic representation of three principles (a–c) governing the dynamics between biology and culture that lead to an aging-associated increase in the incompleteness of the biocultural architecture of the life course [2].



have reached higher levels of functioning, there had to be a conjoint increase in the richness and dissemination of culture and its opportunities for practice [88, 91]. The material, mental, social and technological aspects of culture, for instance, were the primary motor for the sharp increase in longevity during the 20th century, not a change in the evolution-based genome. Second, there is an age-related increase in the need for culture because of the fact summarized in figure 4a. Aging is associated with a decrease in biological potential and efficiency of the organism. Such a loss requires an increase in the supportive and compensatory role of culture-based resources including their use and practice.

Third, and as shown in figure 4c, Baltes [2] argued that the efficacy of culture to compensate for biological decline decreases in very old age. This is primarily due to the age-related loss in biological potential and increasing loss in learning potential. There is less improvement for the same input. The intervention result becomes smaller and smaller.

This triangulated, conceptual script of age-associated changes in the biocultural architecture of the life course should be kept in mind when it comes to speculations about the future of aging in a population where more and more individuals reach advanced old age. Of course, the script characterizes a dynamic and evolving framework and new science may change the constellation. Nevertheless, the direction of the age-related change remains one of growing incompleteness and vulnerability, and less chance for modifiability and optimization.

Mastering the New Challenges and Daunting Dilemmas of the Fourth Age

In many ways, the argument about the fourth age presented above gives rise to melancholy rather than optimism. In our concluding section, we would like to modulate such an impression of full-fledged pessimism. Human aging has latent potentials that still need to be uncovered, and science as well as social policy are powerful sources for positive change [92].

Genetic Medicine and Technology

Contemporary science is becoming an era of the life- and biosciences. Not surprisingly, therefore, when it comes to innovations in the optimization of human aging one frequently mentioned factor is the contribution of 'new genetics' [93, 94]. While in the past the human genome changed over thousands of years, modern science suggests new strategies of genetic corrections that can be implemented within a shorter time frame. Certainly, there is some hope in this line of inquiry [25]. However, we venture to add two perspectives on possible limitations.

The first is the inherent incompleteness of the overall biogenetic architecture of the life course summarized above [2]. This meta-theoretical framework suggests that it would require changing the whole system of biological functioning. The second perspective on limits of genetic intervention technology is the argument that most expressions of morbidity and diseases involve biogenetic multi-causality. Many genes are involved in the process of aging, and many lie dormant and might become operative when genetic interventions take place. Admittedly, some dis-

Table 3. A theory of adaptive development: selective optimization with compensation (SOC) [16]

Selection: elective and loss-based

Concerns directionality of development including selection of alternative outcomes and goal structures

Optimization

Concerns means for achieving desired outcomes (attaining higher levels of functioning)

Compensation

Concerns activation or acquisition of new means for counteracting loss/decline in means that threatens the maintenance of a given level of functioning

SOC behaviors are universal processes of optimal development
 SOC behaviors are relativistic in that their phenotype depends on person- and context-specific features
 SOC is a developmental construct. Its peak expression is in adulthood. In old age, elective selection and compensation become more important

eases are more single-gene-based and there is hope that such diseases might be rectified with genetic therapy. However, we are impressed with the arguments advanced by many biomedical researchers [95, 96] that the complexity of the genetic action involved in human aging is too great and person-specific to permit quick and universal solutions.

Despite much uncertainty about the general promise of genetic intervention technology, this technology is arguably the perhaps most important avenue toward completing the biocultural architecture of the life course, and one that might redesign the human genome such that it comes closer to the unfinished symphony of Schubert. Therefore, regarding the future of the fourth age, societies and policy makers should take an explicit position on the need for massive increases in support of modern biomedical technology including of course its behavioral-health components [23]. What is essential, however, is that these efforts are placed into the larger frame of biocultural orchestration rather than simple genetic determinism [88, 94].

Successful Aging through Selection, Optimization and Compensation

Aside from the yet untested promise of genetic intervention technology, there are other strategies of managing the journey of aging into the oldest ages. In addition to social policy and aging-friendly support structures as well as preventive and corrective health policies, these include

psychological strategies of life management. In the following, we summarize one theory of effective life management that Margret Baltes, Paul Baltes and colleagues [2, 16, 97–99] have articulated and tested during the last decade. It is the theory of selective optimization with compensation.

As shown in table 3, the theory of selective optimization with compensation proceeds from the assumption that the life course consists of a changing script regarding the means and goals of life. These changes in means and goals require systematic changes in the allocation of resources. Overall, the primary investment of resources in early life is into processes of gain (growth). With increasing age, more and more resources are invested into maintenance and repair.

Our favorite example of the psychological meaning of selective optimization with compensation comes from several interviews with the 80-year-old pianist Rubinstein. When Rubinstein was asked how he continued to be such an excellent concert pianist, he named three reasons. He played fewer pieces, but practiced them more often, and he used contrasts in tempo to simulate faster playing than he in the meantime could master. Rubinstein reduced his repertoire (i.e., selection). This gave him the opportunity to practice each piece more (i.e., optimization). And finally, he used contrasts in speed to hide his loss in mechanical finger speed, a case of compensation.

Rubinstein described a classic example of what psychology has shown is a key strategy of effective aging. People who select, optimize and compensate are among those who feel better and more agentic. The art of life in old age consists of the creative search for a new, usually smaller territory that is cared for with similar intensity as in the past. The same is true for cultures. Cultures who offer older persons ways of selecting, optimizing and compensating are the cultures which assist best in maximizing the gains of older age.

Using this image of the smaller territory brings us to a further concrete example from life that we owe to Bert Brim [100]. His father grew to be very old, 103 years to be exact. As a younger old person he was fully engaged in running his farm, including the surrounding hills. As a 75-year-old, he was somewhat impaired in his mobility. Thus, he concentrated on his garden. As a 90-year-old, he could hardly walk and his hearing and sight were impaired. At that time, his houseplants received special care. Later he focused on the flowers on the window ledge near his chair in the living room. The window became a center of his goal striving and subjective well-being. In the writings of the great Greek epic writer Hesiod there is a saying

that fits perfectly with this strategy of successful aging: 'Half can be more than a whole.'

Conclusions and Outlook

To conclude, we return to the idea that old age has two faces and, in this context, suggest directions for future research and policy. On the one hand, there is much scientific evidence to suggest that older persons can be more effective and productive members of a well-functioning society than the current culture of old age permits. One major quest, therefore, is to invest scientific and policy efforts in a broad range of areas that contribute to a better culture of old age.

On the other hand, we submit that recent evidence about the fourth age, the oldest old, mandates close attention. Specifically, we propose that one byproduct of the recent addition of years to people's lives is the new and daunting challenge of living and dying in the fourth age (oldest old). There is now increasing evidence to show that the fourth age is not a simple continuation of the third age. Among the oldest old, there is a high prevalence of dysfunction and reduced potential for enhancement of function.

Aside from physical dysfunction, the accelerated increase in psychological mortality during the fourth age is of special significance. It threatens some of the most precious features of the human mind such as intentionality, personal identity and psychological control over one's future as well as the chance to live and die with dignity.

Furthermore, the chances for human dignity may actually be reduced in the fourth age if social policy is predominantly directed towards promoting longer lives beyond the third age. Healthy and successful aging has its age limits.

To deal effectively with the problems of the fourth age that arise from a continuation of the aging of the population, new levels of scientific, medical and social resources are required together with efforts aimed at modulation. In addition, societies will have to ponder carefully how to consider the question of both human rights and human responsibilities and how to allocate resources to the different subgroups that constitute society as a whole [101]. A vital society requires age fairness in resource allocation: optimizing the state of the future aging population requires well-functioning and productive younger age groups so that societal resources continue to be available to support old age. Age fairness in resource allocation is a particular dilemma in developing countries where long-range planning requires prioritized investment of scarce resources into children, youth and young adulthood.

In our view, most elderly citizens are aware of this dilemma, and most are also prepared to invest in the young. In this spirit, we hope that gerontologists will join in a new commitment to strengthen the earlier ages of the life course. 'Old for young' is a motto that could become a part of the aging enterprise so that a proper balance of perspectives and age fairness can be achieved. If this motto is adopted, perhaps societies will proceed more carefully and be watchful for the negative consequences of pushing biological aging or sheer longevity to its limits.

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