


An overview of theories about autism.

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Autism as the result of an extreme male brain

- ▶ affected individuals are extremely focused on systemizing
> < empathizing
- ▶ Men: more systemizing brain
- ▶ Women: empathizing brain
- ▶ Support for the theory:
 - 1) more males are affected by autism
 - 2) high-functioning affected individuals tend to outperform unaffected people with similar IQs on systemizing tasks
 - 3) behavioral differences between people with and without autism are mediated by differences at the anatomical level of the brain.
 - 4) prenatal exposure to testosterone (an androgen) is positively related to the development of autistic traits.
- ▶ (Ploeger & Galis, 2011)

So having an extreme male brain..

- ▶ condition which we strongly associate with autism
- ▶ may have had practical advantages given demands of ancestral times
- ▶ These advantages would have conferred greater reproductive success
- ▶ (Ploeger & Galis, 2011)

Autism as the result of an extreme imprinted brain

- ▶ imbalanced genomic imprinting theory
- ▶ Genomic imprinting: expression of genes from only one of the two parental chromosomes.
- ▶ We inherit two copies of every allele, a maternal and a paternal copy.
- ▶ In most cases both copies are functional
- ▶ in some exceptional cases one of the copies is turned off and thus not functional.
- ▶ (Ploeger & Galis, 2011)

This may be the consequence of imprinting..

- ▶ maternal imprinting ensures that only the maternal copy is expressed
- ▶ paternal imprinting ensures that only the paternal copy is expressed.
- ▶ evolutionary function of imprinted genes is unknown
- ▶ (Ploeger & Galis, 2011)

But it has been suggested ..

- ▶ genomic imprinting originates in a conflict
- ▶ between the sexes about the amount of investment of the mother in the child.
- ▶ Paternally expressed imprinted genes tend to promote fetal growth
- ▶ $>$ $<$ maternally expressed imprinted genes tend to suppress fetal growth
- ▶ father's point of view: beneficial that the mother invests as much as possible in the child
- ▶ mother's point of view: important to preserve her resources
- ▶ imprinted genes are highly expressive in the central nervous system
- ▶ they are involved in neurodevelopment
- ▶ Imprinted genes are often implicated in disorders, because a single change can dysregulate their function

(Ploeger & Galis, 2011)

Crespi and Badcock

- ▶ hypothesized that autism reflects reduced maternal brain functions, and enhanced paternal brain functions.
- ▶ more males are affected than females.
- ▶ children with autism impose additional demands compared to normal children
- ▶ which is beneficial from the point of view of the father, because the mother will spend more of her time and resources on the child
- ▶ in the case of autism, the behavior of the child assumes pathological proportions which no longer benefit either the mother or the father.
- ▶ (Ploeger & Galis, 2011)

Autism as the result of a reptile brain

- ▶ through stages of phylogeny, mammals, have evolved a functional neural organization that regulates emotions and social behavior.
- ▶ humans have a well-developed ability to shift adaptively between mobilization and social engagement behaviors
- ▶ individuals with autism lack this ability
- ▶ nervous system of the autistic individual is in a constant state of hypervigilance or shutdown.
- ▶ generally adaptive responses in reptiles, but are severely maladaptive in mammals.
- ▶ does not explain the genetic background and the heritability of autism
- ▶ (Ploeger & Galis, 2011)

Epistatic interactions between the effects of genes

- ▶ Epistatic: interaction in which one gene suppresses the expression of another
- ▶ integration of different approaches on the evolution of autism: interactions between the effects of genes
- ▶ autism is caused by many interacting genes (nearly 30 genes)
- ▶ this same set of genes is involved in the development of intelligence.
- ▶ intelligence is positively correlated with potential reproductive success
- ▶ 30 genes that are involved in autism can potentially spread in the population, thanks to the link with intelligence.
- ▶ (Ploeger & Galis, 2011)

Epistatic interactions between genes ..

- ▶ some unlucky interactions, especially in combination with negative spontaneous mutations
- ▶ lead to the development of autism, low intelligence, or other pathologies.
- ▶ On certain intelligence tests, individuals with autism show equal or better performance levels compared to normal individuals.
- ▶ evidence for the relation between autism and exceptional abilities, with some famous examples of autistic savants.
- ▶ co-occurrence of savant syndrome and autism is an example of the effect of epistatic interactions between genes
- ▶ (Ploeger & Galis, 2011)

The proposal

- ▶ combination of high heritability and low fertility in autism
- ▶ can be explained by the effects of epistatic interactions
- ▶ between genes that are involved in both intelligence and autism.
- ▶ (Ploeger & Galis, 2011)

The Theory of Mind Hypothesis of autism

that cause action.

- ▶ Possessing a theory of mind is to be able to effectively reflect on the contents of one's own and others minds
- ▶ allows us to predict and anticipate behaviors in others
- ▶ and respond accordingly and appropriately.
- ▶ Difficulty in understanding other minds and interpreting behavior is a core cognitive feature of individuals diagnosed with autism.
- ▶ individuals with autism fail to “impute mental states to themselves and others”
- ▶ this deficit manifests as inability to mentalise, or failure to take into account others’ mental states.
- ▶ (Rajendran & Mitchell 2007)

Widely used test of Theory of Mind

- ▶ transfer test of false belief
- ▶ the participant watches a sequence of events
- ▶ usually enacted by dolls
- ▶ story unfolds so that one doll has a belief about the location of an object that is incongruous with its real location
- ▶ participant then makes a judgment about where the doll will look
- ▶ in order to give the correct answer the participant has to infer the mental state of the doll (I think he thinks)
- ▶ 80% of children with autism failed the unexpected transfer task
- ▶ (Rajendran & Mitchell 2007)

Second-order false belief task

- ▶ Problem: 20% of autistic individuals passed tests of false belief
- ▶ deficit seemed not to be universal
- ▶ So they used the more difficult second-order false belief task
- ▶ (I think, he thinks, she thinks)
- ▶ none of the children with autism passed the test.
- ▶ (Rajendran & Mitchell 2007)

The theory of mind

- ▶ remarkably successful in making specific predictions about the impairments
- ▶ in socialization, imagination and communication shown by people with autism.
- ▶ It cannot explain either the non-triad features of autism, or earlier experimental findings of abnormal assets and deficits on non-social tasks.
- ▶ it may be necessary to postulate an additional cognitive abnormality
- ▶ (Rajendran & Mitchell 2007)

Weak Central Coherence theory

- ▶ it explains some of the non-social, as well as the social features of autism
- ▶ such as the attention to acute detail that ranges from pedantry to obsession.
- ▶ typically developing individuals process information by extracting overall meaning or gist.
- ▶ autism is characterized by weak or absent drive for global coherence
- ▶ individuals with autism process things in a detail, focused or piecemeal way
- ▶ processing the constituent parts, rather than the global whole.
- ▶ (Frith & Happé, 1994)

The broken mirror theory

- ▶ caused by a hypoactivity of mirror neurons
- ▶ a neuronal system that is activated when an action is performed by a person
- ▶ and when the subject observes the same action done by a conspecific.
- ▶ one of the key mechanisms for what concerns social interactions
- ▶ it allows an individual to embody in himself the mental states of those who have faced as they were their own.
- ▶ Autistic patients would not be able to embody in themselves others' mental states
- ▶ due to a dysfunction related to mirror neurons.
- ▶ hypoactivity of the mirror system would be found only in certain circumstances and not in other.
- ▶ (Keller & Bugiani & Fantin & Pirfo 2011)

Hypoactivity of the mirror system

- ▶ imitation tasks which **do not** require an explicit imitative behavior: hypoactivity of the autistic mirror system.
- ▶ does not occur when the subject is explicitly asked to imitate an observed movement.
- ▶ deficits associated with the mirror system does not stop at simple task imitation.
- ▶ Autistic subjects have great difficulty in understanding the others' intentions
- ▶ seem to have no impairment regarding the goal of the action, or rather the "what" of the action.
- ▶ could not understand the general intention of the model: "why" this action is performed.
- ▶ (Keller et al. 2011)

Conclusion

- ▶ Autistic subjects, for those problems of embodiment of the mental states of others,
- ▶ which are possible only thanks to mirror neurons
- ▶ have many difficulties in reading the emotional states of others.
- ▶ (Keller et al. 2011)

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