# From sensory perception to maladaptation: Rethinking health conditions and mental disorders through an evolutionary lens

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The mismatch hypothesis suggests that diseases and mental disorders may arise from the maladaptation of human traits to modern environments. This paper explores the evolutionary development of the human brain and neural systems, highlighting how changes in our culture have led to a mismatch between our genetically controlled biopsychology and our current lifestyle. The paper discusses the emergence of emotional maladaptation and psychiatric conditions, such as anorexia, agoraphobia, schizophrenia, and autism, in the context of evolutionary maladaptation. By examining these conditions from an evolutionary perspective, we can better understand their persistence and develop novel approaches to treatment and prevention. This paper emphasises the importance of considering the interplay between genetic, environmental, and evolutionary factors in understanding health conditions and mental disorders, and calls for a shift in focus from the individual to the broader societal context.

Keywords: consciousness; curiosity; evolutionary psychology; mind; maladaptation

The answer to the question of why we now often get diseases that were once uncommon is that our body and mind traits have been adapted to the environments in which we have evolved, but have recently become maladaptive to modern environments created by us (Boyd, 2009a). This explanation is known as the "mismatch hypothesis" and it is at the heart of evolutionary medicine, states that because human beings evolved to become hunter-gatherers, the optimal state should be our adaptation to the hunter-gatherer lifestyle (Segovia-Cuéllar & Del Savio, 2021). If we accept that genetics and other diseases can be the consequences of adaptation incompatibilities, we can comprehend why these diseases cannot be prevented despite improved sanitation and comfortable living conditions (Rodríguez et al., 2014). While disease-causing alleles may have been well-adaptive in man's hunter-gatherer past, they may now be producing maladaptive traits under modern living conditions (Brady et al., 2019a). There are numerous mismatch diseases caused by environmental changes that can impair the function of the body and mind (Vugt et al., 2020). There could be various explanations why alleles that were once protective may now be maladaptive in the environment we live in. Certain conditions must be met so that it can be said that a disease is caused by evolutionary maladaptation. To be classified as a mismatch disease, it must be associated with a change in a specific environmental stimulus (Manus, 2018). Many mismatch diseases occur when a familiar stimulus increases or decreases went beyond the levels to which the body or mind is adapted, or when the stimulus is completely new and to which the body or mind is not adapted at all; i.e., when the stimulus is too much, too little or too new (Gluckman et al., 2019). The change in our culture has resulted in a sharp mismatch between our old genetically controlled biopsychology and our current way of life. However, from an evolutionary perspective, this mismatch did not lead to genetic maladaptation, i.e. reproductive differentiation, and our species has survived (Gurven & Lieberman, 2020). Evolutionary selection tends to maintain the frequency in the population of genes that increase reproductive success in youth, even if they increase susceptibility to disease in old age (Brady et al., 2019b).

**Sensory perception and neural structures**

Life forms increased their ability to replicate by developing ways of sensing their environment, and these sensing systems evolved into neurons systems in some branches of life (Bongard, 2021). In some species, neural systems evolved into life forms that influenced their ability to change behaviour, thus making them even more successful replicators. These adaptive neural systems that could evolve within a single lifetime were very successful (Sousa et al., 2017). The capacity of such a system is measured by its limits for processing and integrating vast amounts of information in the shortest possible time. This means that the time it takes to process information determines the success of such a neural system. While the human brain developed from such a structure, its most significant limitation has been the incompatibility between its sizes with the amount of information it can processes (Hofman, 2014).

For 700 million years, neural systems competed with each other even before the evolution of a centralised brain (Moroz & Anderson, 2015). Each neuron tries to suppress its neighbour in order to transmit its own information. Only a few of the neurons win this race and manage to escape the pollution of the others' signals in a way that determines the animal's behaviour. This is required for the nervous system to function (Yao et al., 2019). This competition-based system is too primitive to require a centralised brain and must have emerged close to the birth of complex multicellularity (Strausfeld et al., 2016).

The organised brain is the result of the course of information-processing, these courses ensure the organism to adapt and survive throughout evolution, and the information it collects plays a fundamental role in this (Gaiseanu, 2020). A living being's ability to process information gathered from its environment is the driving force behind evolution; a brain's capacity to process information from the environment determines its capacity to respond to environmental stimuli, which in turn affects its chances of survival (Hofman, 2014).

The complexity of the neural systems that comprise the cerebral cortex determines the living being's ability to predict that is a sign of intelligence in higher organisms such as primates. One of the most distinguishing characteristics of these living beings is a cerebral cortex that has grown throughout evolution: marine mammals and great apes have a disproportionately large cerebral cortex. Their mental faculties and speed of information processing are proportional to the sophistication of their neural structures (Hofman, 2014).

**Evolution of consciousness**

There is a general consensus that consciousness emerges as a result of brain activity, though how this occurs is unclear (Revonsuo & Kamppinen, 2013). Whether consciousness has evolutionary adaptive value, seems to depend on when it evolved (Pierson & Trout, 2017). Consciousness must have arisen as a solution to one of the most important problems that all nervous systems have to cope up with: The endless influx of far more information than can be properly processed. The brain, in turn, has developed ever finer mechanisms that select only certain signals against the eliminated ones in order to properly process them. This evolutionary progression culminates in consciousness. Thus, consciousness, must have developed gradually over the last half billion years and cannot be unique to humans (Lopez & Fuxjager, 2012).

The ability to understand what's on another person's mind is found in mammals and birds, therefore it must have originated in reptiles. Thus, reptiles may be smarter than previously thought (Jarvis, 2009). Three hundred million years of reptile-avian-mammalian evolution must have been resulted in the development of a "model of the self" and a "model of the social environment", each of which has evolved sequentially to influence the other (Early et al., 2020). We understand others by projecting ourselves onto them, but we also understand ourselves by pondering how others perceive us (Sartre, 2014).

Evolution has strengthened our tendency to model others so that we are perfectly attuned to each other's state of mind (Dyaballa & Barbosa, 2015). The side effect of this is that we are unable to keep this useless and meaningless data out, just as we are unable to avoid watching commercials while watching a documentary on ancient Egyptian civilisation on TV; this is why deity, tales and lies can be permanent. A large prefrontal cortex may be both the pre-condition and the post-condition of God, the indispensable catalyst of sapiens. One trait that distinguishes human beings from other animals is an overdeveloped prefrontal cortex that is likely to continue to develop (Rouault et al., 2019). But if this region of our brain did not create beliefs, would it have developed to this extent? If our prefrontal cortex co-evolved through beliefs, what path would human evolution take when their beliefs were taken away?

**Speech**

The evolution of a large neocortex was accompanied by the development of language and technology. This allowed human beings to develop the complex social structures in which they live (Dunbar & Shultz, 2021). Language may represent the last great leap in the evolution of consciousness as well. Communication skills had to be developed in order for hunter-gatherer cooperation based on equality to emerge. This new level of cooperation may also have contributed to the development of consciousness (Cortina & Liotti, 2010). It is unknown when language started to be used, however it was certainly in use prior to out of Africa spread. Human beings may have attributed consciousness to everything around them through language and culture (Monaghan & Roberts, 2019).

**Necessity of mind functions**

One answer to why the primate-human brain was large, even if it began shrinking after the starting of agriculture, has to do with solving problems of food supply: searching for rare fruits, sorting out nuts, processing certain foods and keeping pests at bay required intelligence (Redman, 2021). However, it cannot be said that only primates face these challenges. Another answer is that primates are highly social animals. They do not only live in large groups, but they also have very intense social relationships. They harbour friendship or ill will toward one another; they form subgroups, make and break agreements, fight and make peace. They show respect for the leader in sight, while going behind their back. To have all of this social manoeuvrability, it is essential to have a substantial record of social information. Beyond knowing each individual's relationship with the other, it is required to show the ability to use this knowledge for their own benefit (Ziegler & Crockford, 2017).

**Behaviours: Genetic or cultural?**

We have developed the capacities to be prudent, to negotiate and to infer the motivation of others through evolutionary processes. The need to show reciprocal altruism has led us to succeed in living in a group, to develop concepts of virtue, and to create belief systems (Finlay & Syal, 2014). These functions gave us the capacity to adapt our behaviour to the majority in order to be able to live within the conditions of our own society. Thus, it cannot be said that behaviour is either entirely genetically or entirely culturally determined; the two have interacted intensely throughout our evolution and life course (Ehrlich & Feldman, 2003).

Human life is dependent on a complex web of interpersonal interactions. We evolved with the capacity to interpret, communicate and negotiate the actions of other members of our species. The evolution of human behaviour can be understood on the basis of mate choice, kin relationships, mutual altruism and social group dynamics (Uchiyama et al., 2021). A large brain is required for all of this. The size of the neocortex correlates with the size of the group in apes and other social mammals. Brain volume, in turn, correlates with the hierarchy that sustains social cohesion and the frequency of freeloading attempts in the group. Many human behaviours have evolved to take into account the presence of a deadbeat in the group. The human brain is programmed for close social interaction with a maximum of 150 people, the number of members of tribes formed by our hunter-gatherer ancestors (Silk et al., 2013).

Even with advanced thinking skills, there was no need for a complex lifestyle early in the *Homo sapiens*' history. As the environment expanded, new prey, such as fish, was encountered, new tools had to be made for obtaining and preparing and cooking plant foods and for sewing clothes. This cultural development resulted in gradual changes in our social environment; it is the interaction between our cultural and biological evolution that is reflected in our behaviour (Portin, 2015).

**Art and symbols**

It is widely recognised that some of our mental abilities distinguish *Homo sapiens* from other hominids. However, there is still no agreement on what makes human cognition so special (Visalberghi et al., 2017). Art indicates that human beings utilised symbols to communicate, with which our ancestors communicated about their environment and themselves, most likely using language (Hodgson & Verpooten, 2015). Whether Neanderthals had an interest in art and the ability to use language is still a matter of debate, symbolic thinking and language development may be the features that clarify the line between the mental abilities of these two Homo species (Miyagawa et al., 2018).

Essentially, it is unclear why we have developed this behaviour, which provides no selective advantage; art contributes neither to reproductive success nor to a share of the food, and it is difficult to understand the continued descent of "talented" individuals in the population's gene pool without any contribution to reproductive fitness, even though it may also increase the risk of predation. Moreover, art has always been one step ahead of technology; we enjoy decorating our tools rather than improving them (Harari, 2014). On the other hand, technology is essential for the development of art: if we did not make a fire, we would not be able to invent the charcoal pencil, and without the blood of game animal, cave painters would have been left without paint (Boyd, 2009b).

There is only one phase difference between evolution of the human body and the birth of thought (Herculano-Houzel & Fonseca-Azevedo, 2012). The evidence for symbolic thinking is aging as the geography of expeditions expands; the roots of symbolic thinking now date back over 100,000 years (Sterelny, 2017). Whenever it was born, symbolic thinking must have played a crucial role in the evolution of the human mind. The ability to cognition may very well have emerged with the ascent of *Homo sapiens*. Once this skill was acquired, it paved the way for the advancement of language, the exchange of technology, and the establishment of social bonds. These advancements must have made it easier for humans to spread into new and more challenging environments, such as the ocean coasts. The beginning of the discovery of the world can also be dated to this period (Bender, 2020). From then on, the way would open up for making trade contracts and establishing companies, families and banks.

**Learning as reward**

Game is a way for youths to unravel the complexity of their learning environment via exploration (DeDonno, 2016). Game is a "spontaneous, unstructured activity, based mostly on fantasy and imagination, or organised games with set rules. Many games are derived from everyday life and reflect the culture from which they developed" (Britannica, 2017). The world provides abundance of various types of data to students. Much of this data, however, can only be obtained by the learner probing their surroundings through their own actions. Learning experiences do not "fall" to the infant on their own rather the infant's own activities generate and select these experiences (Taylor & Boyer, 2020). The form of information seeking in which a learner chooses their own experiences is called "active learning" (Chi & Wylie, 2014).

Learning, as hesitation before a repeated activity due to curiosity gradually gives way to mastery, occurs forward (Chi & Wylie, 2014). With this progression, repeated activities result in intrinsic motivation as the infant discovers new developmental niches. Learning enhancement facilitates intrinsic rewards and choices aimed at maximising this reward (Zheng et al., 2020). This type of intrinsic learning motivation has evolutionary origins; this is how long-term evolutionary fitness is maximised under changing environmental conditions (Narvaez et al., 2016). The search for developmental niches leads to spontaneous discoveries during the reinforcement learning process. Thus, the intrinsic rewards of learning progression and reduced hesitation are well-deserved (Chi & Wylie, 2014).

**A too much curious ape**

The motivation for knowledge exploration that drives a living being to perform activities for the sake of acquiring knowledge is called "curiosity" (Silvia, 2019). Such a curiosity-motivational mechanism is only one of many motivational mechanisms at work in a living being, such as foraging and mate choice, and curiosity interacts with, complements or conflicts with these other motivations at any given moment (Oudeyer & Smith, 2016). The developmental processes gained by curiosity must have played a significant role in the evolution of language. Game and curiosity can be freely expressed in human beings, at which children are cared for and protected for a relatively long period of time; humans are unrivalled in this regard (Postle, 2016). The human being is an extremely curious creature. This is because we are sometimes referred to as "informavore" and it is this curiosity that makes us probe everywhere from the ocean depths to the infinity of space. Our lives are shaped by a strong drive to acquire information: Just like carnivores that hunt and eat meat, we are creatures that seek internalised information (Kenji & Ming, 2019). In fact, all primates are informavores: Information stimulates our brains in the same way that food and sex do. However, parts of our brains are able to distinguish between information and other rewards, allowing us behavioural flexibility and complex choice (Cogliati et al., 2017).

Evolution has made us high-level learning algorithms and imbued the algorithm with curiosity (Harari, 2014). We have a highly curious nature, and our curiosity leads us to spend much of our time gossiping: our curiosity leads us to unproductive tasks like reading news about people we have never met, and acquiring information we will never use (Oudeyer & Smith, 2016). We are overflowing with useless information. So why has evolution shaped us to waste time rather than being chosen to focus on more serious work? We get bored and switch places we visit all the time, we want to try everything, we dream of wandering up volcano chimneys (Verne, 2012), we are easily distracted and waste our time (van Schaik & Burkart, 2011). But the time we waste today could be stored in a learning algorithm in our brains, waiting for the moment when it will be needed. Naturally, if we knew exactly what we wanted to learn, we could focus on it, but in this complex world it is impossible to know what will be useful in the future (Dan et al., 2020). And, curiosity is a gift from nature to us, a bonus to discovery and invention, otherwise we would be extremely boring creatures; we would not be able to explore new places without the risk of getting lost, we would never attempt to build a new tool if we were afraid of the risk of injury. If evolution has made us a learning algorithm, the curiosity equation that this algorithm needs is the full advantage of our capacity to learn (van Schaik et al., 2019).

**Curiosity and exploration**

Our species exhibits more childlike behaviour than other mammals (Iordansky, 2005). Evolution has made us more childlike and weaker than our primate cousins, giving us our childlike curiosity, our capacity to learn and our interconnectedness traits (Somel et al., 2009). Because we have a longer childhood, we can take a lot from our surroundings, such as sharing culture. Even in adulthood, we learn different ways of thinking and acting, which makes it easier to adapt to changing circumstances (Acharya & Relojo, 2017; Gopnik et al., 2020).

The reason for animals seeking information is obvious from an evolutionary perspective: information is vital for their survival and reproduction (Brush et al., 2016). A bird that spends its life eating mulberries on a single branch without exploring its surroundings is deprived of eating much more beautiful fruits nearby. Exploration is a common behaviour in the animal kingdom (Pisula, 2008). Instead of going straight to its food, the insect first travels around its surroundings, gathering more information about its surroundings (Brush et al., 2016). So what drives animals to engage in information-seeking behaviour? The first possibility is that every animal learns throughout its life that the better information it has about its environment, the better access it has to rewards such as food and other essential resources. However, while this learning drive is applicable to human beings and monkeys, we may have difficulty applying this explanation to insects (Valenza et al., 2006). Curiosity-driven behaviour, on the other hand, is observed in young animals, even before they have had enough experience to learn the relationship between information and reward (Silver et al., 2021). A novel visual scene also holds the human newborn's attention longer than a familiar one (Valenza et al., 2006).

The second possibility is that evolutionary pressures have created an intrinsic reward for information. So-called primary rewards, such as food and sex, are pleasurable because animals that can feed and mate have a better chance of survival and reproduction (Kenji & Ming, 2019). Evolution has created a reward system in the animal's brain that directs it towards behaviours that help it obtain resources. This reward system may be driving the animal towards a search behaviour that intrinsically rewards finding new information (Hintze & Yee, 2021). If learning is intrinsically rewarding, the brain should respond to new information in the same way that it responds to primary rewards like food and sex. Namely, the animal should be motivated to seek information by the brain reward processing system as if it were a primary reward (Cogliati et al., 2017). Food and information, which both motivate animals to engage in behaviours that help them survive, should be processed in a similar way somewhere in the brain. Likewise, some types of information are more interesting than others, and different people are interested in very different subjects. In this case, it must be recognised that reward circuits in different parts of the brain interact with each other. Even when our motivation for information alone is impeded, other regions also get their fair share (Baldassarre et al., 2014).

**Fairy tale-lover**

A story or tale does not necessarily have to be based on real events, but some, such as the Canterbury tales or the Nibelungen stories, are at least based on the narration of events related to reality (Chaucer, 1960; Schottenfels, 2013). Ultimately, a story or tale can be said to have an artistic quality depending on the creativity of the teller or writer, and strangely enough, it seems that our curiosity about telling and listening to tales has made the most significant contribution to our ability to speaking skill (Corballis, 2013). We raise our children with stories and this is how they develop their cognitive abilities, but by what selective pressure has the adult interest in listening to tales become permanent (von Heiseler, 2014)? Oral history accounts for the majority of language and story. Writing has a relatively short history, but the permanence and spread of the language has been thanks to this, so that we can now communicate all over the world. The ability to speak is a relatively recent development in our lineage, but human beings seem to have evolved to be capable of telling and listening to stories; after all, who would not prefer to be comforted by stories rather than facing the harsh reality (Boyd, 2018)? While fairy tales can be soothing, reality can create anxiety. This is because fairy tales are not only a feature of every civilisation, but also extraordinarily diverse (Lauer, 2022). Everything is a fairy tale, from the shaman's prayer for healing illness to TV series, religions to opera, and that is why TV and church/mosque are equally appealing, and religious books can be read as storybooks. The lives of the Greek gods are like a soap opera, which is why we admire their extravagance rather than overthrowing the kings and confiscating their property.

**Mind maladaptations**

Some psychiatric symptoms and syndromes may be evolutionary adaptations. Unwanted symptoms such as nausea, vomiting and fever are actually healthy, functional and physiological responses to toxins and infections. Similarly, psychological symptoms that are considered pathological, such as intense delusion and hypochondriasis, may be healthy functional responses to some social disorders, but they can be distressing and harmful (Albert, 2017). Disorder is the inability of a mental mechanism designed by evolution to perform a natural function. Disorders can be defined as harmful naturally selected disabilities that prevent internal mechanisms from functioning. Many disorders are not even disabilities; they are either healthy responses, such as fever, or dysfunctions that natural selection cannot eliminate, such as reading disorder (Keller, 2018).

Emotions evolved because they have adaptive values that are characteristic of social species (Pacella, 2017). Emotions, on the other hand, can be maladaptive and have psychiatric consequences. Mind maladaptations may have resulted from a major change in one's social environment (Barrett, 2012). In any case, the harmony between the individual and the environment has changed. Affective disorders which are characterised by an excess of negative emotions account for nearly half of all mental disorders (Zentall, 2017). There is no doubt that most anxiety and depression are pathological, but the ability to experience anxiety and depression is shaped by natural selection along with the mechanisms that regulate them (Bergstrom & Meacham, 2016). These disorders are not like atherosclerotic heart disease, for example, where the disease is caused by a specific pathological lesion. They are more like chronic pain or chronic cough; the problem is the failure to regulate a response that would be normal or beneficial (Nesse, 2011).

According to the "fire detector" principle, a delay in reacting to a real threat can be catastrophic, therefore an optimal system is designed with a threshold that will frequently give false alarms (Nesse, 2019). Evolution also designed the human brain to be somewhat paranoid in order to provide humans with a defence mechanism to protect themselves against potential threats to their lives (Perera et al., 2010). Paranoia leads the brain to make many false positive errors, while humans avoid a small number of false negative errors, which are real, but can be extremely costly (Grant et al., 2014). This is analogous to a fire detector alarmed by cigarette smoke. Although it generates unnecessary alarms when smoking, the detector does not miss the real fire (Nesse, 2019).

The social environment is one of the stressors that contribute to psychiatric disorders because it prevents the person from achieving or meeting their basic needs (Creel et al., 2013). Low mood progresses to depression when an unattainable goal cannot be given up (Tiller, 2013). A childhood filled with chronic frustration, failures and shame can result in a traumatised and frustrated adulthood with a high risk of behavioural disorders (Del Giudice et al., 2015). However, not everyone is equally vulnerable; some may emerge as confident adults able to overcome adversity in difficult environments, perhaps with buffers such as the protection of an adult like a teacher (Tung & Gilad, 2013). Pathology is prevalent in communities where members are subjected to chronic frustration, such as military troop, with many cases going undiagnosed or untreated (Akdeniz et al., 2014). Some psychiatric disorders are associated with social occurrences including divorce, quitting a job, and a lack of leadership, and lack of communication aggravates the situation (Helbich, 2018). When genes and environmental factors interact, they can also result in mental diseases. For example, the serotonin-related polymorphism that predisposes people to depression nearly invariably only does so as a result of interactions with unfavourable life events. However, it is challenging to evaluate the effects of the environment and negative life events, and genetic analyses produce ambiguous results (Margoob & Mushtaq, 2011).

## CONCLUSION

Each person may develop symptoms or act in a way that alarmed or threatened others when exposed to unexpected stress. For instance, conditions classified as "psychiatric" like anorexia and agoraphobia may result from acquired defences against stress rather than alterations in the brain's chemistry (Drobinin et al., 2022). Not all forms of psychopathology fit the same model of illness. A disturbed person may not be labelled "insane" if they have a supportive extended family (Kofink et al., 2013). Disorders like Schizophrenia now require explanations that are fundamentally different. While the old adaptive value view of schizophrenia was that a haplotype-linked to a high IQ increased the risk of schizophrenia, however this view has now been largely discredited (Ogawa & Vallender, 2014). Furthermore, a GABA-A receptor-associated haplotype is poorly found in lineages with schizophrenia, suggesting positive selection (Byars et al., 2014). Schizophrenia and autism, like other psychiatric disorders, are also survived in society despite a negative fitness effect that puts patients at a disadvantage in terms of evolution (Hoffmann et al., 2014). In terms of its etiology and pathophysiology, autism is similar to schizophrenia, and there is evidence suggesting that the origins of schizophrenia and autism overlap as modern humans diverged from a common lineage (Greenspan, 2014). Schizophrenia has survived for generations as a maladaptive by-product of human traits such as language, social cognizance, interpersonal behaviour, and increased brain size, with evolutionary advantages such as increased creativity (Power et al., 2014).

Although biochemical and neurological factors undoubtedly underlie schizophrenia, depression, and bipolar disorder, the severity of their clinical manifestations varies and not all may require intervention (Toyokawa et al., 2012). Modern psychiatry, on the other hand, focuses on the sick person, whereas the disorder is frequently ingrained in society and rooted in our evolutionary history.

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