Evolutionary psychology
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Introduction

Evolutionary psychology

Evolutionary psychology (EP) is an approach in the social and natural sciences that examines psychological traits such as memory, perception, and language from a modern evolutionary perspective. It seeks to identify which human psychological traits are evolved adaptations, that is, the functional products of natural selection or sexual selection. Adaptationist thinking about physiological mechanisms, such as the heart, lungs, and immune system, is common in evolutionary biology. Evolutionary psychology applies the same thinking to psychology, arguing that the mind has a modular structure similar to that of the body, with different modular adaptations serving different functions. Evolutionary psychologists argue that much of human behavior is the output of psychological adaptations that evolved to solve recurrent problems in human ancestral environments.[1]

The adaptationist approach is steadily increasing as an influence in the general field of psychology.[2][3] Evolutionary psychologists suggest that EP is not simply a subdiscipline of psychology but that evolutionary theory can provide a foundational, metatheoretical framework that integrates the entire field of psychology, in the same way it has for biology.[4][5]

Evolutionary psychologists hold that behaviors or traits that occur universally in all cultures are good candidates for evolutionary adaptations[3] including the abilities to infer others’ emotions, discern kin from non-kin, identify and prefer healthier mates, and cooperate with others. They report successful tests of theoretical predictions related to such topics as infanticide, intelligence, marriage patterns, promiscuity, perception of beauty, bride price and parental investment.[6]

The theories and findings of EP have applications in many fields, including economics, law, psychiatry, politics, and literature.[7][8]

Controversies concerning EP involve questions of testability, cognitive and evolutionary assumptions (such as modular functioning of the brain or the ancestral environment), importance of non-genetic and non-adaptive explanations, as well as political and ethical issues due to interpretations of research results.[9]

Scope

Principles

Evolutionary psychology is an approach that views human nature as a universal set of evolved psychological adaptations to recurring problems in the ancestral environment. It refers to sociobiology, a systematic study in biological basis in gender behaviour. Proponents of EP suggest that it seeks to heal a fundamental division at the very heart of science --- that between the soft human social sciences and the hard natural sciences, recognizing that human beings are living organisms, which motivates understanding psychology as a branch of biology. Anthropologist John Tooby and psychologist Leda Cosmides note:

"Evolutionary psychology is the long-fore stalled scientific attempt to assemble out of the disjointed, fragmentary, and mutually contradictory human disciplines a single, logically integrated research framework for the psychological, social, and behavioral sciences—a framework that not only incorporates the evolutionary sciences on a full and equal basis, but that systematically works out all of the revisions in existing belief and research practice that such a synthesis requires."[10]
Just as human physiology and evolutionary physiology have worked to identify physical adaptations of the body that represent "human physiological nature," the purpose of evolutionary psychology is to identify evolved emotional and cognitive adaptations that represent "human psychological nature." EP is, to quote Steven Pinker, "not a single theory but a large set of hypotheses" and a term which "has also come to refer to a particular way of applying evolutionary theory to the mind, with an emphasis on adaptation, gene-level selection, and modularity." Evolutionary psychology adopts an understanding of the mind that is based on the computational theory of mind. It describes mental processes as computational operations, so that for example a fear response is described as arising from a neurological computation that inputs the perceptual data, e.g. a visual image of a spider and outputs the appropriate reaction, e.g. fear of possibly dangerous animals.

While philosophers have generally considered human mind to include broad faculties, such as reason and lust, evolutionary psychologists describe evolved psychological mechanisms as narrowly focused to deal with specific issues, such as catching cheaters or choosing mates. EP views the human brain as comprising many functional mechanisms, called psychological adaptations or evolved cognitive mechanisms or cognitive modules, designed by the process of natural selection. Examples include language-acquisition modules, incest-avoidance mechanisms, cheater-detection mechanisms, intelligence and sex-specific mating preferences, foraging mechanisms, alliance-tracking mechanisms, agent-detection mechanisms, and others. Some mechanisms, termed domain-specific, deal with recurrent adaptive problems over the course of human evolutionary history. Domain-general mechanisms, on the other hand, are proposed to deal with evolutionary novelty.

EP has roots in cognitive psychology and evolutionary biology but also draws on behavioral ecology, artificial intelligence, genetics, ethology, anthropology, archaeology, biology, and zoology. EP is closely linked to sociobiology,[3] but there are key differences between them including the emphasis on domain-specific rather than domain-general mechanisms, the relevance of measures of current fitness, the importance of mismatch theory, and psychology rather than behaviour. Most of what is now labeled as sociobiological research is now confined to the field of behavioral ecology.

Nikolaas Tinbergen's four categories of questions can help to clarify the distinctions between several different, but complementary, types of explanations.[11] Evolutionary psychology focuses primarily on the "why?" questions, while traditional psychology focuses on the "how?" questions.[12]

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<tr>
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<th>Sequential vs. Static Perspective</th>
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<tr>
<td>Historical/Developmental</td>
<td>Explanation of current form in terms of a historical sequence</td>
</tr>
<tr>
<td>Ontogeny</td>
<td>Explanation of the current form of species</td>
</tr>
<tr>
<td>How vs. Why Questions</td>
<td>How an individual organism's structures function</td>
</tr>
<tr>
<td>Proximate</td>
<td>Developmental explanations for changes in individuals, from DNA to their current form</td>
</tr>
<tr>
<td>Evolutionary</td>
<td>The history of the evolution of sequential changes in a species over many generations</td>
</tr>
<tr>
<td>Adaptation</td>
<td>A species trait that evolved to solve a reproductive or survival problem in the ancestral environment</td>
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Premises

Evolutionary psychology is founded on several core premises.

1. The brain is an information processing device, and it produces behavior in response to external and internal inputs.[13] [4]
2. The brain's adaptive mechanisms were shaped by natural and sexual selection.[13] [4]
3. Different neural mechanisms are specialized for solving problems in humanity's evolutionary past.[13] [4]
4. The brain has evolved specialized neural mechanisms that were designed for solving problems that recurred over deep evolutionary time,[13] giving modern humans Stone age minds.[4]
5. Most contents and processes of the brain are unconscious; and most mental problems that seem easy to solve are actually extremely difficult problems that are solved unconsciously by complicated neural mechanisms.[4]
6. Human psychology consists of many specialized mechanisms, each sensitive to different classes of information or inputs. These mechanisms combine to produce manifest behavior.[13]

History

Evolutionary psychology has its historical roots in Charles Darwin's theory of natural selection.[3] In The Origin of Species Darwin predicted that psychology would develop an evolutionary basis:

In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation.


Two of his later books were devoted to the study of animal emotions and psychology; The Descent of Man, and Selection in Relation to Sex in 1871 and The Expression of the Emotions in Man and Animals in 1872. Darwin's work inspired William James's functionalist approach to psychology.[3]

The content of EP has derived from, on the one hand, the biological sciences (especially evolutionary theory as it relates to ancient human environments, the study of paleoanthropology and animal behavior) and, on the other, the human sciences especially psychology.

Evolutionary biology as an academic discipline emerged with the modern evolutionary synthesis in the 1930s and 1940s.[15] In the 1930s the study of animal behaviour (ethology) emerged with the work of Dutch biologist Nikolaas Tinbergen and Austrian biologists Konrad Lorenz and Karl von Frisch.


In the 1970s, two major branches developed from ethology. Firstly, the study of animal social behavior (including humans) generated sociobiology, defined by its pre-eminent proponent Edward O. Wilson in 1975 as "the systematic study of the biological basis of all social behavior"[17] and in 1978 as "the extension of population biology and evolutionary theory to social organization".[18] Secondly, there was behavioral ecology which placed less emphasis on social behavior by focusing on the ecological and evolutionary basis of both animal and human behavior.

In the 1970s and 1980s university departments began to include the term evolutionary biology in their titles. The modern era of evolutionary psychology was ushered in, in particular, by Donald Symons' 1979 book The Evolution
Human Sexuality and Tooby and Cosmides 1992 book *The Adapted Mind*.\[3\]

From psychology there are the primary streams of developmental, social and cognitive psychology. Establishing some measure of the relative influence of genetics and environment on behavior has been at the core of behavioral genetics and its variants, notably studies at the molecular level that examine the relationship between genes, neurotransmitters and behavior. Dual inheritance theory (DIT), developed in the late 1970s and early 1980s, has a slightly different perspective by trying to explain how human behavior is a product of two different and interacting evolutionary processes: genetic evolution and cultural evolution. DIT is a "middle-ground" between much of social science, which views culture as the primary cause of human behavioral variation, and human sociobiology and evolutionary psychology which view culture as an insignificant by-product of genetic selection.\[19]\]

**Theoretical foundations**

The theories on which evolutionary psychology is based originated with Charles Darwin's work, including his speculations about the evolutionary origins of social instincts in humans. Modern evolutionary psychology, however, is possible only because of advances in evolutionary theory in the 20th century.

Evolutionary psychologists say that natural selection has provided humans with many psychological adaptations, in much the same way that it generated humans' anatomical and physiological adaptations.\[20]\] As with adaptations in general, psychological adaptations are said to be specialized for the environment in which an organism evolved, the environment of evolutionary adaptedness, or EEA.\[20]\] [21] Sexual selection provides organisms with adaptations related to mating.\[20]\] For male mammals, which have a relatively fast reproduction rate, sexual selection leads to adaptations that help them compete for females.\[20]\] For female mammals, with a relatively slow reproduction rate, sexual selection leads to choosiness, which helps females select higher quality mates.\[20]\] Charles Darwin described both natural selection and sexual selection, but he relied on group selection to explain the evolution of self-sacrificing behavior. Group selection is a weak explanation because in any group the less self-sacrificing animals will be more likely to survive and the group will become less self-sacrificing.

In 1964, William D. Hamilton proposed inclusive fitness theory, emphasizing a "gene's-eye" view of evolution. Hamilton noted that individuals can increase the replication of their genes into the next generation by helping close relatives with whom they share genes survive and reproduce. According to "Hamilton's rule", a self-sacrificing behavior can evolve if it helps close relatives so much that it more than compensates for the individual animal's sacrifice. Inclusive fitness theory resolved the issue of how "altruism" evolved. Other theories also help explain the evolution of altruistic behavior, including evolutionary game theory, tit-for-tat reciprocity, and generalized reciprocity. These theories not only help explain the development of altruistic behavior but also account for hostility toward cheaters (individuals that take advantage of others' altruism).\[2]\]

Several mid-level evolutionary theories inform evolutionary psychology. The r/K selection theory proposes that some species prosper by having many offspring while others follow the strategy of having fewer offspring but investing much more in each one. Humans follow the second strategy. Parental investment theory explains how parents invest more or less in individual offspring based on how successful those offspring are likely to be, and thus how much they might improve the parents' inclusive fitness. According to the Trivers-Willard hypothesis, parents in good conditions tend to invest more in sons (who are best able to take advantage of good conditions), while parents in poor conditions tend to invest more in daughters (who are best able to have successful offspring even in poor conditions). According to life history theory, animals evolve life histories to match their environments, determining details such as age at first reproduction and number of offspring. Dual inheritance theory posits that genes and human culture have interacted, with genes affecting the development of culture and culture, in turn, affecting human evolution on a genetic level (see also the Baldwin effect).
Evolved psychological mechanisms

Evolutionary psychology is based on the hypothesis that, just like hearts, lungs, livers, kidneys, and immune systems, cognition has functional structure that has a genetic basis, and therefore has evolved by natural selection. Like other organs and tissues, this functional structure should be universally shared amongst a species, and should solve important problems of survival and reproduction.

Evolutionary psychologists seek to understand psychological mechanisms by understanding the survival and reproductive functions they might have served over the course of evolutionary history. These might include abilities to infer others' emotions, discern kin from non-kin, identify and prefer healthier mates, cooperate with others. Consistent with the theory of natural selection, evolutionary psychology sees humans as often in conflict with others, including mates and relatives. Even mothers sometimes struggle with their children over weaning, which benefits the mother more than the child. Evolutionary psychology also recognizes the role of kin selection and reciprocity in evolving prosocial traits such as altruism.[2] Like chimps and bonobos, humans have subtle and flexible social instincts, allowing them to form extended families, lifelong friendships, and political alliances.[2] In studies testing theoretical predictions, evolutionary psychologists have made modest findings on topics such as infanticide, intelligence, marriage patterns, promiscuity, perception of beauty, bride price and parental investment.[6]

Products of evolution: adaptations, exaptations, byproducts, and random variation

Not all traits of organisms are adaptations. As noted in the table below, traits may also be exaptations, byproducts of adaptations (sometimes called "spandrels"), or random variation between individuals.[22]

Psychological adaptations are hypothesized to be innate or relatively easy to learn, and to manifest in cultures worldwide. For example, the ability of toddlers to learn a language with virtually no training is likely to be a psychological adaptation. On the other hand, ancestral humans did not read or write, thus today learning to read and write require extensive training, and presumably represent byproducts of cognitive processing that use psychological adaptations designed for other functions.[23]

<table>
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<tr>
<th>Adaptation</th>
<th>Exaptation</th>
<th>By-Product</th>
<th>Random Noise</th>
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<tr>
<td>Definition</td>
<td>Organismic trait designed to solve an ancestral problem(s). Shows complexity, special &quot;design&quot;, functionality</td>
<td>Adaptation that has been &quot;re-designed&quot; to solve a different adaptive problem.</td>
<td>Byproduct of an adaptive mechanism with no current or ancestral function</td>
</tr>
<tr>
<td>Physiological Example</td>
<td>Bones / Umbilical cord</td>
<td>Small bones of the inner ear</td>
<td>White color of bones / Belly button</td>
</tr>
<tr>
<td>Psychological Example</td>
<td>Toddlers' ability to learn to talk with minimal instruction.</td>
<td>Voluntary Attention</td>
<td>Ability to learn to read and write.</td>
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One of the tasks of evolutionary psychology is to identify which psychological traits are likely to be adaptations, byproducts or random variation. George C Williams suggested that an "adaptation is a special and onerous concept that should only be used where it is really necessary".[24] As noted by Williams and others, adaptations can be identified by their improbable complexity, species universality, and adaptive functionality.

Obligate and facultative adaptations

A question that may be asked about an adaptation is whether it is generally obligate (relatively robust in the face of typical environmental variation) or facultative (sensitive to typical environmental variation).[25] The sweet taste of sugar and the pain of hitting one's knee against concrete are the result of fairly obligate psychological adaptations; typical environmental variability during development does not much affect their operation. By contrast, facultative adaptations are somewhat like "if-then" statements. For example, adult attachment style seems particularly sensitive...
to early childhood experiences. As adults, the propensity to develop close, trusting bonds with others is dependent on whether early childhood caregivers could be trusted to provide reliable assistance and attention. The adaptation for skin to tan is conditional to exposure to sunlight; this is an example of another facultative adaptation. When a psychological adaptation is facultative, evolutionary psychologists concern themselves with how developmental and environmental inputs influence the expression of the adaptation.

Cultural universals
Evolutionary psychologists hold that behaviors or traits that occur universally in all cultures are good candidates for evolutionary adaptations. Cultural universals include behaviors related to language, cognition, social roles, gender roles, and technology. Evolved psychological adaptations (such as the ability to learn a language) interact with cultural inputs to produce specific behaviors (e.g., the specific language learned). Basic gender differences, such as greater eagerness for sex among men and greater coyness among women, are explained as sexually dimorphic psychological adaptations that reflect the different reproductive strategies of males and females. Evolutionary psychologists contrast their approach to what they term the "standard social science model," according to which the mind is a general-purpose cognition device shaped almost entirely by culture.

Environment of evolutionary adaptedness
EP argues that to properly understand the functions of the brain, one must understand the properties of the environment in which the brain evolved. That environment is often referred to as the "environment of evolutionary adaptedness" (EEA).

The term "environment of evolutionary adaptedness" was coined by John Bowlby as part of attachment theory. It refers to the environment to which a particular evolved mechanism is adapted. More specifically, the EEA is defined as the set of historically recurring selection pressures that formed a given adaptation, as well as those aspects of the environment that were necessary for the proper development and functioning of the adaptation.

Humans, comprising the genus Homo, appeared between 1.5 and 2.5 million years ago, a time that roughly coincides with the start of the Pleistocene 1.8 million years ago. Because the Pleistocene ended a mere 12,000 years ago, most human adaptations either newly evolved during the Pleistocene, or were maintained by stabilizing selection during the Pleistocene. Evolutionary psychology therefore proposes that the majority of human psychological mechanisms are adapted to reproductive problems frequently encountered in Pleistocene environments. In broad terms, these problems include those of growth, development, differentiation, maintenance, mating, parenting, and social relationships.

The EEA is significantly different from modern society. Our ancestors lived in smaller groups, had more cohesive cultures, and had more stable and rich contexts for identity and meaning. Researchers look to existing hunter-gatherer societies for clues as to how our hunter-gatherer ancestors lived. Since hunter-gatherer societies are egalitarian, the ancestral population may have been egalitarian as well, a social pattern different from the hierarchies found in chimp bands. Unfortunately, the few surviving hunter-gatherer societies are different from each other, and they have been pushed out of the best land and into harsh environments, so it is not clear how closely they reflect ancestral culture.

Evolutionary psychologists sometimes look to chimpanzees, bonobos, and other great apes for insight into human ancestral behavior. Christopher Ryan and Cacilda Jetha argue that evolutionary psychologists have overemphasized our similarity to chimps, which are more violent, while underestimating our similarity to bonobos, which are more peaceful.
Mismatches

Since an organism's adaptations were suited to its ancestral environment, a new and different environment can create a mismatch. Because humans are mostly adapted to Pleistocene environments, psychological mechanisms sometimes exhibit "mismatches" to the modern environment. One example is the fact that although about 10,000 people are killed with guns in the US annually, whereas spiders and snakes kill only a handful, people nonetheless learn to fear spiders and snakes about as easily as they do a pointed gun, and more easily than an unpointed gun, rabbits or flowers. A potential explanation is that spiders and snakes were a threat to human ancestors throughout the Pleistocene, whereas guns (and rabbits and flowers) were not. There is thus a mismatch between our evolved fear-learning psychology and the modern environment.

This mismatch also shows up in the phenomena of the supernormal stimulus, a stimulus that elicits a response more strongly than the stimulus for which the response evolved. The term was coined by Niko Tinbergen to describe animal behavior, but psychologist Deirdre Barrett said that supernormal stimulation governs the behavior of humans as powerfully as that of animals. She explained junk food as an exaggerated stimulus to cravings for salt, sugar, and fats, and she says that television is an exaggeration of social cues of laughter, smiling faces and attention-grabbing action. Magazine centerfolds and double cheeseburgers pull instincts intended for an EEA where breast development was a sign of health, youth and fertility in a prospective mate, and fat was a rare and vital nutrient.

Research methods

Evolutionary theory is heuristic in that it may generate hypotheses that might not be developed from other theoretical approaches. One of the major goals of adaptationist research is to identify which organismic traits are likely to be adaptations, and which are byproducts or random variations. As noted earlier, adaptations are expected to show evidence of complexity, functionality, and species universality, while byproducts or random variation will not. In addition, adaptations are expected to manifest as proximate mechanisms that interact with the environment in either a generally obligate or facultative fashion (see above). Evolutionary psychologists are also interested in identifying these proximate mechanisms (sometimes termed "mental mechanisms" or "psychological adaptations") and what type of information they take as input, how they process that information, and their outputs.

Evolutionary psychologists use several strategies to develop and test hypotheses about whether a psychological trait is likely to be an evolved adaptation. Buss (2011) notes that these methods include:

- **Cross-cultural Consistency.** Characteristics that have been demonstrated to be cross-cultural human universals such as smiling, crying, facial expressions are presumed to be evolved psychological adaptations. Several evolutionary psychologists have collected massive datasets from cultures around the world to assess cross-cultural universality.

- **Function to Form (or "problem to solution").** The fact that males, but not females, risk potential misidentification of genetic offspring (referred to as "paternity insecurity") led evolutionary psychologists to hypothesize that, compared to females, male jealousy would be more focused on sexual, rather than emotional, infidelity.

- **Form to Function (reverse-engineering -- or "solution to problem").** Morning sickness, and associated aversions to certain types of food, during pregnancy seemed to have the characteristics of an evolved adaptation (complexity and universality). Margie Profet hypothesized that the function was to avoid the ingestion of toxins during early pregnancy that could damage fetus (but which are likely harmless to healthy women).
Corresponding Neurological Modules

Evolutionary psychology and cognitive neuropsychology are mutually compatible -- evolutionary psychology helps to identify psychological adaptations and their ultimate, evolutionary functions, while neuropsychology helps to identify the proximate manifestations of these adaptations.

Evolutionary psychologists also use various sources of data for testing, including experiments, archeological records, data from hunter-gatherer societies, observational studies, self-reports and surveys, public records, and human products. Recently, additional methods and tools have been introduced based on fictional scenarios, mathematical models, and multi-agent computer simulations.

Major areas of research

Foundational areas of research in evolutionary psychology can be divided into broad categories of adaptive problems that arise from the theory of evolution itself: survival, mating, parenting, family and kinship, interactions with non-kin, and cultural evolution.

Survival and individual level psychological adaptations

Problems of survival are thus clear targets for the evolution of physical and psychological adaptations. Major problems our ancestors faced included food selection and acquisition; territory selection and physical shelter; and avoiding predators and other environmental threats.

Consciousness

Consciousness is likely an evolved adaptation since it meets George Williams' criteria of species universality, complexity, and functionality, and it is a trait that apparently increases fitness. In his paper "Evolution of consciousness," John Eccles argues that special anatomical and physical adaptations of the mammalian cerebral cortex gave rise to consciousness. In contrast, others have argued that the recursive circuitry underwriting consciousness is much more primitive, having evolved initially in pre-mammalian species because it improves the capacity for interaction with both social and natural environments by providing an energy-saving "neutral" gear in an otherwise energy-expensive motor output machine. Once in place, this recursive circuitry may well have provided a basis for the subsequent development of many of the functions that consciousness facilitates in higher organisms, as outlined by Bernard J. Baars. Richard Dawkins suggested that we evolved consciousness in order to make ourselves the subjects of thought. Daniel Povinelli suggests that large, tree-climbing apes evolved consciousness to take into account one's own mass when moving safely among tree branches. Consistent with this hypothesis, Gordon Gallup found that chimps and orangutans, but not little monkeys or terrestrial gorillas, demonstrated self-awareness in mirror tests.

The concept of consciousness can refer to voluntary action, awareness, or wakefulness. However, even voluntary behavior involves unconscious mechanisms. Many cognitive processes take place in the cognitive unconscious, unavailable to conscious awareness. Some behaviors are conscious when learned but then become unconscious, seemingly automatic. Learning, especially implicitly learning a skill, can take place outside of consciousness. For example, plenty of people know how to turn right when they ride a bike, but very few can accurately explain how they actually do so.

Sleep may have evolved to conserve energy when activity would be less fruitful or more dangerous, such as at night, especially in winter.
Sensation and perception

Many experts, such as Jerry Fodor, write that the purpose of perception is knowledge, but evolutionary psychologists hold that its primary purpose is to guide action. For example, they say, depth perception seems to have evolved not to help us know the distances to other objects but rather to help us move around in space. Evolutionary psychologists say that animals from fiddler crabs to humans use eyesight for collision avoidance, suggesting that vision is basically for directing action, not providing knowledge.

Building and maintaining sense organs is metabolically expensive, so these organs evolve only when they improve an organism's fitness. More than half the brain is devoted to processing sensory information, and the brain itself consumes roughly one-fourth of one's metabolic resources, so the senses must provide exceptional benefits to fitness. Perception accurately mirrors the world; animals get useful, accurate information through their senses. Scientists who study perception and sensation have long understood the human senses as adaptations. Depth perception consists of processing over half a dozen visual cues, each of which is based on a regularity of the physical world. Vision evolved to respond to the narrow range of electromagnetic energy that is plentiful and that does not pass through objects. Sound waves go around corners and interact with obstacles, creating a complex pattern that includes useful information about the sources of and distances to objects. Larger animals naturally make lower-pitched sounds as a consequence of their size. The range over which an animal hears, on the other hand, is determined by adaptation. Homing pigeons, for example, can hear very low-pitched sound (infrasound) that carries great distances, even though most smaller animals detect higher-pitched sounds. Taste and smell respond to chemicals in the environment that are thought to have been significant for fitness in the EEA. For example, salt and sugar were apparently both valuable to our ancestors, and we favor salty and sweet tastes. The sense of touch is actually many senses, including pressure, heat, cold, tickle, and pain. Pain, while unpleasant, is adaptive. An important adaptation for senses is range shifting, by which the organism becomes temporarily more or less sensitive to sensation. For example, one's eyes automatically adjust to dim or bright ambient light. Sensory abilities of different organisms often coevolve, as is the case with the hearing of echolocating bats and that of the moths that have evolved to respond to the sounds that the bats make.

Evolutionary psychologists claim that perception demonstrates the principle of modularity, with specialized mechanisms handling particular perception tasks. For example, people with damage to a particular part of the brain suffer from the specific defect of not being able to recognize faces (prosopagnosia). EP suggests that this indicates a so-called face-reading module.

Learning and facultative adaptations

In evolutionary psychology, learning is said to be accomplished through evolved capacities, specifically facultative adaptations. Facultative adaptations express themselves differently depending on input from the environment. Sometimes the input comes during development and helps shape that development. For example, migrating birds learn to orient themselves by the stars during a critical period in their maturation. Evolutionary psychologists claim that humans also learn language along an evolved program, also with critical periods. The input can also come during daily tasks, helping the organism cope with changing environmental conditions. For example, animals evolved Pavlovian conditioning in order to solve problems about causal relationships. Animals accomplish learning tasks most easily when those tasks resemble problems that they faced in their evolutionary past, such as a rat learning where to find food or water. Learning capacities sometimes demonstrate differences between the sexes. In many animal species, for example, males can solve spatial problem faster and more accurately than females, due to the effects of male hormones during development. The same might be true of humans.
Emotion and motivation
Motivations direct and energize behavior, while emotions provide the affective component to motivation, positive or negative.\cite{54} In the early 1970s, Paul Ekman and colleagues began a line of research that suggests that many emotions are universal.\cite{54} He found evidence that humans share at least five basic emotions: fear, sadness, happiness, anger, and disgust.\cite{54} Social emotions evidently evolved to motivate social behaviors that were adaptive in the EEA.\cite{54} For example, spite seems to work against the individual but it can establish an individual's reputation as someone to be feared.\cite{54} Shame and pride can motivate behaviors that help one maintain one's standing in a community, and self-esteem is one's estimate of one's status.\cite{2} \cite{54}

Cognition
Cognition refers to internal representations of the world and internal information processing. From an EP perspective, cognition is not "general purpose," but uses heuristics, or strategies, that generally increase the likelihood of solving problems our ancestors routinely faced. For example, humans are far more likely to solve logic problems that involve detecting cheating (a common problem given our social nature) than the same logic problem put in purely abstract terms.\cite{55} Since our ancestors did not encounter truly random events, we may be cognitively predisposed to incorrectly identify patterns in random sequences. "Gamblers' Fallacy" is one example of this. Gamblers may falsely believe that they have hit a "lucky streak" even when each outcome is actually random and independent of previous trials. Most people believe that if a fair coin has been flipped 9 times and Heads appears each time, that on the tenth flip, there is a greater than 50% chance of getting Tails.\cite{54} Humans find it far easier to make diagnoses or predictions using frequency data than when the same information is presented as probabilities or percentages, presumably because our ancestors lived in relatively small tribes (usually with fewer that 150 people) where frequency information was more readily available.\cite{54}

Personality
Evolutionary psychology is primarily interested in finding commonalities between people, or basic human psychological nature. From an evolutionary perspective, the fact that people have fundamental differences in personality traits initially presents something of a puzzle.\cite{56} (Note: The field of behavioral genetics is concerned with statistically partitioning differences between people into genetic and environmental sources of variance. However, understanding the concept of heritability can be tricky—heritability refers only to the differences between people, never the degree to which the traits of an individual are due to environmental or genetic factors, since traits are always a complex interweaving of both.)

Personality traits are conceptualized by evolutionary psychologists as due to normal variation around an optimum, or due to frequency-dependent selection, or facultative adaptations. Like variability in height, some personality traits may be simply reflect inter-individual variability around a general optimum.\cite{56} Or, personality traits may represent different genetically predisposed "behavioral morphs" -- alternate behavioral strategies that depend on the frequency of competing behavioral strategies in the population. For example, if most of the population is generally trusting and gullible, the behavioral morph of being a "cheater" (or, in the extreme case, a sociopath) may be advantageous.\cite{57} Finally, like many other psychological adaptations, personality traits may be facultative—sensitive to typical variations in the social environment, especially during early development. For example, later born children are more likely than first borns to be rebellious, less conscientious and more open to new experiences, which may be advantageous to them given their particular niche in family structure.\cite{58}
Language

According to Steven Pinker, who builds on the work by Noam Chomsky, the universal human ability to learn to talk between the ages of 1 - 4, basically without training, suggests that language acquisition is a distinctly human psychological adaptation (see, in particular, Pinker's The Language Instinct). Pinker and Bloom (1990) argue that language as a mental faculty shares many likenesses with the complex organs of the body which suggests that, like these organs, language has evolved as an adaptation, since this is the only known mechanism by which such complex organs can develop. Pinker follows Chomsky in arguing that the fact that children can learn any human language with no explicit instruction suggests that language, including most of grammar, is basically innate and that it only needs to be activated by interaction. Chomsky himself does not believe language to have evolved as an adaption, but suggests that it likely evolved as a byproduct of some other adaptation, a so-called spandrel. But Pinker and Bloom argue that the organic nature of language strongly suggests that it has an adaptational origin.

Evolutionary psychologists hold that the FOXP2 gene may well be associated with the evolution of human language. In the 1980s, psycholinguist Myrna Gropnik identified a dominant gene that causes language impairment in the KE family of Britain. This gene turned out to be a mutation of the FOXP2 gene. Humans have a unique allele of this gene, which has otherwise been closely conserved through most of mammalian evolutionary history. This unique allele seems to have first appeared between 100 and 200 thousand years ago, and it is now all but universal in humans.

Currently several competing theories about the evolutionary origin of language coexist, none of them having achieved a general consensus. Researchers of language acquisition in primates and humans such as Michael Tomasello and Talmy Givón, argue that the innatist framework has understated the role of imitation in learning and that it is not at all necessary to posit the existence of an innate grammar module to explain human language acquisition. Tomasello argues that studies of how children and primates actually acquire communicative skills suggests that we learn complex behavior through experience, so that instead of a module specifically dedicated to language acquisition, language is acquired by the same cognitive mechanisms that are used to acquire all other kinds of socially transmitted behavior.

On the issue of whether language is best seen as having evolved as an adaptation or as a spandrel, evolutionary biologist W. Tecumseh Fitch, following Stephen J. Gould, argues that it is unwarranted to assume that every aspect of language is an adaptation, or that language as a whole is an adaptation. He criticizes some strands of evolutionary psychology for suggesting a pan-adaptionist view of evolution, and dismisses Pinker and Bloom's question of whether "Language has evolved as an adaptation" as being misleading. He argues instead that from a biological viewpoint the evolutionary origins of language is best conceptualized as being the probable result of a convergence of many separate adaptations into a complex system. A similar argument is made by Terrence Deacon who in The Symbolic Species argues that the different features of language have co-evolved with the evolution of the mind and that the ability to use symbolic communication is integrated in all other cognitive processes.

If the theory that language could have evolved as a single adaptation is accepted, the question becomes which of its many functions has been the basis of adaptation, several evolutionary hypotheses have been posited: that it evolved for the person of social grooming, that it evolved to as way to show mating potential or that it evolved to form social contracts. Evolutionary psychologists recognize that these theories are all speculative and that much more evidence is required to understand how language might have been selectively adapted.
Mating

Given that sexual reproduction is the means by which genes are propagated into future generations, sexual selection plays a large role in the direction of human evolution. Human mating, then, is of interest to evolutionary psychologists who aim to investigate evolved mechanisms to attract and secure mates. Several lines of research have stemmed from this interest, such as studies of mate selection, mate poaching, and mate retention. Much of the research on human mating is based on parental investment theory, which makes important predictions about the different strategies men and women will use in the mating domain (see above under "Middle-level evolutionary theories"). In essence, it predicts that women will be more selective when choosing mates, whereas men will not, especially under short-term mating conditions. This has led some researchers to predict sex differences in such domains as sexual jealousy, wherein females will react more aversively to emotional infidelity and males will react more aversively to sexual infidelity. This particular pattern is predicted because the costs involved in mating for each sex are distinct. Women, on average, should prefer a mate who can offer some kind of resources (e.g., financial, commitment), which means that a woman would also be more at risk for losing those valued traits in a mate who commits an emotional infidelity. Men, on the other hand, are limited by the fact that they can never be certain of the paternity of their children because they do not bear the offspring themselves. This obstacle entails that sexual infidelity would be more aversive than emotional infidelity for a man because investing resources in another man's offspring does not lead to propagation of the man's own genes.

Another interesting line of research is that which examines women's mate preferences across the ovulatory cycle. The theoretical underpinning of this research is that ancestral women would have evolved mechanisms to select mates with certain traits depending on their hormonal status. For example, the theory hypothesizes that, during the ovulatory phase of a woman's cycle (approximately days 10-15 of a woman's cycle), a woman who mated with a male with high genetic quality would have been more likely, on average, to produce and rear a healthy offspring than a woman who mated with a male with low genetic quality. These putative preferences are predicted to be especially apparent for short-term mating domains because a potential male mate would only be offering genes to a potential offspring. This hypothesis allows researchers to examine whether women select mates who have characteristics that indicate high genetic quality during the high fertility phase of their ovulatory cycles. Indeed, studies have shown that women's preferences vary across the ovulatory cycle. In particular, Haselton and Miller (2006) showed that highly fertile women prefer creative but poor men as short-term mates. Creativity may be a proxy for good genes. Research by Gangestad et al. (2004) indicates that highly fertile women prefer men who display social presence and intrasexual competition; these traits may act as cues that would help women predict which men may have, or would be able to acquire, resources.

Parenting

Reproduction is always costly for women, and can also be for men. Individuals are limited in the degree to which they can devote time and resources to producing and raising their young, and such expenditure may also be detrimental to their future condition, survival and further reproductive output. Parental investment is any parental expenditure (time, energy etc.) that benefits one offspring at a cost to parents' ability to invest in other components of fitness (Clutton-Brock 1991: 9; Trivers 1972). Components of fitness (Beatty 1992) include the well being of existing offspring, parents' future reproduction, and inclusive fitness through aid to kin (Hamilton, 1964). Parental investment theory is a branch of life history theory. Robert Trivers' theory of parental investment predicts that the sex making the largest investment in lactation, nurturing and protecting offspring will be more discriminating in mating and that the sex that invests less in offspring will compete for access to the higher investing sex (see Bateman's principle). Sex differences in parental effort are important in determining the strength of sexual selection.
The benefits of parental investment to the offspring are large and are associated with the effects on condition, growth, survival and ultimately, on reproductive success of the offspring. However, these benefits can come at the cost of parent's ability to reproduce in the future e.g. through the increased risk of injury when defending offspring against predators, the loss of mating opportunities whilst rearing offspring and an increase in the time to the next reproduction. Overall, parents are selected to maximise the difference between the benefits and the costs, and parental care will be likely to evolve when the benefits exceed the costs.

The Cinderella effect is a term used to describe the high incidence of stepchildren being physically, emotionally or sexually abused, neglected or murdered, or otherwise mistreated at the hands of their stepparents at significantly higher rates than their genetic counterparts. It takes its name from the fairy tale character Cinderella, who in the story was cruelly mistreated by her stepmother and stepsisters.\[82\] Daly and Wilson (1996) noted: "Evolutionary thinking led to the discovery of the most important risk factor for child homicide -- the presence of a stepparents. Parental efforts and investments are valuable resources, and selection favors those parental psyches that allocate effort effectively to promote fitness. The adaptive problems that challenge parental decision making include both the accurate identification of one's offspring and the allocation of one's resources among them with sensitivity to their needs and abilities to convert parental investment into fitness increments…. Stepc tolerant were seldom or never so valuable to one's expected fitness as one's own offspring would be, and those parental psyches that were easily parasitized by just any appealing youngster must always have incurred a selective disadvantage"(Daly & Wilson, 1996, p64 - 65). However, they note that not all stepparents will "want" to abuse their partner's children, or that genetic parenthood is absolute insurance against abuse. They see step parental care is as primarily "mating effort" towards the genetic parent.\[83\]

**Family and kin**

Inclusive fitness is the sum of an organism's classical fitness (how many of its own offspring it produces and supports) and the number of equivalents of its own offspring it can add to the population by supporting others.\[84\] The first component is called classical fitness by Hamilton (1964).

From the gene's point of view, evolutionary success ultimately depends on leaving behind the maximum number of copies of itself in the population. Until 1964, it was generally believed that genes only achieved this by causing the individual to leave the maximum number of viable offspring. However, in 1964 W. D. Hamilton proved mathematically that, because close relatives of an organism share some identical genes, a gene can also increase its evolutionary success by promoting the reproduction and survival of these related or otherwise similar individuals. Hamilton claimed that this leads natural selection to favor organisms that would behave in ways that maximize their inclusive fitness. It is also true that natural selection favors behavior that maximizes personal fitness.

Hamilton's rule describes mathematically whether or not a gene for altruistic behaviour will spread in a population:

\[ rb > c \]

where

- \( c \) is the reproductive cost to the altruist,
- \( b \) is the reproductive benefit to the recipient of the altruistic behavior, and
- \( r \) is the probability, above the population average, of the individuals sharing an altruistic gene – commonly viewed as "degree of relatedness".

The concept serves to explain how natural selection can perpetuate altruism. If there is an "altruism gene" (or complex of genes) that influences an organism's behavior to be helpful and protective of relatives and their offspring, this behavior also increases the proportion of the altruism gene in the population, because relatives are likely to share genes with the altruist due to common descent. Altruists may also have some way to recognize altruistic behavior in unrelated individuals and be inclined to support them. As Dawkins points out in *The Selfish Gene* (Chapter 6) and *The Extended Phenotype*,\[85\] this must be distinguished from the green-beard effect.
Psychological adaptations related to interactions with kin are facultative. Although it is generally true that humans tend to be more altruistic toward their kin than toward non-kin, there may be exceptions. Specific types of behavioral output are dependent on the interaction of both genetic and environmental influences. For example, John Bowlby and others have noted that patterns of attachment to others are dependent on early developmental experiences with caregivers.\textsuperscript{[86]} In any specific instance, the manifestation of emotional bonds into altruistic behavior depends on early bonding experiences, and symbolic, economic and other cultural factors, which may or may not always coincide with consanguinity.\textsuperscript{[87]}

**Interactions with non-kin / reciprocity**

Although interactions with non-kin are generally less altruistic compared to those with kin, cooperation can be maintained with non-kin via mutually beneficial reciprocity as was proposed by Robert Trivers.\textsuperscript{[16]} If there are repeated encounters between the same two players in an evolutionary game in which each of them can choose either to "cooperate" or "defect," then a strategy of mutual cooperation may be favored even if it pays each player, in the short term, to defect when the other cooperates. Direct reciprocity can lead to the evolution of cooperation only if the probability, \( w \), of another encounter between the same two individuals exceeds the cost-to-benefit ratio of the altruistic act:

\[
 w > \frac{c}{b}
\]

Reciprocity can also be indirect if information about previous interactions is shared. Reputation allows evolution of cooperation by indirect reciprocity. Natural selection favors strategies that base the decision to help on the reputation of the recipient: studies show that people who are more helpful are more likely to receive help. The calculations of indirect reciprocity are complicated and only a tiny fraction of this universe has been uncovered, but again a simple rule has emerged.\textsuperscript{[88]} Indirect reciprocity can only promote cooperation if the probability, \( q \), of knowing someone's reputation exceeds the cost-to-benefit ratio of the altruistic act:

\[
 q > \frac{c}{b}
\]

One important problem with this explanation is that individuals may be able to evolve the capacity to obscure their reputation, reducing the probability, \( q \), that it will be known.\textsuperscript{[89]}

Trivers argues that friendship and various social emotions evolved in order to manage reciprocity.\textsuperscript{[90]} Liking and disliking, he says, evolved to help our ancestors form coalitions with others who reciprocated and to exclude those who did not reciprocate.\textsuperscript{[90]} Moral indignation may have evolved to prevent one's altruism from being exploited by cheaters, and gratitude may have motivated our ancestors to reciprocate appropriately after benefiting from others' altruism.\textsuperscript{[90]} Likewise, we feel guilty when we fail to reciprocate.\textsuperscript{[6]} These social motivations match what evolutionary psychologists expect to see in adaptations that evolved to maximize the benefits and minimize the drawbacks of reciprocity.\textsuperscript{[90]}

Evolutionary psychologists say that humans have psychological adaptations that evolved specifically to help us identify nonreciprocators, commonly referred to as "cheaters."\textsuperscript{[90]} In 1993, Robert Frank and his associates found that participants in a prisoner's dilemma scenario were often able to predict whether their partners would "cheat," based on a half hour of unstructured social interaction.\textsuperscript{[90]} In a 1996 experiment, for example, Linda Mealey and her colleagues found that people were better at remembering the faces of people when those faces were associated with stories about those individuals cheating (such as embezzling money from a church).\textsuperscript{[90]}
Evolution and culture

Evolutionary psychology incorporates insights derived from other disciplines about how cultural phenomena evolve over time. Theories that have applied evolutionary perspectives to cultural phenomena include memetics, cultural ecology, and dual inheritance theory (gene-culture co-evolution).\[91\]

Memetics is a theory of mental content based on an analogy with evolution, originating from Richard Dawkins’ 1976 book *The Selfish Gene.* It purports to be an approach to evolutionary models of cultural information transfer. A meme, analogous to a gene, is essentially a “unit of culture”—an idea, belief, pattern of behavior, etc. which is “hosted” in one or more individual minds, and which can reproduce itself from mind to mind. Thus what would otherwise be regarded as one individual influencing another to adopt a belief is seen memetically as a meme reproducing itself. As with genetics, particularly under Dawkins’s interpretation, a meme’s success may be due to its contribution to the effectiveness of its host. Memetics is notable for sidestepping the traditional concern with the truth of ideas and beliefs.

Susan Blackmore (2002) re-stated the definition of meme as: whatever is copied from one person to another person, whether habits, skills, songs, stories, or any other kind of information. Further she said that memes, like genes, are replicators in the sense as defined by Dawkins.\[92\] That is, they are information that is copied. Memes are copied by imitation, teaching and other methods. The copies are not perfect: memes are copied with variation; moreover, they compete for space in our memories and for the chance to be copied again. Only some of the variants can survive. The combination of these three elements (copies; variation; competition for survival) forms precisely the condition for Darwinian evolution, and so memes (and hence human cultures) evolve. Large groups of memes that are copied and passed on together are called co-adapted meme complexes, or *memeplexes.* In her definition, the way that a meme replicates is through imitation.

Dual inheritance theory (DIT), also known as gene-culture coevolution, suggests that cultural information and genes co-evolve. Marcus Feldman and Luigi Luca Cavalli-Sforza (1976) published perhaps the first dynamic models of gene-culture coevolution.\[93\] These models were to form the basis for subsequent work on DIT, heralded by the publication of three seminal books in 1980 and 1981. Charles Lumsden and E.O. Wilson’s *Genes, Mind and Culture* (1981).\[94\] also outlined a series of mathematical models of how genetic evolution might favor the selection of cultural traits and how cultural traits might, in turn, affect the speed of genetic evolution. Another 1981 book relevant to this topic was Cavalli-Sforza and Feldman’s *Cultural Transmission and Evolution: A Quantitative Approach.*\[95\] Borrowing heavily from population genetics and epidemiology, this book built a mathematical theory concerning the spread of cultural traits. It describes the evolutionary implications of vertical transmission, passing cultural traits from parents to offspring; oblique transmission, passing cultural traits from any member of an older generation to a younger generation; and horizontal transmission, passing traits between members of the same population.

Robert Boyd and Peter Richerson's (1985) *Culture and the Evolutionary Process* presents models of the evolution of social learning under different environmental conditions, the population effects of social learning, various forces of selection on cultural learning rules, different forms of biased transmission and their population-level effects, and conflicts between cultural and genetic evolution.

Along with game theory, Herbert Gintis suggested that Dual Inheritance Theory has potential for unifying the behavioral sciences, including economics, biology, anthropology, sociology, psychology and political science because it addresses both the genetic and cultural components of human inheritance.\[96\] Laland and Brown hold a similar view.
In psychology sub-fields

Developmental psychology
In evolutionary theory, what matters most is that individuals live long enough to reproduce and pass on their genes. So why do humans live so long after reproduction? Many evolutionary psychologists have proposed that living a long life improves the survival of babies because while the parents were out hunting, the grandparents cared for the young.

According to Paul Baltes, the benefits granted by evolutionary selection decrease with age. Natural Selection has not eliminated many harmful conditions and nonadaptive characteristics that appear among older adults, such as Alzheimer disease. If it were a disease that killed 20 year-olds instead of 70 year-olds this may have been a disease that natural selection could have destroyed ages ago. Thus, unaided by evolutionary pressures against nonadaptive conditions, we suffer the aches, pains, and infirmities of aging. And as the benefits of evolutionary selection decrease with age, the need for culture increases.[97]

Social psychology
As humans are a highly social species, there are many adaptive problems associated with navigating the social world (e.g., maintaining allies, managing hierarchies, interacting with outgroup members). Researchers in the emerging field of evolutionary social psychology have made many discoveries pertaining to topics traditionally studied by social psychologists, including person perception, social cognition, attitudes, emotions, motivation, and cross-cultural differences.[98]

Abnormal psychology
Adaptationist hypotheses regarding the etiology of psychological disorders are often based on analogies between physiological and psychological dysfunctions,[99] as noted in the table below. Evolutionary psychiatrists and psychologists suggest that some mental disorders have multiple causes.[12]

<table>
<thead>
<tr>
<th>Causal mechanism of failure or malfunction of adaptation</th>
<th>Physiological Example</th>
<th>Hypothesized Psychological Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functioning adaptation (adaptive defense)</td>
<td>Fever / Vomiting</td>
<td>Mild depression or anxiety</td>
</tr>
<tr>
<td></td>
<td>(functional responses to infection or ingestion of toxins)</td>
<td>(functional responses to mild loss or stress)</td>
</tr>
<tr>
<td>By-product of an adaptation(s)</td>
<td>Intestinal gas</td>
<td>Sexual fetishes (?)</td>
</tr>
<tr>
<td></td>
<td>(byproduct of digestion of fiber)</td>
<td>(possible byproduct of normal sexual arousal adaptations that have 'imprinted' on unusual objects or situations)</td>
</tr>
<tr>
<td>Adaptations with multiple effects</td>
<td>Gene for malaria resistance, in homozygous form, causes sickle cell anemia</td>
<td>Adaptation(s) for high levels of creativity may also predispose schizophrenia or bi-polar disorder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(adaptations with both positive and negative effects, perhaps dependent on alternate developmental trajectories)</td>
</tr>
<tr>
<td>Malfunctioning adaptation</td>
<td>Allergies</td>
<td>Autism</td>
</tr>
<tr>
<td></td>
<td>(over-reactive immunological responses)</td>
<td>(possible malfunctioning of theory of mind module)</td>
</tr>
<tr>
<td>Frequency-dependent morphs</td>
<td>The two sexes / Different blood and immune system types</td>
<td>Personality traits and personality disorders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(may represent alternative behavioral strategies dependent on the frequency of the strategy in the population)</td>
</tr>
<tr>
<td>Mismatch between ancestral &amp; current environments</td>
<td>Modern diet-related Type 2 Diabetes</td>
<td>More frequent modern interaction with strangers (compared to family and close friends) may predispose greater incidence of depression &amp; anxiety</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tails of normal (bell shaped) curve</td>
<td>Very short or tall height</td>
<td>Tails of the distribution of personality traits (e.g., extremely introverted or extroverted)</td>
</tr>
</tbody>
</table>

Evolutionary psychologists have suggested that schizophrenia and bipolar disorder may reflect a side-effect of genes with fitness benefits, such as increased creativity. Some individuals with bipolar disorder are especially creative during their manic phases and the close relatives of schizophrenics have been found to be more likely to have creative professions. A 1994 report by the American Psychiatry Association found that people suffered from schizophrenia at roughly the same rate in Western and non-Western cultures, and in industrialized and pastoral societies, suggesting that schizophrenia is not a disease of civilization nor an arbitrary social invention. Likewise sociopathy may represent an evolutionarily stable strategy, by which a small number of people who cheat on social contracts benefit in a society consisting mostly of non-sociopaths.

These speculations have yet to be developed into fully testable hypotheses, and a great deal of research is required to confirm their validity. Clinical psychology and psychiatry are relatively isolated from the field of evolutionary psychology and the etiological speculations of evolutionary psychology have yet to pass the scrutiny and demanding research criteria of these larger disciplines. Psychiatrists raise the concern that evolutionary psychologists seek to explain hidden adaptive advantages without engaging the rigorous empirical testing required to back up such claims. While there is strong research to suggest a genetic link to bipolar disorder and schizophrenia, there is significant debate within clinical psychology about the relative influence and the mediating role of cultural or environmental factors. For example, epidemiological research suggests that different cultural groups may have divergent rates of diagnosis, symptomatology, and expression of mental illnesses. There has also been increasing acknowledgment of culture-bound disorders, which may be viewed as an argument for an environmental versus genetic psychological adaptation. While certain mental disorders may have psychological traits that can be explained as 'adaptive' on an evolutionary scale, these disorders cause afflicted individuals significant emotional and psychological distress and negatively influence the stability of interpersonal relationships and day-to-day adaptive functioning.

**Psychology of religion**

Adaptationist perspectives on religious belief suggest that, like all behavior, religious behaviors are a product of the human brain. As with all other organ functions, cognition's functional structure has been argued to have a genetic foundation, and is therefore subject to the effects of natural selection and sexual selection. Like other organs and tissues, this functional structure should be universally shared amongst humans and should have solved important problems of survival and reproduction in ancestral environments. However, evolutionary psychologists remain divided on whether religious belief is more likely a consequence of evolved psychological adaptations, or is a byproduct of other cognitive adaptations.

**Reception**

**Initial response**

Although the application of adaptationist approaches to studying animal behavior has become standard and uncontroversial, evolutionary psychology has been entangled in the larger philosophical and social science controversies related to the nature versus nurture debate. Some of the controversy has been related not to the science itself, but to concerns about its potential political misuse by others. For example, eugenics and social darwinism were political philosophies of the early 20th Century that were largely based on the naturalistic fallacy -- the idea that what is natural is necessarily a moral good. Other critics have expressed concerned about EP itself. As an
adaptationist, nature-nurture interactionist perspective, it challenged the basic tenets of the predominant paradigm of the social sciences, social constructionism. This view suggested that biology could be pretty much safely ignored when studying human behavior. The result has been sometimes heated discussions between supporters of these two different theoretical paradigms. \[\text{[116]}\]

**Reductionism and determinism**

Some critics view evolutionary psychology as a form of genetic reductionism and genetic determinism,\[\text{[117]}\] a common critique being that evolutionary psychology does not address the complexity of individual development and experience and fails to explain the influence of genes on behavior in individual cases.\[\text{[118]}\] Evolutionary psychologists respond that EP works within a nature-nurture interactionist framework that acknowledges that many psychological adaptations are facultative (sensitive to environmental variations during individual development). EP is generally not focused on proximate analyses of behavior but rather its focus is on the study of distal/ultimate causality (the evolution of psychological adaptations). The field of behavioral genetics is focused on the study of the proximate influence of genes on behavior.\[\text{[119]}\]

**Testability of hypotheses**

A frequent critique of the discipline is that the hypotheses of evolutionary psychology are difficult or impossible to adequately test, thus questioning its status as an actual scientific discipline, for example because many current traits probably evolved to serve different functions than they do now.\[\text{[3]}\] While evolutionary psychology hypotheses are difficult to test, evolutionary psychologists assert that is not impossible.\[\text{[120]}\] Part of the critique of the scientific base of evolutionary psychology includes a critique of the concept of the Environments of Evolutionary Adaptation (EEA). Some critics have argued that we know so little about the environment in which Homo sapiens evolved that explaining specific traits as an adaption to that environment becomes highly speculative.\[\text{[121]}\] Evolutionary psychologists respond that we do know many things about this environment, including the facts that only women got pregnant, our ancestors were hunter-gatherers that generally lived in small tribes, etc.\[\text{[122]}\]

**Modularity of mind**

There is disagreement among evolutionary psychologists concerning the ability and necessity of the computational, and specifically the modular, theory of mind to explain the evolutionary adaptation of psychological traits. Evolutionary psychologists proposing alternative, non-computational models of the mind argue that computational theories are no better at explaining biological reality than non-evolutionary psychology. Proponents of computational theories criticize non-computational approaches for their lack of predictions and empirical support and point to computational theories' record of empirically confirmed predictions.\[\text{[119]}\] Proponents of computational theories also disagree among themselves about the mind's modular structure either as a few generalist modules or as many highly specific modules.\[\text{[123]}\]\[\text{[124]}\]
Evolutionary psychology defence

Overall, evolutionary psychologists argue that many of the criticisms leveled against the field are straw men, are based on a incorrect nature vs. nurture dichotomy, or are based on a misunderstandings of the discipline.¹¹⁹

Notes

[1] Confer et al. 2010; Buss, 2005; Durrant & Ellis, 2003; Pinker, 2002; Tooby & Cosmides, 2005
[6] "Despite this difficulty, there have been many careful and informative studies of human social behaviour from an evolutionary perspective. Infanticide, intelligence, marriage patterns, promiscuity, perception of beauty, bride price, altruism, and the allocation of parental care have all been explored by testing predictions derived from the idea that conscious and unconscious behaviours have evolved to maximize inclusive fitness. The findings have been impressive." "social behaviour, animal." Encyclopedia Britannica. Encyclopedia Britannica Online. Encyclopedia Britannica, 2011. Web. 23 Jan. 2011. (http://www.britannica.com/EBchecked/topic/550897/animal-social-behaviour).
[13] Evolutionary Psychology at the University of Texas (http://homepage psy.uta. edu/homepage/Group/BussLAB/about.htm)
[22] Buss et al. 1998
[27] Pinker 2002
[28] Barkow et al. 1992
[33] CDC pdf (http://www.cdc.gov/nchs/data/nvss/nvsr54/nvsr54_10.pdf)
Evolutionary psychology

[49] Peters, Frederic “Consciousness as Recursive, Spatiotemporal Self-Location” (http://proceedings.nature.com/documents/2444/version/1)
[62] Workman & Reader 2008: 277 “There are a number of hypotheses suggesting that language evolved to fulfill a social function such as social grooming (to bind large groups together), the making of social contracts (to enable monogamy and male provisioning) and the use of language to impress potential mates. While each of these hypotheses has its merits, each is still highly speculative and requires more evidence from different areas of research (such as linguistics and anthropology).”
[68] Buss 1994
[69] Buss & Barnes 1986
[71] Schmitt and Buss 2001
[72] Buss 1988
[74] Buss 1989
[75] Buss et al. 1992
Evolutionary psychology


[83] Daly & Wilson 1998

[84] Definition and explanation of inclusive fitness from Personality Research.org (http://www.personalityresearch.org/evolutionary/ inclusive.html)


[86] Bowlby, John "Attachment" 1982, P. 57


References


Further reading


External links

- Evolutionary Psychology (http://www.dmoz.org/Science/Social_Sciences/Psychology/Evolutionary_Psychology/) at the Open Directory Project
- Evolutionary Psychology-Approaches in Psychology (http://www.psychegames.com/evolutionary-psychology.htm)

Academic societies

- Human Behavior and Evolution Society (http://www.hbes.com); international society dedicated to using evolutionary theory to study human nature
- The International Society for Human Ethology (http://evolution.anthro.univie.ac.at/ishe); promotes ethological perspectives on the study of humans worldwide
- European Human Behaviour and Evolution Association (http://www.ehbea.com/) an interdisciplinary society that supports the activities of European researchers with an interest in evolutionary accounts of human cognition, behaviour and society
- The Association for Politics and the Life Sciences (http://www.aplsnet.org/); an international and interdisciplinary association of scholars, scientists, and policymakers concerned with evolutionary, genetic, and ecological knowledge and its bearing on political behavior, public policy and ethics.
- Society for Evolutionary Analysis in Law (http://www.sealsite.org/) a scholarly association dedicated to fostering interdisciplinary exploration of issues at the intersection of law, biology, and evolutionary theory
- The New England Institute for Cognitive Science and Evolutionary Psychology (http://www.une.edu/nei/) aims to foster research and education into the interdisciplinary nexus of cognitive science and evolutionary studies
- The NorthEastern Evolutionary Psychology Society (http://www.neepsociety.com/); regional society dedicated to encouraging scholarship and dialogue on the topic of evolutionary psychology
- Feminist Evolutionary Psychology Society (http://fepsociety.org/) researchers that investigate the active role that females have had in human evolution
Journals

• Evolutionary Psychology (http://www.epjournal.net/) free access online scientific journal
• Politics and the Life Sciences (http://www.politicsandthelifesciences.org/) is an interdisciplinary peer-reviewed journal published by the Association for Politics and the Life Sciences (http://www.aplsnet.org/)
• Human Nature: An Interdisciplinary Biosocial Perspective (http://www.springer.com/social+sciences/anthropology+and+archaeology/journal/12110) advances the interdisciplinary investigation of the biological, social, and environmental factors that underlie human behavior. It focuses primarily on the functional unity in which these factors are continuously and mutually interactive. These include the evolutionary, biological, and sociological processes as they interact with human social behavior.
• Biological Theory: Integrating Development, Evolution and Cognition (http://www.kli.ac.at/publications-a.html) devoted to theoretical advances in the fields of biology and cognition, with an emphasis on the conceptual integration afforded by evolutionary and developmental approaches.
• Evolutionary Anthropology (http://www3.interscience.wiley.com/cgi-bin/jtoc?ID=38641)
• ([Behavioral and Brain Sciences (http://www.bbsonline.org/)]) interdisciplinary articles in psychology, neuroscience, behavioral biology, cognitive science, artificial intelligence, linguistics and philosophy. About 30% of the articles have focused on evolutionary analyses of behavior.
• Evolution and Development (http://www3.interscience.wiley.com/journal/118546131/home) Research relevant to interface of evolutionary and developmental biology
• The Evolutionary Review - Art, Science, and Culture (http://www.evolutionaryreview.com/ed.htm)

Videos

• Brief video clip re what EP is (from the "Evolution" PBS Series) (http://www.youtube.com/watch?v=pEmX8Rim-hs)
• TED talk (http://www.ted.com/index.php/talks/steven_pinker_chalks_it_up_to_the_blank_slate.html) by Steven Pinker about his book The Blank Slate: The Modern Denial of Human Nature
• RSA talk (https://www.youtube.com/watch?v=PWHlvFiv70Q) by evolutionary psychologist Robert Kurzban on modularity of mind, based on his book Why Everyone (Else) is a Hypocrite
• Richard Dawkins' lecture on natural selection and evolutionary psychology (http://www.youtube.com/watch?v=BzJUCG7L9I4)
• Evolutionary Psychology-Steve Pinker & Frans de Waal (http://www.youtube.com/watch?v=z3X5AuKE9rg) Audio recording
• Stone Age Minds: A conversation with evolutionary psychologists Leda Cosmides and John Tooby (http://www.youtube.com/watch?v=nNW_B8EwgH4)
• Margaret Mead and Samoa (http://video.google.com/videoplay?docid=4165874976901589227&q=margaret+mead+and+samoan&total=8&start=0&num=10&so=0&type=search&plindex=0). Review of the nature vs. nurture debate triggered by Mead's book "Coming of Age in Samoa."
• Secrets of the Tribe (http://vimeo.com/18751423) Documents the conflicts between cultural and evolutionary anthropologists who have studied the Yanomamo tribes.
• Video interview (http://video.google.com/videoplay?docid=3554279466299738997) with Steven Pinker by Robert Wright (journalist) discussing evolutionary psychology
• Video interview (http://video.google.com/videoplay?docid=4975549474851602314) with Edward O. Wilson by Robert Wright (journalist), contextualizing evolutionary psychology within science, politics, academics and philosophy
Gene-centered view of evolution

The gene-centered view of evolution, gene selection theory or selfish gene theory holds that evolution occurs through the differential survival of competing genes, increasing the frequency of those alleles whose phenotypic effects successfully promote their own propagation, with gene defined as "not just one single physical bit of DNA [but] all replicas of a particular bit of DNA distributed throughout the world". The proponents of this viewpoint argue that, since heritable information is passed from generation to generation almost exclusively by genetic material, natural selection and evolution are best considered from the perspective of genes.

This is in contrast to the organism-centered viewpoint adopted historically by biologists. Proponents of the gene-centered viewpoint argue that it permits understanding of diverse phenomena such as altruism and intragenomic conflict that are otherwise difficult to explain from an organism-focused perspective.

The gene-centered view of evolution is a synthesis of the theory of evolution by natural selection, the particulate inheritance theory and the non-transmission of acquired characters. It states that those genes whose phenotypic effects successfully promote their own propagation will be favorably selected in detriment to their competitors. This process produces adaptations for the benefit of genes that promote the reproductive success of the organism, or of other organisms containing the same gene (kin altruism and green-beard effects), or even only its own propagation in detriment to the other genes of the genome (intragenomic conflict).

Introduction

The gene-centered view of evolution is a different way of looking at the basis of evolutionary development. It turns the whole solution of evolution inside-out for the purpose of examination. What this new perspective reveals is a more easily understood model for the evolution of social characteristics such as selfishness and altruism that much of the study of evolution, caught up in the survival of the individual organisms, overlooks.

Acquired characteristics are not inherited

Discoveries in science such as the formulation of the central dogma of molecular biology made it clear that the inheritance of acquired characters was not an evolutionary factor in a physical sense and identified genes as lasting entities that survive through many generations. Maynard Smith summarized the issue:

> If the central dogma is true, and if it is also true that nucleic acids are the only means whereby information is transmitted between generations, this has crucial implications for evolution. It would imply that all evolutionary novelty requires changes in nucleic acids, and that these changes – mutations – are essentially accidental and non-adaptive in nature. Changes elsewhere – in the egg cytoplasm, in materials transmitted through the placenta, in the mother's milk – might alter the development of the child, but, unless the changes were in nucleic acids, they would have no long-term evolutionary effects.

—Maynard Smith

The rejection of the inheritance of acquired characters, combined with the classical mathematical evolutionary biology developed by Ronald Fisher, J. B. S. Haldane and Sewall Wright, paved the way to the formulation of the selfish-gene theory. For cases where environment can influence heredity, see epigenetics.
The gene as the unit of selection

The view of the gene as the unit of selection was developed mainly in the works W. D. Hamilton,[4] [5] [6] Colin Pittendrigh[7] and George C. Williams. It was later popularized by Richard Dawkins in his books *The Selfish Gene* (1976)[9] and *The Extended Phenotype* (1982).[10]

According to Williams’ 1966 book *Adaptation and Natural Selection*,

> ![The essence of the genetical theory of natural selection is a statistical bias in the relative rates of survival of alternatives (genes, individuals, etc.). The effectiveness of such bias in producing adaptation is contingent on the maintenance of certain quantitative relationships among the operative factors. One necessary condition is that the selected entity must have a high degree of permanence and a low rate of endogenous change, relative to the degree of bias (differences in selection coefficients).]

—Williams,[8] 1966, pp. 22–23

Williams argued that "[t]he natural selection of phenotypes cannot in itself produce cumulative change, because phenotypes are extremely temporary manifestations". Each phenotype is the unique product of the interaction between genome and environment. It does not matter how fit and fertile a phenotype is, it will eventually be destroyed and will never be duplicated.

Since 1954, it has been known that DNA is the main physical substrate to genetic information, and it is capable of high-fidelity replication through many generations. So, a particular sequence of DNA can have a high permanence and a low rate of endogenous change.

In normal sexual reproduction, an entire genome is the unique combination of father's and mother's chromosomes produced at the moment of fertilization. It is generally destroyed with its organism, because "meiosis and recombination destroy genotypes as surely as death".[8] Only half of it is transmitted to each descendant due to independent segregation.

The gene as an informational entity persists for an evolutionarily significant span of time through a lineage of many physical copies.

In his book *River out of Eden*, Dawkins coins the phrase *God's utility function* to explain his view on genes as units of selection. He uses this phrase as a synonym of the "meaning of life" or the "purpose of life". By rephrasing the word *purpose* in terms of what economists call a utility function, meaning "that which is maximized", Dawkins attempts to reverse-engineer the purpose in the mind of the Divine Engineer of Nature, or the Utility Function of God. Finally, Dawkins argues that it is a mistake to assume that an ecosystem or a species as a whole exists for a purpose. He writes that it is incorrect to suppose that individual organisms lead a meaningful life either; in nature, only genes have a utility function – to perpetuate their own existence with indifference to great sufferings inflicted upon the organisms they build, exploit and discard.

Organisms as vehicles

Genes are not naked in the world. They are usually packed together inside a genome, which is itself contained inside an organism. Genes group together into genomes because "genetic replication makes use of energy and substrates that are supplied by the metabolic economy in much greater quantities than would be possible without a genetic division of labour".[11] They build vehicles to promote their mutual interests of jumping into the next generation of vehicles. As Dawkins puts it, organisms are the "survival machines" of genes.[9]

The phenotypic effect of a particular gene is contingent on its environment, including the fellow genes constituting with it the total genome. A gene never has a fixed effect, so how is it possible to speak of a gene for long legs? It is because of the phenotypic *differences* between alleles. One may say that one allele, all other things being equal or varying within certain limits, causes greater legs than its alternative. This difference enables the scrutiny of natural selection.
"A gene can have multiple phenotypic effects, each of which may be of positive, negative or neutral value. It is the net selective value of a gene's phenotypic effect that determines the fate of the gene".\cite{12} For instance, a gene can cause its bearer to have greater reproductive success at a young age, but also cause a greater likelihood of death at a later age. If the benefit outweighs the harm, averaged out over the individuals and environments in which the gene happens to occur, then phenotypes containing the gene will generally be positively selected and thus the abundance of that gene in the population will increase.

Even so, it becomes necessary to model the genes in combination with their vehicle as well as in combination with the vehicle's environment.

**Selfish-gene theory**

The selfish-gene theory of natural selection can be restated as follows:

> Genes do not present themselves naked to the scrutiny of natural selection, instead they present their phenotypic effects. [...] Differences in genes give rise to differences in these phenotypic effects. Natural selection acts on the phenotypic differences and thereby on genes. Thus genes come to be represented in successive generations in proportion to the selective value of their phenotypic effects.

— Cronin,\cite{12} 1991, p.60

The result is that "the prevalent genes in a sexual population must be those that, as a mean condition, through a large number of genotypes in a large number of situations, have had the most favourable phenotypic effects for their own replication".\cite{13} In other words, we expect selfish genes ("selfish" meaning that it promotes its own survival without necessarily promoting the survival of the organism, group or even species). This theory implies that adaptations are the phenotypic effects of genes to maximize their representation in future generations. An adaptation is maintained by selection if it promotes genetic survival directly, or else some subordinate goal that ultimately contributes to successful reproduction.

**Individual altruism, genetic egoism**

The gene is a unit of hereditary information that exists in many physical copies in the world, and which particular physical copy will be replicated and originate new copies does not matter from the gene's point of view.\cite{14} A selfish gene could be favored by selection by producing altruism among organisms containing it. The idea is summarized as follows:

If a gene copy confers a benefit $B$ on another vehicle at cost $C$ to its own vehicle, its costly action is strategically beneficial if $pB > C$, where $p$ is the probability that a copy of the gene is present in the vehicle that benefits. Actions with substantial costs therefore require significant values of $p$. Two kinds of factors ensure high values of $p$: relatedness (kinship) and recognition (green beards).

—20, 20

A gene in a somatic cell of an individual may forego replication to promote the transmission of its copies in the germ line cells. It ensures the high value of $p = 1$ due to their constant contact and their common origin from the zygote.

The kin selection theory predicts that a gene may promote the recognition of kinship by historical continuity: a mammalian mother learns to identify her own offspring in the act of giving birth; a male preferentially directs resources to the offspring of mothers with whom he has copulated; the other chicks in a nest are siblings; and so on. The expected altruism between kin is calibrated by the value of $p$, also known as the coefficient of relatedness. For instance, an individual has a $p = 1/2$ in relation to his brother, and $p = 1/8$ to his cousin, so we would expect, *ceteris paribus*, greater altruism among brothers than among cousins. In this vein, geneticist J.B.S. Haldane famously joked, "Would I lay down my life to save my brother? No, but I would to save two brothers or eight cousins."\cite{15} However, examining the human propensity for altruism, kin selection theory seems incapable of explaining cross-familiar, cross-racial and even cross-species acts of kindness.
Green-beard effect

Green-beard effects gained their name from a thought-experiment of Richard Dawkins,[9] who considered the possibility of a gene that caused its possessors to develop a green beard and to be nice to other green-bearded individuals. Since then, ‘green-beard effect’ has come to refer to forms of genetic self-recognition in which a gene in one individual might direct benefits to other individuals that possess the gene. Such genes are essentially especially selfish, benefiting themselves regardless of the fates of their vehicles.

All kinds of altruism

Kindness

On the other hand, a single trait, group reciprocal kindness, is capable of explaining the vast majority of altruism that is generally accepted as "good" by modern societies. Imagine a green-bearding behavioral trait whose recognition does not depend on the recognition of some external feature such as beard color, but relies on recognition of the behavior itself. Imagine now that the behavior is altruistic. The success of such a trait in sufficiently intelligent and undeceived organisms is implicit. Moreover, the existence of such a trait predicts a tendency for kindness to unrelated organisms that are apparently kind, even if the organisms are of a completely different species. Moreover, the gene need not be exactly the same, so long as the effect is similar. Multiple versions of the gene—or even meme—would have virtually the same effect in a sort of symbiotic green-bearding cycle of altruism.

Deceit

Whenever recognition plays a role in evolution, so does deception. Just like the harmless lizard that has evolved a pattern that mimics its poisonous cousin and therefore tricks predators, the selfish creature may pretend to be kind by “growing a green beard” (whatever that green beard may be). Thus green-bearding and the selfish-gene theory also give rise to an explanation for the evolution of lies and deceit, characteristics that do not benefit the population as a whole.

Intragenomic conflict

As genes are capable of producing individual altruism, they are capable of producing conflict among genes inside the genome of one individual. This phenomenon was called intragenomic conflict and arises when one gene promotes its own replication in detriment to other genes in the genome. The classic example is segregation distorter genes that cheat during meiosis or gametogenesis and end up in more than half of the functional gametes. These genes persist even resulting in reduced fertility. Egbert Leigh compared the genome to "a parliament of genes: each acts in its own self-interest, but if its acts hurt the others, they will combine together to suppress it" to explain the relative low occurrence of intragenomic conflict.[16]

Criticism

Prominent opponents of this gene-centric view of evolution include evolutionary biologist Ernst Mayr, paleontologist Stephen Jay Gould, biologist and anthropologist David Sloan Wilson and philosopher Elliott Sober. Writing in the New York Review of Books, Gould has characterized the gene-centered perspective as confusing book-keeping with causality. Gould views selection as working on many levels, and has called attention to a hierarchical perspective of selection. Gould also called the claims of Selfish Gene "strict adaptationism", "ultra-Darwinism", and "Darwinian fundamentalism", describing them as excessively "reductionist". He saw the theory as leading to a simplistic "algorithmic" theory of evolution, or even to the re-introduction of a teleological principle.[17] Mayr went so far as to say "Dawkins' basic theory of the gene being the object of evolution is totally non-Darwinian".[18]
Gould also addressed the issue of selfish genes in his essay 'Caring groups and selfish genes'.[19] Gould acknowledged that Dawkins was not imputing conscious action to genes, but simply using a shorthand metaphor commonly found in evolutionary writings. To Gould, the fatal flaw was that "no matter how much power Dawkins wishes to assign to genes, there is one thing that he cannot give them – direct visibility to natural selection".[19] Rather, the unit of selection is the phenotype, not the genotype, because it is phenotypes which interact with the environment at the natural-selection interface. So, in Kim Sterelny's summation of Gould's view, "gene differences do not cause evolutionary changes in populations, they register those changes".[20] Richard Dawkins replied to this criticism in a later book, The Extended Phenotype, that Gould confused particulate genetics with particulate embryology, stating that genes do "blend", as far as their effects on developing phenotypes are concerned, but that they do not blend as they replicate and recombine down the generations.[10]

Since Gould's death in 2002, Niles Eldredge has continued with counter-arguments to gene-centered natural selection.[21] Eldredge notes that in Dawkins' book A Devil's Chaplain, which was published just before Eldredge's book, "Richard Dawkins comments on what he sees as the main difference between his position and that of the late Stephen Jay Gould. He concludes that it is his own vision that genes play a causal role in evolution", while Gould (and Eldredge) "sees genes as passive recorders of what worked better than what".[21]

Price equation

The **Price equation** (also known as **Price's equation**) is a covariance equation which is a mathematical description of evolution and natural selection. The Price equation was derived by George R. Price, working in London to rederive W.D. Hamilton's work on kin selection.

Main figures in selection debate

Besides Richard Dawkins and George C. Williams, other biologists and philosophers have expanded and refined the selfish-gene theory, such as John Maynard Smith, George R. Price, Robert Trivers, David Haig, Helena Cronin, David Hull, Philip Kitcher and Daniel C. Dennett.

Individuals opposing this gene-centric view include Ernst Mayr, Stephen Jay Gould, David Sloan Wilson and philosopher Elliott Sober.

Proponents of multilevel selection (MLS) include E.O. Wilson, David Sloan Wilson, Elliott Sober, Richard E. Michod[22] and Samir Okasha.[22]

Notes

Evolutionary psychology controversy

From its beginning, evolutionary psychology (EP) has generated substantial controversy and criticism. Criticisms include 1) disputes about the testability of evolutionary hypotheses, 2) alternatives to some of the cognitive assumptions (such as massive modularity) frequently employed in evolutionary psychology, 3) vagueness stemming from evolutionary assumptions (e.g. uncertainty about the environment of evolutionary adaptation, EEA), 4) differing stress on the importance of non-genetic and non-adaptive explanations, as well as 5) political and ethical issues.

Evolutionary psychologists respond by arguing that many of these criticisms are straw men, are based on a incorrect nature vs. nurture dichotomy, or are based on a misunderstandings of the discipline.

History of the debate

Critics and supporters have debated various aspects of evolutionary psychology. The history of debate from the evolutionary psychology perspective is covered in detail in books by Segerstråle (2000) and Alcock (2001). Also see recent overviews of EP with rebuttals to critics in Confer, et al. (2010), as well as relevant chapters in D. M. Buss (Ed.), The Handbook of Evolutionary Psychology.


Critics of EP have argued that evolutionary psychology is based on misconceptions of biological and evolutionary theory.
Massive modularity

One controversy concerns the particular modularity of mind theory used in evolutionary psychology (massive modularity). Critics, including some psychologists using other evolutionary frameworks, argue in favor of other theories.

Fear and phobias as innate or learnt

Critics have questioned the proposed innateness of certain phobias.[6]

Environment of evolutionary adaptedness

One method employed by evolutionary psychologists is using knowledge of the environment of evolutionary adaptedness to generate hypotheses regarding possible psychological adaptations.

Part of the critique of the scientific base of evolutionary psychology includes a critique of the concept of the environment of evolutionary adaptation (EEA). EP often assumes that human evolution occurred in a uniform environment, and critics suggest that we know so little about the environment (or probably multiple environments) in which homo sapiens evolved, that explaining specific traits as an adaption to that environment becomes highly speculative.[7]

Evolutionary psychologists John Toby and Leda Cosmides state that research is confined to certainties about the past, such as pregnancies only occurring in women, and that humans lived in groups. They argue that there are many environmental features that are known regarding our species' evolutionary history. They argue that our hunter-gatherer ancestors dealt with predators and prey, food acquisition and sharing, mate choice, child rearing, interpersonal aggression, interpersonal assistance, diseases and a host of other fairly predictable challenges that constituted significant selection pressures. Knowledge also include things such as nomadic, kin-based lifestyle in small groups, long life for mammals, low fertility for mammals, long female pregnancy and lactation, cooperative hunting and aggression, tool use, and sexual division of labor.[8]

Testability

A frequent critique of EP is that its hypotheses are difficult or impossible to adequately test, challenging its status as an empirical science. As an example, critics point out that many current traits likely evolved to serve different functions than they do now, confounding attempts to make backward inferences into history.[9] Evolutionary psychologists acknowledge the difficulty of testing their hypotheses but assert it is nevertheless possible.[10]

Critics argue that many hypotheses put forward to explain the adaptive nature of human behavioural traits are "just-so stories"; neat adaptive explanations for the evolution of given traits that do not rest on any evidence beyond their own internal logic. They allege that evolutionary psychology can predict many, or even all, behaviours for a given situation, including contradictory ones. Therefore many human behaviours will always fit some hypotheses. Noam Chomsky argued:

"You find that people cooperate, you say, 'Yeah, that contributes to their genes' perpetuating.' You find that they fight, you say, 'Sure, that's obvious, because it means that their genes perpetuate and not somebody else's. In fact, just about anything you find, you can make up some story for it."

Leda Cosmides argued in an interview [13]:

"Those who have a professional knowledge of evolutionary biology know that it is not possible to cook up after the fact explanations of just any trait. There are important constraints on evolutionary explanation. More to the point, every decent evolutionary explanation has testable predictions about the design of the trait. For example, the hypothesis that pregnancy sickness is a byproduct of prenatal hormones predicts different patterns of food aversions than the hypothesis that it is an adaptation that evolved to protect the fetus from
Evolutionary psychology controversy

pathogens and plant toxins in food at the point in embryogenesis when the fetus is most vulnerable – during the first trimester. Evolutionary hypotheses – whether generated to discover a new trait or to explain one that is already known – carry predictions about the nature of that trait. The alternative – having no hypothesis about adaptive function – carries no predictions whatsoever. So which is the more constrained and sober scientific approach?"

A 2010 review article by evolutionary psychologists describes how an evolutionary theory may be empirically tested. An hypothesis is made about the evolutionary cause of a psychological phenomenon or phenomena. Then the researcher makes predictions that can be tested. This involves predicting that the evolutionary cause will have caused other effects than the ones already discovered and known. Then these predictions are tested. The authors argue numerous evolutionary theories have been tested in this way and confirmed or falsified.[14] Buller (2005) makes the point that the entire field of evolutionary psychology is never confirmed or falsified; only specific hypotheses, motivated by the general assumptions of evolutionary psychology, are testable. Accordingly he views evolutionary psychology as a paradigm rather than a theory, and attributes this view to prominent evolutionary psychologists including Cosmides, Tooby, Buss, and Pinker.[15]

In his review article Discovery and Confirmation in Evolutionary Psychology [16] (in The Oxford Handbook of Philosophy of Psychology) Edouard Machery concludes:

"Evolutionary psychology remains a very controversial approach in psychology, maybe because skeptics sometimes have little first-hand knowledge of this field, maybe because the research done by evolutionary psychologists is of uneven quality. However, there is little reason to endorse a principled skepticism toward evolutionary psychology: Although clearly fallible, the discovery heuristics and the strategies of confirmation used by evolutionary psychologists are on a firm grounding."

**Ethnocentrism**

One aspect of evolutionary psychology is finding traits that have been shown to be universal in humans. Many critics have pointed out that many traits considered universal at some stage or another by evolutionary psychologists and sociobiologists often turn out to be dependent on cultural and particular historical circumstances. Critics allege that evolutionary psychologists tend to assume that their own current cultural context represents a universal human nature; for example, in a review of Steven Pinker's book on evolutionary psychology (The Blank Slate), Louis Menand wrote: "In general, the views that Pinker derives from 'the new sciences of human nature' are mainstream Clinton-era views: incarceration is regrettable but necessary; sexism is unacceptable, but men and women will always have different attitudes toward sex; dialogue is preferable to threats of force in defusing ethnic and nationalist conflicts; most group stereotypes are roughly correct, but we should never judge an individual by group stereotypes; rectitude is all very well, but 'noble guys tend to finish last'; and so on."

[17]

However, evolutionary psychologists point out that their research actually focuses on commonalities between people of different cultures to help to identify "human psychological nature" and cultural universals. It is not a focus on local behavioral variation (which may sometimes be considered ethnocentric) that interests evolutionary psychologists; rather their focus is to find underlying psychological commonalities between people from various cultures.[18]
**Reductionism and determinism**

Some critics view evolutionary psychology as a form of genetic reductionism and determinism.[1]

Evolutionary psychology is in part based on the theory that our psychology is fundamentally based on biology, the composition of our brains. Some see this as a form of reductionism whereby the nature of complex things can be understood in terms of simpler or more fundamental things (i.e. reduced).

Such critics argue that a reductionist analysis of the relationship between genes and behaviour results in a flawed research program and a restricted interpretation of the evidence, creating problems for the creation of models attempting to explain behaviour. Lewontin, Rose & Kamin instead advocate a dialectical interpretation of behaviour in which "it is not just that wholes are more than the sum of their parts, it is that parts become qualitatively new by being parts of the whole."[19] They argue that reductionist explanations such as the hierarchical reductionism proposed by Richard Dawkins will cause the researcher to miss dialectical ones.

Evolutionary psychologists Workman and Reader reply that while reductionism may be a "dirty word" to some it is actually an important scientific principle. They argue it is at the root of discoveries such as the world being made up of atoms and complex life being the result of evolution. At the same time they emphasize that it is important to look at all "levels" of explanations, e.g. both psychologists looking at environmental causes of depression and neuroscientists looking the brain contribute to different aspects of our knowledge of depression. Workman and Reader also deny the accusation of genetic determinism, asserting that genes usually do not cause behaviors absolutely but predispose to certain behaviors that are affected by factors such as culture and an individual's life history.[20]

**Alternative explanations**

**Adaptive explanations vs. environmental, cultural, social, and dialectical explanations**

A common critique is that evolutionary psychology does not address the complexity of individual development and experience and fails to explain the influence of genes on behavior in individual cases.[21]

Critics assert that evolutionary psychology has trouble developing research that can distinguish between environmental and cultural explanation and adaptive evolutionary explanations. Some studies have been criticized for their tendency to attribute to evolutionary processes elements of human cognition that may be attributable to social processes (e.g. preference for particular physical features in mates), cultural artifacts (e.g. patriarchy and the roles of women in society), or dialectical considerations (e.g. behaviours in which biology interacts with society, as when a biologically determined skin colour determines how one is treated). Evolutionary psychologists are frequently criticized for ignoring the vast bodies of literature in psychology, philosophy, politics and social studies. Both sides of the debate stress that statements such as "biology vs. environment" and "genes vs. culture" amount to false dichotomies, and outspoken critics of sociobiology such as Richard Lewontin, Steven Rose and Leon Kamin helped to popularise a "dialectical" approach to questions of human behaviour, where biology and environment interact in complex ways to produce what we see.[22]

Evolutionary psychologists respond that their discipline is not primarily concerned with explaining the behavior of specific individuals, but rather broad categories of human behaviors across societies and cultures. It is the search for species-wide psychological adaptations (or "human nature") that distinguishes evolutionary psychology from purely cultural or social explanations. These psychological adaptations include cognitive decision rules that respond to different environmental, cultural, and social circumstances in ways that are (on average) adaptive.

Evolutionary psychologists Confer et al. argue the evolutionary psychology fully accept nature-nurture interactionism and that it possible to test the theories in order to distinguish between different explanations.[14]
Adaptive explanations vs. other evolutionary mechanisms

Critics point out that within evolutionary biology there are many other non-adaptive pathways along which evolution can move to produce the behaviors seen in humans today. Natural selection is not the only evolutionary process that can change gene frequencies and produce novel traits. Genetic drift refers to random effects resulting from chance variation in the genes, environment, or development. Evolutionary by-products are traits that were not specially designed for an adaptive function, although they may also be species-typical and may also confer benefits on the organism. A "spandrel" is a term coined by Gould and Lewontin (1979a) for traits which confer no adaptive advantage to an organism, but are 'carried along' by an adaptive trait. Gould advocates the hypothesis that cognition in humans came about as a spandrel: "Natural selection made the human brain big, but most of our mental properties and potentials may be spandrels - that is, nonadaptive side consequences of building a device with such structural complexity".[23]

Once a trait acquired by some other mechanism confers an adaptive advantage, as evolutionary psychologists argue that many of our "mental properties and potentials" do, it may be open to further selection as an "exaptation". Critics allege that the adaptive (and exaptive) significance of mental traits studied by evolutionary psychologists has not been shown, and that selection has not necessarily guided the appearance of such traits.

Evolutionary psychologists suggest that critics mischaracterize their field, and that their empirical research is designed to help identify which psychological traits are likely to adaptations, and which are not.[24]

Disjunction and grain problems

Some have argued that even if the theoretical assumptions of evolutionary psychology turned out to be true, it would nonetheless lead to methodological problems that would compromise its practice.[25] The disjunction and grain problems are argued to create methodological challenges related to the indeterminacy of evolutionary psychology's adaptive functions. That is, the inability to correctly choose, from a number of possible answers to the question: "what is the function of a given mechanism?".[25]

The disjunction problem[25] occurs when a mechanism appears to respond to one thing (F), but is also correlated with another (G). Whenever F is present, G is also present, and the mechanism seems to respond to both F and G. The difficulty thus involves deciding whether to characterize the mechanism's adaptive function as being related to F, G, or both. "For example, a frogs pre-catching mechanism responds to flies, bees, food pellets, etc.; so is its adaptation attuned to flies, bees, fleebees, pellets, all of these, or just some?"[25]

The grain problem[25] refers to the challenge in knowing what kind of environmental 'problem' an adaptive mental mechanism might have solved. As summarized by Sterenly & Griffiths (1999): "What are the problems 'out there' in the environment? Is the problem of mate choice a single problem or a mosaic of many distinct problems? These problems might include: When should I be unfaithful to my usual partner? When should I desert my old partner? When should I help my sibs find a partner? When and how should I punish infidelity?"[29] The grain problem therefore refers to the possibility that an adaptive problem may actually involve a set of nested 'sub-problems' "which may themselves relate to different input domains or situations. Franks states that "if both adaptive problems and adaptive solutions are indeterminate, what chance is there for evolutionary psychology?"[25]

Franks also states that "The arguments in no sense count against a general evolutionary explanation of psychology," and that by relaxing assumptions the problems may be avoided, although this may reduce the ability to make detailed models."[25]
Behaviors that reduce reproductive success

Behaviors such as homosexuality and suicide seem to reduce reproductive success and pose a challenge for evolutionary psychology. Evolutionary psychologists have proposed explanations, such that there may be reproductive benefits for relatives or that they may be byproducts of adaptive behaviors that usually increase reproductive success but a review by Confer et al. states that they "remain at least somewhat inexplicable on the basis of current evolutionary psychological accounts."[14]

Political and ethical issues

That human psychology may be determined by our biology, which is shaped by our evolutionary past, is an important idea for those involved in ethics. The implications are as broad and varied as the field of ethics itself.

"Is" and "ought"

Part of the controversy has consisted in each side accusing the other of holding or supporting extreme political viewpoints: evolutionary psychology has often been accused of supporting right wing politics, whereas critics have been accused of being motivated by Marxist viewpoints.[7][30]

Many critics have alleged that evolutionary psychology and sociobiology are nothing more than political justifications for the "status quo." Evolutionary psychologists have been accused of conflating "is" and "ought", and evolutionary psychology has been used to argue against social change (because the way things are now has been evolved and adapted), and to argue against social justice (e.g. the argument that the rich are only rich because they've inherited greater abilities, so programs to raise the standards of the poor are doomed to fail).[31]

In rebuttal, Glenn Wilson, a pioneer of EP, "promoting recognition of the true power and role of instincts is not the same as advocating the total abandonment of social restraint."[32] Left-wing philosopher Peter Singer in his book A Darwinian Left has argued that the view of human nature provided by evolution is compatible with and should be incorporated into the ideological framework of the Left.

Evolutionary psychology critics have argued that researchers use their research to promote a right-wing agenda. Evolutionary psychologists conducted a 2007 study investigating the views of a sample of 168 United States PhD psychology students. The authors concluded that those who self-identified as adaptationists were much less conservative than the general population average. They also found no differences compared to non-adaptationist students and found non-adaptationists to express a preference for less strict and quantitative scientific methodology than adaptationists.[33]

The book The Blank Slate by Steven Pinker responded to many of the moral and political criticisms. He also describes two logical fallacies. "The naturalistic fallacy is the idea that what is found in nature is good. It was the basis for Social Darwinism, the belief that helping the poor and sick would get in the way of evolution, which depends on the survival of the fittest. Today, biologists denounce the Naturalistic Fallacy because they want to describe the natural world honestly, without people deriving morals about how we ought to behave -- as in: If birds and beasts engage in adultery, infanticide, cannibalism, it must be OK)."

"The moralistic fallacy is that what is good is found in nature. It lies behind the bad science in nature-documentary voiceovers: lions are mercy-killers of the weak and sick, mice feel no pain when cats eat them, dung beetles recycle dung to benefit the ecosystem and so on. It also lies behind the romantic belief that humans cannot harbor desires to kill, rape, lie, or steal because that would be too depressing or reactionary."[34]

Evolutionary psychology has been criticized by some feminists, such as Tang-Martinez, as justifying rape.[35] Evolutionary psychologists McKibbin et al. argue that this is a fallacy in the same way it would be a fallacy to accuse the scientists doing research on the causes of cancer of justifying cancer. Instead, they argue that understanding the causes of rape may help create preventive measures.[35]

For more discussion of these issues, see Confer, et al., (2010).[14]
Notes

Further reading

Books and book chapters

- Malik, K. (2002). *Man, beast, and zombie: What science can and cannot tell us about human nature*
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Articles


Evolutionary psychology controversy


**Other documents**
- Geher, G (http://www.glenngeher.com). (2006). Evolutionary psychology is not evil! ... and here's why ... Psihologijske Teme (Psychological Topics); Special Issue on Evolutionary Psychology, 15, 181-202. (http://www2.newpaltz.edu/~geherg/ep_not_evil.pdf)
• Evolutionary Psychology Under Attack (http://www.cognitionandculture.net/index.php?option=com_content&view=article&id=471:evolutionary-psychology-under-attack&catid=29:dan&Itemid=34) by Dan Sperber


**Online videos**

• TED talk (http://www.ted.com/index.php/talks/steven_pinker_chalks_it_up_to_the_blank_slate.html) by Steven Pinker about his book *The Blank Slate: The Modern Denial of Human Nature*

• Margaret Mead and Samoa (http://video.google.com/videoplay?docid=4165874976901589227&q=margaret+mead+and+samoa&total=8&start=0&num=10&so=0&type=search&plindex=0). Review of the nature vs. nurture debate triggered by Mead's book "Coming of Age in Samoa."

• Secrets of the Tribe (http://vimeo.com/18751423) Documents the conflicts between cultural and evolutionary anthropologists who have studied the Yanomamo tribes.

• The Norwegian "Brainwash" series examines the very different perceptions and theoretical orientations of cultural determinists and evolutionary adaptationists. Note: the password to view these is "hjernevask" (no capital letters, no quotes).
  * The Gender Equality Paradox (http://vimeo.com/19707588)
  * The Parental Effect (http://vimeo.com/19893826)
  * Violence (http://vimeo.com/19921232)
  * Sex (http://vimeo.com/19921928)
  * Nature or Nurture (http://vimeo.com/19889788)
Effects explained by evolutionary psychology
Cognitive

Modularity of mind

Modularity of mind is the notion that a mind may, at least in part, be composed of separate innate structures which have established evolutionarily developed functional purposes. Somewhat different definitions of "module" have been proposed by different authorities.

Early investigations

Historically, questions regarding the functional architecture of the mind have been divided into two different theories of the nature of the faculties. The first can be characterized as a horizontal view because it refers to mental processes as if they are interactions between faculties such as memory, imagination, judgement, and perception, which are not domain specific (e.g., a judgement remains a judgement whether it refers to a perceptual experience or to the comprehension of language). The second can be characterized as a vertical view because it claims that the mental faculties are differentiated on the basis of domain specificity, are genetically determined, are associated with distinct neurological structures, and are computationally autonomous.

The vertical vision goes back to the 19th century movement called phrenology and its founder Franz Joseph Gall, who claimed that the individual mental faculties could be associated precisely, in a sort of one to one correspondence, with specific physical areas of the brain. Hence, someone's level of intelligence, for example, could be literally "read off" from the size of a particular bump on his posterior parietal lobe. This simplistic view of modularity has been disproven over the course of the last century.

Fodor's Modularity of Mind

In the 1980s, however, Jerry Fodor revived the idea of the modularity of mind, although without the notion of precise physical localizability. Drawing from Noam Chomsky's idea of the language acquisition device and other work in linguistics as well as from the philosophy of mind and the implications of optical illusions, he became one of its most articulate proponents with the 1983 publication of Modularity of Mind.\[1\]

According to Fodor, a module falls somewhere between the behaviorist and cognitivist views of lower-level processes.

Behaviorists tried to replace the mind with reflexes which Fodor describes as encapsulated (cognitively impenetrable or unaffected by other cognitive domains) and non-inferential (straight pathways with no information added). Low level processes are unlike reflexes in that they are inferential. This can be demonstrated by poverty of the stimulus arguments in which the proximate stimulus, that which is initially received by the brain (such as the 2D image received by the retina), cannot account for the resulting output (for example, our 3D perception of the world), thus necessitating some form of computation.

In contrast, cognitivists saw lower level processes as continuous with higher level processes, being inferential and cognitively penetrable (influenced by other cognitive domains, such as beliefs). The latter has been shown to be untrue in some cases, such as with many visual illusions (ex. Müller-Lyer illusion), which can persist despite a person's awareness of their existence. This is taken to indicate that other domains, including one's beliefs, cannot influence such processes.

Fodor arrives at the conclusion that such processes are inferential like higher order processes and encapsulated in the same sense as reflexes.
Although he argued for the modularity of "lower level" cognitive processes in *Modularity of Mind* he also argued that higher level cognitive processes are not modular since they have dissimilar properties. *The Mind Doesn't Work That Way*, a reaction to Steven Pinker's *How the Mind Works*, is devoted to this subject.

Fodor (1983) states that modular systems must—at least to "some interesting extent"—fulfill certain properties:

1. Domain specificity, modules only operate on certain kinds of inputs—they are specialised
2. Informational encapsulation, modules need not refer to other psychological systems in order to operate
3. Obligatory firing, modules process in a mandatory manner
4. Fast speed, probably due to the fact that they are encapsulated (thereby needing only to consult a restricted database) and mandatory (time need not be wasted in determining whether or not to process incoming input)
5. Shallow outputs, the output of modules is very simple
6. Limited accessibility
7. Characteristic ontogeny, there is a regularity of development
8. Fixed neural architecture.

Pylyshyn (1999) has argued that while these properties tend to occur with modules, one stands out as being the real signature of a module; that is the encapsulation of the processes inside the module from both cognitive influence and from cognitive access. This is referred to as "information encapsulation". One example is that conscious awareness of the Müller-Lyer illusion being an illusion does not correct the visual processing.

**Evolutionary psychology and Massive Modularity**

Other perspectives on modularity come from evolutionary psychology, particularly from the work of Leda Cosmides and John Tooby. This perspective suggests that modules are units of mental processing that evolved in response to selection pressures. On this view, much modern human psychological activity is rooted in adaptations that occurred earlier in human evolution, when natural selection was forming the modern human species.

Evolutionary psychologists propose that the mind is made up of genetically influenced and domain-specific, mental algorithms or computational modules, designed to solve specific evolutionary problems of the past. Cosmides and Tooby also state in a brief "primer" on their website, that “...the brain is a physical system. It functions like a computer,” “…the brain’s function is to process information,” “different neural circuits are specialized for solving different adaptive problems,” and “our modern skulls house a stone age mind.”

The definition of *module* has caused confusion and dispute. J. A. Fodor initially defined module as "functionally specialized cognitive systems" that have nine features but not necessarily all at the same time. In his views modules can be found in peripheral processing such as low-level visual processing but not in central processing. Later he narrowed the two essential features to domain-specificity and information encapsulation. Frankenhuis and Ploeger write that domain-specificity means that "a given cognitive mechanism accepts, or is specialized to operate on, only a specific class of information". Information encapsulation means that information processing in the module cannot be affected by information in the rest of the brain. One example being awareness that certain optical illusion, caused by low level processing, are false not preventing the illusions from persisting.

Evolutionary psychologists instead usually define modules as functionally specialized cognitive systems that are domain-specific and may also contain innate knowledge about the class of information processed. Modules can be found also for central processing. This theory is sometimes referred to as *Massive Modularity*.

Several groups of critics, including psychologists working within evolutionary frameworks, argue that the massively modular theory of mind does little to explain adaptive psychological traits. Proponents of other models of the mind argue that the computational theory of mind is no better at explaining human behavior than a theory with mind entirely a product of the environment. Even within evolutionary psychology there is discussion about the degree of modularity, either as a few generalist modules or as many highly specific modules.
Wallace (2010) observes that the evolutionary psychologists' definition of 'mind' have been heavily influenced by cognitivism and/or information processing definitions of the mind. Critics point out that these assumptions underlying Evolutionary Psychologists’ hypotheses are controversial and have been contested by some psychologists, philosophers, and neuroscientists. For example, Jaak Panksepp, an affective neuroscientist, point to the "remarkable degree of neocortical plasticity within the human brain, especially during development" and states that "the developmental interactions among ancient special-purpose circuits and more recent general-purpose brain mechanisms can generate many of the 'modularized' human abilities that evolutionary psychology has entertained."[7]

Philosopher David Buller agrees with the general argument that the human mind has evolved over time but disagree with the specific claims evolutionary psychologists make. Buller has argued that the contention that the mind consists of thousands of modules, including sexually dimorphic jealousy and parental investment modules, are unsupported by the available empirical evidence. However, Buller has also stated that even if massive modularity is false this does not necessarily have broad implications for evolutionary psychology. Evolution may create innate motives even without innate knowledge.[11]

There are alternatives to the "massively modular" view of the mind. Donald argues that over evolutionary time the mind has gained adaptive advantage from being a general problem solver. The mind, as described by Donald, includes module-like "central" mechanisms, in addition to more recently evolved "domain-general" mechanisms. A 2010 review by evolutionary psychologists stated that a theory of one or a few domain-general mechanisms such as "rationality" has several problem: 1. Evolutionary theories using the idea of numerous domain-specific adaptions have produced testable predictions that have been empirically confirmed; the theory of domain-general rational thought has produced no such predictions or confirmations. 2. The rapidity of responses such as jealousy due to infidelity indicates a domain-specific dedicated module rather than a general, deliberate, rational calculation of consequences. 3. Reactions may occur instinctively (consistent with innate knowledge) even if a person have not learned such knowledge. One example being that in the ancestral environment it is unlikely that males during development learn that infidelity (usually secret) may cause paternal uncertainty (from observing the phenotypes of children born many months later and making a statistical conclusion from the phenotype dissimilarity to the cuckolded fathers).[13]

For some research done to address these criticisms, see Daly and Wilson's response to Buller's criticism above, and Bryant (2006) On Hasty Generalization About Evolutionary Psychology. With respect to general purpose problem solvers, see Barkow, Cosmides, and Tooby (1992) The Adapted Mind: Evolutionary Psychology and The Generation of Culture for their argument that a purely general problem solving mechanism is impossible to build due to the frame problem.

Arguments against modularity

In contrast to modular mental structure, some theories posit domain-general processing, in which mental activity is distributed across the brain and cannot be decomposed, even abstractly, into independent units. A staunch defender of this view is William Uttal, who argues in The New Phrenology (2003) that there are serious philosophical, theoretical, and methodological problems with the entire enterprise of trying to localise cognitive processes in the brain. Part of this argument is that a successful taxonomy of mental processes has yet to be developed.
References

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[14] (http://psych.mcmaster.ca/dalywilson/reply to david buller.pdf)

Further reading


Online videos

- Stone Age Minds: A conversation with evolutionary psychologists Leda Cosmides and John Tooby (http://www.youtube.com/watch?v=nNW_B8EwgH4)
Agent detection

**Agent detection** is the inclination for animals and humans to presume the purposeful intervention of a sentient or intelligent agent in situations that may or may not involve an intelligent agent.

**Evolutionary origins**

It is believed that humans evolved agent detection as a survival strategy. In situations where one is unsure of the presence of an intelligent agent (such as an enemy or a predator), there is survival value in assuming its presence so that precautions can be taken. For example, if a human came across an indentation in the ground that might be a lion's footprint, it is advantageous to err on the side of caution and assume that the lion is present.[1]

Psychologists Kurt Gray and Daniel Wegner wrote:

> "The high cost of failing to detect agents and the low cost of wrongly detecting them has led researchers to suggest that people possess a Hyperactive Agent Detection Device, a cognitive module that readily ascribes events in the environment to the behavior of agents." [2]

**Role in religion**

Some scientists believe that the belief in creator gods is an evolutionary by-product of agent detection.[3] A spandrel is a non-adaptive trait formed as a side effect of an adaptive trait. The psychological trait in question is "if you hear a twig snap in the forest, some sentient force is probably behind it". This trait prevents the primate from being murdered or eaten as food. However this hypothetical trait could remain in modern humans: thus some evolutionary psychologists theorize that "even if the snapping was caused by the wind, modern humans are still inclined to attribute the sound to a sentient agent; they call this person a god."[4]

Kurt and Wegner also said that agent detection is likely to be a "foundation for human belief in God" but "simple overattribution of agency cannot entirely account for the belief in God..." because Theory of Mind and what they refer to as "existential theory of mind" are also required to "give us the basic cognitive capacity to conceive of God." [2]

**References**


Biophilia hypothesis

The **biophilia hypothesis** suggests that there is an instinctive bond between human beings and other living systems. Edward O. Wilson introduced and popularized the hypothesis in his book entitled *Biophilia*.¹

**Love of living systems**

The term "biophilia" literally means "love of life or living systems." It was first used by Erich Fromm to describe a psychological orientation of being attracted to all that is alive and vital.² Wilson uses the term in the same sense when he suggests that biophilia describes "the connections that human beings subconsciously seek with the rest of life." He proposed the possibility that the deep affiliations humans have with nature are rooted in our biology. Unlike phobias, which are the aversions and fears that people have of things in the natural world, philias are the attractions and positive feelings that people have toward certain habitats, activities, and objects in their natural surroundings.

To many people, "nature" means plants as in a park or forest, but the weather and animals are also closely involved. In the book *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations* edited by Peter Kahn and Stephen Kellert,³ the importance of animals, especially those with which a child can develop a nurturing relationship, is emphasised particularly for early and middle childhood. Chapter 7 of the same book reports on the help that animals can provide to children with autistic-spectrum disorders.⁴

**Product of biological evolution**

Human preferences toward things in nature, while refined through experience and culture, are hypothetically the product of biological evolution. For example, adult mammals (especially humans) are generally attracted to baby mammal faces and find them appealing across species. The large eyes and small features of any young mammal face are far more appealing than those of the mature adults. The biophilia hypothesis suggests that the positive emotional response that adult mammals have toward baby mammals across species helps increase the survival rates of all mammals.

Similarly, the hypothesis helps explain why ordinary people care for and sometimes risk their lives to save domestic and wild animals, and keep plants and flowers in and around their homes. In other words, our natural love for life helps sustain life.

**Development**

The hypothesis has since been developed as part of theories of evolutionary psychology in the book *The Biophilia Hypothesis* edited by Stephen R. Kellert and Edward O. Wilson⁵ and by Lynn Margulis. Also, Stephen Kellert’s work seeks to determine common human responses to perceptions of, and ideas about, plants and animals, and to explain them in terms of the conditions of human evolution.

**References**

Reciprocal altruism

In evolutionary biology, reciprocal altruism is a behaviour whereby an organism acts in a manner that temporarily reduces its fitness while increasing another organism's fitness, with the expectation that the other organism will act in a similar manner at a later time. The concept was initially developed by Robert Trivers to explain the evolution of cooperation as instances of mutually altruistic acts. The concept is close to the strategy of "tit for tat" used in game theory.

Theory

The concept of "reciprocal altruism", as introduced by Trivers, suggests that altruism, defined as an act of helping someone else although incurring some cost for this act, could have evolved since it might be beneficial to incur this cost if there is a chance of being in a reverse situation where the person whom I helped before may perform an altruistic act towards me. Putting this into the form of a strategy in a repeated prisoner’s dilemma would mean to cooperate unconditionally in the first period and behave cooperatively (altruistically) as long as the other agent does as well. If chances of meeting another reciprocal altruist are high enough or the game is repeated for a long enough amount of time, this form of altruism can evolve within a population. This is very close to the notion of "tit for tat" introduced by Anatol Rapoport, although there still seems a slight distinction in that "tit for tat" cooperates in the first period and from thereon always replicates an opponent’s previous action, whereas “reciprocal altruists” stop cooperation in the first instance of non-cooperation by an opponent and stay non-cooperative from thereon. This distinction leads to the fact that in contrast to reciprocal altruism, tit for tat may be able to restore cooperation under certain conditions despite cooperation having broken down.

Stephens shows a set of necessary and jointly sufficient conditions “…for an instance of reciprocal altruism:

1. the behaviour must reduce a donor's fitness relative to a selfish alternative;
2. the fitness of the recipient must be elevated relative to non-recipients;
3. the performance of the behaviour must not depend on the receipt of an immediate benefit;
4. conditions 1, 2, and 3 must apply to both individuals engaging in reciprocal helping.”

There are two additional conditions necessary “…for reciprocal altruism to evolve:

1. A mechanism for detecting 'cheaters' must exist.
2. A large (indefinite) number of opportunities to exchange aid must exist.”
The first two conditions are necessary for altruism as such, while the third is distinguishing reciprocal altruism from simple mutualism and the fourth makes the interaction reciprocal. Condition number five is required as otherwise non-altruists may always exploit altruistic behaviour without any consequences and therefore evolution of reciprocal altruism would not be possible. However, it is pointed out that this "conditioning device" does not need to be conscious. Condition number six is required to avoid cooperation breakdown through backwards induction—a possibility suggested by game theoretical models.[2]

Examples
The following examples could be understood as altruism. However, showing reciprocal altruism in an unambiguous way requires more evidence as will be shown later.

Cleaner fish
The first example is that of the cleaner fish. Aside from the mutuality and the clear advantageous symbiosis of the cleaner and the host, which cannot be interpreted in terms of altruism, the host displays some additional behaviour that meets the criteria for altruism: The host allows the cleaner free entrance and exit and does not eat the cleaner, even after the cleaning is done.[3] [4] [5] [6] The host signals the cleaner it is about to depart the cleaner's locality, even when the cleaner is not in its body. The host may chase off possible dangers to the cleaner.[6]

The following evidence supports the hypothesis:

- The cleaning by cleaners is essential for the host. In the absence of cleaners the hosts leave the locality or suffer from injuries done by ecto-parasites.[7] Difficulty and danger in finding a cleaner. Hosts leave their element to get cleaned.[6] Others wait no longer than 30 seconds before searching for cleaners elsewhere.[3]
- A key element in the establishment of reciprocal altruism is that the same two individuals interact repeatedly. This is conditioned by site specifics of either individuals (spatial condition) and by a large enough lifespan of the species (temporal condition). Surprisingly there is sufficient evidence that individual cleaners and hosts indeed interact repeatedly.[5] [7] [8]

This example meets the criteria that are described in Robert Trivers’ model. However, some important elements, which are essential to establish reciprocity, are not yet shown: The criterion that an individual doesn’t expect an immediate payment. In the cleaner-host system the benefit for a cleaner is always immediate. The criterion that failing of one individual to act altruistically will cause the other one to avoid future altruistic acts. This will be very hard to show since such failure will mean death of the cleaner.

If Randall’s claim that the host may chase off possible dangers to the cleaner will be proved right, an experiment might be constructed in which reciprocity could be demonstrated.[5]

Warning calls in birds
Warning calls, although exposing a bird and putting it in danger, are frequently given by birds. An explanation in terms of altruistic behaviour is given by Trivers:

- It has been shown that predators learn specific localities and specialize individually on prey types and hunting techniques.[9] [10] [11] [12] It is therefore disadvantageous for a bird to have a predator eat a conspecific, because the experienced predator may then be more likely to eat him. Alarming another bird by giving a warning call tends to prevent predators from specializing on the caller’s species and locality. In this way, birds in areas in which warning calls are given will be at a selective advantage relative to birds in areas free from warning calls.

Nevertheless, this presentation lacks important elements of reciprocity. It is very hard to detect cheaters. Also, there is no evidence that a bird refrains from giving calls when another bird is not reciprocating. And there is no evidence that individuals interact repeatedly.
Another explanation for warning calls is that these are not warning calls at all: A bird, once it has detected a bird of prey, calls to signal to the bird of prey that it was detected, and that there is no use trying to attack the calling bird. Two facts support this hypothesis:

- The call frequencies match the hearing range of the predator bird.
- Calling birds are less attacked—predator birds attack calling birds less frequently than other birds.

**Vampire bats**

Vampire bats also display reciprocal altruism, as described by Wilkinson. The bats feed each other by regurgitating blood. To qualify for reciprocal altruism, the benefit to the receiver would have to be larger than the cost to the donor. This seems to hold as these bats usually die if they do not find a blood meal two nights in a row. Also, the requirement that individuals who have behaved altruistically in the past are helped by others in the future is confirmed by the data. However, the consistency of the reciprocal behaviour, namely that a previously non-altruistic bat is refused help when it requires it, has not been demonstrated. Therefore, the bats do not seem to qualify yet as an example for reciprocal altruism. However, a closer look at the data shows that - except for a single interaction - all instances of feeding happened between individuals of the same group, who are on average cousins. Thus, it seems much more probable that this example is a case of kin selection than reciprocal altruism.

**Known emotional dispositions as a complex regulating system for reciprocal altruism**

The human altruistic system is a sensitive and unstable one. Therefore, the tendency to give, to cheat, and the response to other’s acts of giving and cheating must be regulated by a complex psychology in each individual. Individuals differ in the degree of these tendencies and responses. According to Trivers the following emotional dispositions and their evolution can be understood in terms of regulation of altruism.

- Friendship and emotions of liking and disliking.
- Moralistic aggression. A protection mechanism from cheaters acts to regulate the advantage of cheaters in selection against the altruists. The moralistic altruist may want to educate or even punish a cheater.
- Gratitude and sympathy. A fine regulation of altruism can be associated with gratitude and sympathy in terms of cost/benefit and the level in which the beneficiary will reciprocate.
- Guilt and repetitive altruism. Prevents the cheater from cheating again. The cheater shows his regret in order to save him from paying too dearly for his acts.
- Subtle cheating. A stable evolutionary equilibrium could include a low percentage of mimics in controversial support of adaptive sociopathy.
- Trust and suspicion. These are regulators for cheating and subtle cheating.
- Partnerships. Altruism with the purpose of creating friendships.

However, it is to be noted that there have been few theoretical and experimental research that assess the importance of reciprocal partner choice; it is known that theoretical models of the evolution of altruism by reciprocal partner choice are rare, mostly due to difficulties of ‘payoffs' between multiple individuals.
References


Cognitive description

A cognitive description is a term used in psychology to describe the cognitive workings of the human mind. A cognitive description specifies what kinds of information is input to a cognitive action, how this information is processed and transformed, what data structures are used and what behaviour is generated.[1]

References

Social

Cognitive fluidity

Cognitive fluidity is a term first popularly applied by Steven Mithen in his book *The Prehistory of the Mind*, a search for the origins of Art, Religion and Science.

The term cognitive fluidity describes how a modular primate mind has evolved into the modern human mind by combining different ways of processing knowledge and using tools to create a modern civilization. By arriving at original thoughts, which are often highly creative and rely on metaphor and analogy modern humans differ from archaic humans. As such, cognitive fluidity is a key element of the human attentive consciousness. The term has been principally used to contrast the mind of modern humans, especially those after 50,000 B.P. (before present), with those of archaic humans such as Neanderthals and Homo erectus. The latter appear to have had a mentality that was original domain-specific in structure; a series of largely isolated cognitive domains for thinking about the social, material, and natural worlds. These are termed “Swiss penknife minds” with a set of special modules for specific domains such as Social, Natural history, General, Technical and Language intelligence. With the advent of modern humans the barriers between these domains appear to have been largely removed in the attentive mode and hence cognition became more fluid. Consciousness is of course attentive and self-reflective, and the role of the modular intelligences in neurological “Default mode” is a topic for current research in self-reflective human consciousness.

External links

- The Prehistory of the Mind The Cognitive Origins of Art, Religion and Science By Steven Mithen Reviewed by Andy Gorman [1]

References

Cognitive module

A cognitive module is, in theories of the modularity of mind and the closely related society of mind theory, a specialised tool or sub-unit that can be used by other parts to resolve cognitive tasks. The question of their existence and nature is a major topic in cognitive science and evolutionary psychology. Some see cognitive modules as an independent part of the mind. Others also see new thought patterns achieved by experience as cognitive modules.

Other theories similar to the cognitive module are cognitive description, cognitive pattern and psychological mechanism. Such a mechanism, if created by evolution, is known as evolved psychological mechanism.

Examples

Some examples of cognitive modules:

- The modules controlling your hands when you ride a bike, to stop it from crashing, by minor left and right turns
- The modules that allow a basketball player to accurately put the ball into the basket by tracking ballistic orbits.
- The modules that recognise hunger and tell you that you need food.
- The modules that cause you to appreciate a beautiful flower, painting or person
- The modules that make humans very efficient in recognising faces, already shown in two-month-old babies.
- The modules that cause some humans to be jealous of their partners' friends.
- The modules that compute the speeds of incoming vehicles and tells you if you have time to cross without crashing into said vehicles.
- The modules that cause parents to love and care for their children.
- The libido modules.
- Modules that specifically discern the movements of animals.
- The fight or flight reflex choice modules.

Psychological disorders – cognitive modules run amok

Many common psychological and personality disorders are caused by cognitive modules running amok.

Jealousy: A common cause of unnecessary conflict in relations is that a man is jealous of a woman's previous sexual partners before she met him. All people are born with a basic jealousy cognitive module, developed through as evolutionary strategy in order to safeguard a mate and trigger aggression towards competitors to ensure paternity and prevent bastards. If this module is activated to too strong a degree, it becomes a personality disorder.

Stalking: An extreme psychological disorder related to jealousy is stalking. A stalker is a person (usually a man) who behaves as if he had a relation to another person (usually a woman) who is not interested in him. There are also women who stalk men, men who stalk men and women who stalk women, but most common is a man stalking a woman. In modern western culture this behaviour is strongly frowned upon.

Paranoia: Being suspicious of fellow human beings is a trait to safeguard against perceived, secret plots against us, a basic human cognitive module useful for survival. But in some people, this turns into unreasonable suspiciousness where there is in reality no plotting against one. Such behaviour is by psychiatrists labeled as paranoid schizophrenia or in milder forms as paranoid personality disorder. These disorders thus occur when the suspiciousness cognitive module is triggered too often and too strongly for triggers that would not trigger this module in normal people.

Obsessive-compulsive disorder: In this quite common disorder, a person will repeatedly check, for example, that a door is locked. One may repeatedly wash hands or other body parts, sometimes for hours, to ensure cleanliness. Again, this disorder is a malfunction of a normal adaptation in all humans to check that a door is locked, to wash to
A cognitive module developed to solve a particular problem can sometimes crop up in other situations where it is not appropriate. One may be angry at one's boss, but take the anger out on one's fellow man. Often, the transference is unconscious (see also Subconscious mind and Unconscious mind). In psychotherapy, the patient is made aware of this, which makes it easier to modify the unsuitable behaviour.

Sigmund Freud's theory of sublimation: said that cognitive modules for some activities, such as sex, may incorrectly show up in disguise in cases where they are not suitable. Freud also introduced the idea of the unconscious, which interpreted as cognitive modules where a person is not aware of the initial cause of these modules and may use them inappropriately.

Schizophrenia: is a psychotic disorder where cognitive modules are triggered too often, overwhelming the brain with information. The inability to repress overwhelming information is a cause of schizophrenia.

Treatment of cognitive module psychological disorders
Cognitive therapy is a psychotherapeutic method that helps people better understand the cognitive modules cause them to do certain things, and to teach them alternative, more appropriate cognitive modules to use instead in the future.

Psychoanalytic view of cognitive modules
According to psychoanalytic theory, many cognitive modules are unconscious and repressed, to avoid mental conflicts. Defenses are meant to be cognitive modules used to suppress the awareness of other cognitive modules. Unconscious cognitive modules may influence our behaviour without our being aware of it.

Evolutionary psychology view of cognitive modules
In the research field of evolutionary psychology it is believed that some cognitive modules are inherited and some are created by learning, but the creation of new modules by learning is often guided by inherited modules.

For example, the ability to drive a car or throw a basket-ball are certainly learned and not inherited modules, but they may make use of inherited modules to rapidly compute trajectories.

There is some disagreement between different social scientists on the importance to the capabilities of the human mind of inherited modules. Evolutionary psychologists claim that other social scientists do not accept that some modules are partially inherited, other social scientists claim that evolutionary psychologists are exaggerating the importance of inherited cognitive modules.

Memory and creative thought
A very important aspect of how humans think is the ability, when encountering a situation or problem, to find more or less similar, but not identical, experiences or cognitive modules. This can be compared to what happens if you sound a tone near a piano. The piano string corresponding to this particular tone will then vibrate. But also other strings, from nearby strings, will vibrate to a lesser extent.

Exactly how the human mind does this is not known, but it is believed that when you encounter a situation or problem, many different cognitive modules are activated at the same time, and the mind selects those most useful for understanding a new situation or solving a new problem.
Ethics and law

Most law-abiding people have cognitive modules that stop them from committing crimes. Criminals have different modules, causing criminal behaviour. Thus, cognitive modules can be a cause of both ethical and unethical behaviour.[39]

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This article is based on an article in Web4Health.[40]

[26] Diagnostic and Statistical Manual of Mental Disorders - DSM-IV, American Psychiatric Association 1994 page 287
[27] Diagnostic and Statistical Manual of Mental Disorders - DSM-IV, American Psychiatric Association 1994 pages 634ff
[29] Diagnostic and Statistical Manual of Mental Disorders - DSM-IV, American Psychiatric Association 1994 pages 417ff
The Cinderella effect is a term used by psychologists to describe the high incidence of stepchildren being physically abused, emotionally abused, sexually abused, neglected, murdered, or otherwise mistreated at the hands of their stepparents at significantly higher rates than at the hands of their genetic parents. It takes its name from the fairy tale character Cinderella, who in the story was cruelly mistreated by her stepmother and stepsisters.

The effect has been called "one of the poster-children of evolutionary psychology."[1]

Background

In the early 1970s, a theory arose on the connection between stepparents and child maltreatment. "In 1973, forensic psychiatrist P. D. Scott summarized information on a sample of 'fatal battered-baby cases' perpetrated in anger (...) 15 of the 29 killers – 52% – were stepfathers."[2] Although initially there was no analysis of this raw data, empirical evidence has since been collected on what is now called the Cinderella effect through official records, reports, and census.

For over 30 years, data has been collected regarding the validity of the Cinderella effect, with a wealth of evidence indicating a direct relationship between step-relationships and abuse. This evidence of child abuse and homicide comes from a variety of sources including official reports of child abuse, clinical data, victim reports, and official homicide data.[3] Studies have concluded that "stepchildren in Canada, Great Britain, and the United States indeed incur greatly elevated risk of child maltreatment of various sorts, especially lethal beatings".[4] Studies have found that not biologically related parents are up to a hundred times more likely to kill a child than biological parents.[5]

Powerful evidence in support of the Cinderella effect comes from the finding that when abusive parents have both step and genetic children, they generally spare their genetic children. In such families, stepchildren were exclusively targeted 9 out of 10 times in one study and in 19 of 22 in another.[6] In addition to displaying higher rates of negative behaviors (e.g., abuse) toward stepchildren, stepparents display fewer positive behaviors toward stepchildren than do the genetic parents. For example, on average, stepparents invest less in education, play with stepchildren less, take stepchildren to the doctor less, etc.[6] This discrimination against stepchildren is unusual compared to abuse statistics involving the overall population given "the following additional facts: (1) when child abuse is detected, it is often found that all the children in the home have been victimized; and (2) stepchildren are almost always the eldest children in the home, whereas the general (...) tendency in families of uniform parentage is for the youngest to be most frequent victims."[4]
Evolutionary psychology theory

Evolutionary psychologists Martin Daly and Margo Wilson propose that the Cinderella effect is a direct consequence of the modern evolutionary theory of inclusive fitness, especially parental investment theory. They argue that human child rearing is so prolonged and costly that "a parental psychology shaped by natural selection is unlikely to be indiscriminate." According to them, "research concerning animal social behaviour provide a rationale for expecting parents to be discriminative in their care and affection, and more specifically, to discriminate in favour of their own young."[8]

Daly and Wilson research

The most abundant data on stepchild mistreatment has been collected and interpreted by psychologists Martin Daly and Margo Wilson, who study with an emphasis in Neuroscience and Behavior at McMaster University. Their first measure of the validity of the Cinderella effect was based on data from the American Humane Association (AHA), an archive of child abuse reports in the United States holding over twenty thousand reports.[9] These records led Wilson and Daly to conclude that "a child under three years of age who lived with one genetic parent and one stepparent in the United States in 1976 was about seven times more likely (…) to become a validated child-abuse case in the records than one who dwelt with two genetic parents.[10] Their overall findings demonstrate that children residing with stepparents have a higher risk of abuse even when other factors are considered.[7]

Explanation

All organisms face trade-offs as to how to invest their time, energy, risk, and other resources, so investment in one domain (e.g. parental investment) generally takes away from their ability to invest in other domains (e.g. mating effort, growth, or investment in other offspring).[11] Investment in non-genetic children therefore reduces an individual's ability to invest in itself or its genetic children, without directly bringing reproductive benefits. Thus, from an evolutionary biology perspective, one would not expect organisms to regularly and deliberately care for unrelated offspring.

Daly and Wilson point out that infanticide is an extreme form of biasing parental investment that is widely practiced in the animal world.[12] For example, when an immigrant male lion enters a pride, it is not uncommon for him to kill the cubs fathered by other males.[13] Since the pride can only provide support for a limited number of cubs to survive to adulthood, the killing of the cubs in competition with the new male’s potential offspring increases the chances of his progeny surviving to maturity.[13] In addition, the act of infanticide speeds the return to sexual receptivity in the females, allowing for the male to father his own offspring in a timelier manner.[14] These observations indicate that in the animal world, males employ certain measures in order to ensure that parental investment is geared specifically toward their own offspring.[12]

Unlike the lion, however, humans in a stepparenting situation face a more complicated tradeoff since they cannot completely disown their partner's offspring from a previous relationship, as they would risk losing sexual access to the mother and any chance of fathering potential offspring. Thus, according to Daly and Wilson, stepparental investment can be viewed as mating effort to ensure the possibility of future reproduction with the mother.[15] This mating effort hypothesis suggests that human males will tend to invest more in their genetic offspring and invest just enough in their stepchildren. It is from this theoretical framework that Daly and Wilson argue that instances of child abuse towards non-biological offspring should be more frequent than towards biological offspring.[15]

One would therefore expect greater parental responsiveness towards one's own offspring than towards unrelated children, and this will result in more positive outcomes and fewer negative outcomes towards one's own children than towards other children in which one is expected to invest (i.e. stepchildren). "If child abuse is a behavioral response influenced by natural selection, then it is more likely to occur when there are reduced inclusive fitness payoffs owing to uncertain or low relatedness."[16] Owing to these adaptations from natural selection, child abuse is more likely to be committed by stepparents than genetic parents – both are expected to invest heavily in the children,
but genetic parents will have greater child-specific parental love that promotes positive caretaking and inhibits maltreatment.

Daly and Wilson report that this parental love can explain why genetic offspring are more immune to lashing out by parents.\cite{17} They assert that, "Child-specific parental love is the emotional mechanism that permits people to tolerate – even to rejoice in – those long years of expensive, unreciprocated parental investment."\cite{17} They point to a study comparing natural father and stepfather families as support for the notion that stepparents do not view their stepchildren the same as their biological children, and likewise, children do not view their stepparents the same as their biological parents.\cite{18} \cite{19} This study, based on a series of questionnaires which were then subjected to statistical analyses, reports that children are less likely to go to their stepfathers for guidance and that stepfathers rate their stepchildren less positively than do natural fathers.\cite{19}

Daly and Wilson’s reports on the overrepresentation of stepparents in child homicide and abuse statistics support the evolutionary principle of maximizing one’s inclusive fitness, formalized under Hamilton’s Rule, which helps to explain why humans will preferentially invest in close kin.\cite{7} \cite{20} \cite{21} Adoption statistics also substantiate this principle, in that non-kin adoptions represent a minority of worldwide adoptions.\cite{12} Research into the high adoption rates of Oceania shows that childlessness is the most common reason for adopting, and that in the eleven populations for which data was available, a large majority of adoptions involved a relative with a coefficient of relatedness greater than or equal to 0.125 (e.g. genetic cousins).\cite{22} It is also observed that parents with both biological and adopted children bias the partitioning of their estates in favor of the biological children, demonstrating again that parental behavior corresponds to the principles of kin selection.\cite{22}

Methods

In their 1985 Canadian sample, Daly and Wilson classify the frequencies of different living arrangements (two natural parents, one natural parent, one natural parent with one stepparent, or other) according to child age. This was accomplished by administering a randomized telephone survey.\cite{7}

Records of child abuse from children’s aid organizations as well as police reports on runaways and juvenile offenders were then used to determine whether children from stepparental living situations were overrepresented as abuse victims when compared to the demographic data gathered from the telephone survey data. The results indicate that the only living situation that has a significant correlation to increased child abuse is one natural parent and one stepparent in the same household. While rates of running away and crime were comparable for children living with stepparents and children of single-parents, abuse rates for children living with stepparents were much higher.\cite{7}

Daly and Wilson examined several potentially confounding variables in their research, including socioeconomic status, family size, and maternal age at childbirth, however only minor differences between natural-parent and stepparent families with respect to these factors were found, indicating that none of these are major contributing factors to the observed Cinderella effect.\cite{7}

Attachment theory

Further information: Attachment Theory

Evolutionary psychologists have also suggested that one of the causes of stepchild abuse may be the lack of a parental attachment bond that the mother would normally form with her own child. This attachment bond must be formed before the age of two in order to become a secure bond, and adoption can often disrupt the development of this bond. An infant must be fed by the primary parental figure, usually the mother, and must have the mother present during severely physically painful events in order for a parental attachment bond to form, and either a consistent omission of the mother from this process or an alteration between two people (the original mother and the adoptive mother) can cause either an insecure attachment or disorganized attachment from the parent to the child. As a result, it is highly recommended by most psychologists that the adoptive mother be present very early in the infants life, preferably immediately after its birth, in order to avoid attachment disruptions and attachment disorders.\cite{23}
Misunderstandings

It is sometimes argued that this evolutionary psychological account does not explain why the majority of stepparents do not abuse their partners' children, or why a significant minority of genetic parents do abuse their own offspring. However, their argument is based on a misunderstanding: the evolutionary psychological account is that (all else equal) parents will love their own children more than other people's children—it does not argue that stepparents will "want" to abuse their partner's children, or that genetic parenthood is absolute proof against abuse. Under this account, stepparental care is seen as "mating effort" towards the genetic parent, such that most interactions between stepparent and stepchildren will be generally positive or at least neutral, just usually not as positive as interactions between the genetic parent and the child would be. [24]

Supportive evidence

Strong support for the Cinderella effect as described by Daly and Wilson comes from a study of unintentional childhood fatal injuries in Australia. [25] Tooley et al. follow the argument of Daly and Wilson to extend the Cinderella effect from cases of abuse to incidences of unintentional fatalities. Children are not only vulnerable to abuse by their parents, but they are also dependent on their parents for supervision and protection from a variety of other harms. [25] [26] Given that parental supervision is fundamentally correlated to incidences of unintentional childhood injury as shown by Wadsworth et al. and Peterson & Stern, Tooley et al. posit that selective pressures would favor an inclination towards parental vigilance against threats to offspring well-being. [25] [26] [27] Tooley et al. further argue that parental vigilance is not as highly engaged in stepparents as genetic parents, therefore placing stepchildren at greater risk for unintentional injury. [25]

Based on data gathered from the Australia National Coroners' Information System, stepchildren under five years of age are two to fifteen times more likely to experience an unintentional fatal injury, especially drowning, than genetic children. [25] Additionally, the study finds that the risks of unintentional fatal injury are not significantly higher for genetic children in single parent homes versus two-parent homes. [25] This difference suggests that removing one biological parent from the home does not significantly increase risk to the children, but that adding a nonbiological parent to the home results in a drastic increase in the risk of unintentional fatal injury. [25] Despite the fact that adding a stepparent to the home increases the available resources in terms of supervision in comparison to a single-parent home, risk of unintentional fatal injury still significantly rises. [25] This higher risk of injury for stepchildren can be attributed to the fact that stepparents occupy the same supervisory role as a genetic parent, yet they have a lower intrinsic commitment to protecting the child and therefore are less likely to be adequately vigilant. [25] The authors conclude that the Cinderella effect applies not only to purposeful abuse by stepparents, but is also relevant to explaining increased rates of accidental fatalities among stepchildren. [25]

Furthermore, a study of parental investment behaviors among American men living in Albuquerque, New Mexico reveals a trend of increasing financial expenditures on genetic offspring in comparison to step-offspring, which also suggests that parents are less inclined to preserve the well-being of stepchildren. [28] The study assesses paternal investment based on four measures: the probability that a child attends college, the probability that the child receives money for college, the total money spent on children, and the amount of time per week spent with children. [28] Four different classifications of father-child relationships are examined and compared, including fathers living with their genetic children and fathers living with the stepchildren of their current mates. [28] Though the study finds a clear trend of increasing investment in genetic children, the data also shows that fathers do still invest substantially in stepchildren. [28] The authors explain the parental investment exhibited by fathers towards stepchildren as possibly motivated by the potential to improve the quality or increase the duration of the man's relationship with the stepchildren's mother. [28] This studied corroborates the findings of Lynn White, that stepparents in general provide less social support to stepchildren than their genetic children. [29]

Though the general trend of the data from this study supports the Cinderella effect, Anderson and colleagues note that the observed differences between parental investment in genetic children and stepchildren might be slightly
reduced by a few confounding factors. For example, the authors point out that stepparenting is a self-selective process, and that when all else is equal, men who bond with unrelated children are more likely to become stepfathers, a factor that is likely to be a confounding variable in efforts to study the Cinderella effect. Anderson and colleagues also conducted a similar study of Xhosa students in South Africa that analyzes the same four classifications of paternal-child relationships, and this study offers similar results to those observed among fathers in Albuquerque.

Additionally, a study of Hadza foragers in Tanzania by Marlowe also finds evidence of decreased care provided by fathers to stepchildren when compared with genetic children. The author uses the Mann-Whitney U-tests to evaluate most of the observed differences in care exhibited towards genetic and stepchildren, and finds that Hadza men spend less time with (U=96), communicate less with (U=94.5), nurture less, and never play with their stepchildren. Marlowe further argues that any care that is provided towards stepchildren is likely attributable to the man’s mating efforts and not parental interest in the well-being of the stepchildren.

In further support of the Cinderella effect as elaborated by Daly and Wilson, a study conducted in a rural village in Trinidad demonstrates that in households containing both genetic children and stepchildren, fathers devote approximately twice as much time to interaction with genetic offspring in comparison to stepchildren. Additionally, this study finds that the duration of the relationship between the stepfather and stepchildren is negatively correlated with the relative proportion of interaction time and positively correlated with the relative proportion of antagonistic interactions between the two. As a proportion of total time spent interacting with genetic and stepchildren, fathers are shown to have approximately 75 percent more antagonistic interactions with stepchildren. In this study, antagonistic interactions are defined as involving physical or verbal combat or an expression of injury. This includes, for example, spanking, screaming, crying, and arguing. The duration of the relationship between genetic fathers and children shows a positive correlation with both relative proportion of interaction time and antagonistic interaction. The author argues that these results show that in terms of time invested, fathers favor genetic children over stepchildren, and this preference is not attributable to the duration of the father-child relationship, a factor which is sometimes believed to be a confounding variable in the Cinderella effect. Though this study does claim a significant increase in antagonistic behavior between stepparents and stepchildren and therefore supports the Cinderella effect, it also notes that only six percent of all the observed parent-child interactions were considered antagonistic, and that the researchers never noticed any blatant physical child abuse.

Criticism

David Buller

Philosopher of science David Buller, who dismisses evolutionary biology in general, argues that evolutionary psychology (EP) mistakenly attempts to discover human psychological adaptations rather than “the evolutionary causes of psychological traits.” Buller also posits that the degree of abuse is exaggerated, since Daly and Wilson's 1985 Canadian sample included cases of sexual abuse as well as cases of unintentional omission, such as not buckling a child’s seatbelt in the car. Buller asserts that unintentional omission does not fall under the realm of dangerous acts, and rather should be designated “maltreatment”. He argues that since sexual abuse is not often accompanied by physical abuse, it is not actually a dangerous act committed against the child. Daly and Wilson respond to Buller’s criticism by stating that Buller confuses the empirical statistical findings, which define the Cinderella effect, with the proposed theoretical framework, which offers an evolutionary explanation for the data. Buller also claims that Daly and Wilson's findings are inherently biased since they use data from official documents, and the officials collecting that data are trained to take special notice of stepparents versus biological parents. Furthermore, Buller states that since Daly and Wilson rely on official reports (such as death certificates) for their data, and that this data is inherently biased against stepparents. He cites a Colorado study, in which it was found...
that maltreatment fatalities were more likely to be correctly reported on death certificates when an unrelated individual was the perpetrator rather than when a parent was the perpetrator, suggesting that the data is empirically skewed to support the Cinderella effect. According to this study, by Crume et al., when the perpetrator of the murder was a parent, maltreatment was correctly noted on the death certificate only 46 percent of the time. Furthermore, they found that when the perpetrator was an “Other unrelated (including boyfriend)” individual, maltreatment was reported on the death certificate 86 percent of the time, significantly higher than for parents. Although these statistics seem to provide evidence of bias against stepparents, further review of the data undermines this conclusion. As Crume et al. and Daly and Wilson note, maltreatment was only likely to be reported on the death certificates 47 percent of the time in the case of “Other relatives (including step-parents),” which represents a marginal increase from the amount of parental maltreatment. Therefore, as Daly and Wilson respond to Buller’s critique, this does not seem to be a significant source of error in studying the Cinderella effect and does not provide evidence for inherent bias in their data.

**Temrin et al. Sweden study**

The findings of Daly and Wilson have been called into question by one study of child homicides in Sweden between 1975 and 1995, which found that children living in households with a non-genetic parent were not at an increased risk of homicide when compared to children living with both genetic parents. The study, published in 2000 and conducted by Temrin and colleagues argued that when Daly and Wilson classified homicides according to family situation, they did not account for the genetic relatedness of the parent who actually committed the crime. In the Swedish sample, in two out of the seven homicides with a genetic and non-genetic parent, the offender was actually the genetic parent and thus these homicides do not support Daly and Wilson’s definition of the Cinderella effect. Daly and Wilson attribute the contrasting findings of the Swedish study to an analytical oversight. Temrin and colleagues neglect to consider the fact that the proportion of children in living situations with a stepparent is not constant for all child age groups, but rather increases with age. After correcting for age differences, the Swedish data set produces results in accordance with the previous findings of Daly and Wilson. The Swedish sample does show, however, decreased risk to children living with a stepparent than do the North American samples collected by Daly and Wilson, suggesting that there is some degree of cross-cultural variation in the Cinderella effect.

**Alternative hypotheses**

It has been noted by multiple researchers that child abuse is an intricate issue and is affected by other factors. Daly and Wilson state, however, that even if evolutionary psychology cannot account for every instance of stepparental abuse, this does not invalidate their empirical findings. Burgess and Drais propose that child maltreatment is too complex to be explained fully by genetic relatedness alone and cite other reasons for child maltreatment, such as social factors, ecological factors and child traits such as disability and age. However, they also note that these traits are simply indicative, and do not inevitably lead to child maltreatment. Temrin and colleagues also suggest that there may be other factors involved with child homicide, such as prior convictions, drug abuse problems, lost custody battles and mental health problems.

In 1984, Giles-Sims and David Finkelhor categorized and evaluated five possible hypotheses that could explain the Cinderella effect: "social-evolutionary theory," "normative theory," "stress theory," "selection factors" and "resource theory". The social-evolutionary theory is based on the proposal that non-genetically related parents will invest less in costly parental duties, due to the fact that their genes are not being passed on by that individual. The normative theory proposes that, due to genetic repercussions, incest among genetically related individuals is a widespread taboo and would thus be less common among biological relatives. They propose that incest among stepfamilies would be less taboo, since there is no risk of genetic degradation. The stress theory proposes that increased stressors, which are inherently more common among stepfamilies, cause an increased risk of abuse. The selection factors theory proposes that individuals who are likely to be stepparents (divorcees) are likely to be inherently more violent due to emotional
disturbances, aggressive impulses, and self-esteem issues. Due to this, stepparents as a group would have a higher proportion of individuals with violent-prone characteristics, which would suggest that the abuse is happening due to personality factors, rather than the stepparental relationship directly. Finally, according to resource theory, individuals who contribute resources are granted authority, while individuals that lack resources are denied authority and more likely to resort to violence to obtain authority. It is therefore hypothesized that stepparents who are able to contribute resources to a family and have those resources be accepted by the family are less likely to be abusive. However, this hypothesis had yet to be tested directly on stepfamilies.[39] This paper of Giles-Sims and Finkelhor predates however practically all empirical studies on the Cinderella effect.

**Ethical issues**

Discussing the implications of this line of research, Australian psychologist Greg Tooley, author of a 2006 study confirming the existence of the effect,[40] confessed that "It is certainly difficult to talk about because it is such a hot issue."[41]

**Conclusion**

Daly and Wilson, whose findings have been corroborated by a number of independent studies,[25] [28] [30] [32] have contributed to an ever-growing body of work related to the Cinderella effect. Of the researchers in disagreement with Daly and Wilson, some have a well-known skepticism of the field of evolutionary psychology, such as David Buller,[33] [34] while others have put forth studies that suffer from analytical error, such as Hans Temrin.[4] [38] While there are other hypotheses that attempt to debunk the Cinderella effect, or explain it in non-evolutionary terms,[39] they remain largely untested and are unlikely to be able to fully account for the striking variation between genetic and stepparental instances of child maltreatment.

**Notes**

[1] Simon Blackburn, *Meet the Flintstones* (http://www.phil.cam.ac.uk/~swb24/reviews/Pinker.htm)—a review of Stephen Pinker's *The Blank Slate*


Cinderella effect


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Trivers–Willard hypothesis

In evolutionary biology, the *Trivers–Willard hypothesis*[1], formally proposed by Robert Trivers and Dan Willard, predicts greater investment in males by parents in good conditions and greater investment in females by parents in poor conditions (relative to parents in good condition). The reasoning for this prediction is as follows: assume that parents have information on the sex of their offspring and can influence their survival differentially. While pressures exist to maintain sex ratios at 50%, evolution will favor local deviations from this if one sex has a likely greater reproductive pay-off than is usual.

Trivers and Willard also identified a circumstance in which reproducing individuals might experience deviations from expected offspring reproductive value: namely, varying maternal condition. In polygynous species males may mate with multiple females and low-condition males will achieve fewer or no matings. Parents in relatively good condition would then be under selection for mutations causing production and investment in sons (rather than daughters), because of the increased chance of mating experienced by these good-condition sons. Mating with multiple females conveys a large reproductive benefit, whereas daughters could translate their condition into only smaller benefits. An opposite prediction holds for poor-condition parents — selection will favor production and investment in daughters, so long as daughters are likely to be mated, while sons in poor condition are likely to be out-competed by other males and end up with zero mates (i.e. those sons will be a reproductive dead-end).

The hypothesis was used to explain why, for example, Red Deer mothers would produce more sons when they are in good condition, and more daughters when in poor condition. In polyandrous species where some females mate with multiple males (and others get no matings) and males mate with one/few females (i.e. "sex-role reversed" species), these predictions from the Trivers–Willard hypothesis are reversed: parents in good condition will invest in daughters in order to have a daughter that can out-compete other females to attract multiple males, whereas parents in poor condition will avoid investing in daughters who are likely to get out-competed and will instead invest in sons in order to gain at least some grandchildren.
"Condition" can be assessed in multiple ways, including body size, parasite loads, or dominance, which has also been shown in macaques (Macaca sylvanus) to affect the sex of offspring, with dominant females giving birth to more sons and non-dominant females giving birth to more daughters[2]. Consequently, high-ranking females give birth to a higher proportion of males than those who are low-ranking.

Assumptions

The Trivers–Willard hypothesis rests on certain assumptions:
1. Parental condition is associated with offspring condition;
2. Differences in offspring condition will persist into adulthood;
3. Being in condition differentially affects the mating success of one sex more than it does the other.

Evolutionary biologists predict a Trivers–Willard effect where these conditions hold, and no effect when these conditions do not hold. In polygynous species where some males have multiple mates and others have none (i.e. greater variance in mating success among males than females), being in good condition affects males more than females. This is reversed in polyandrous species, and possibly in species where condition is based on social status and males disperse.

In their original paper, Trivers and Willard were not yet aware of the biochemical mechanism for the occurrence of biased sex ratios. Eventually, however, Melissa Larson et al. (2001)[3] proposed that a high level of circulating glucose in the mother's bloodstream may favor the survival of male blastocysts. This conclusion is based on the observed male-skewed survival rates (to expanded blastocyst stages) when bovine blastocysts were exposed to heightened levels of glucose. As blood glucose levels are highly correlated with access to high-quality food[4], blood glucose level may serve as a proxy for "maternal condition". Thus, heightened glucose functions as one possible biochemical mechanism for observed Trivers–Willard effects.

References

Youthfulness

Neoteny (ˌniːˈɒtniː), also called juvenilization,[2] is one of the two ways by which paedomorphism can arise. Paedomorphism is the retention by adults of traits previously seen only in juveniles, and is a subject studied in the field of developmental biology. In neoteny, the physiological (or somatic) development of an animal or organism is slowed or delayed. In contrast, in progenesis, sexual development occurs faster. Both processes result in paedomorphism.[3] Ultimately this process results in the retention, in the adults of a species, of juvenile physical characteristics well into maturity and pedogenesis (paedogenesis), the reproduction in a neotenized state.[4]

Neoteny is one of three dimensions of heterochrony, or the change in timing of developmental events: acceleration (faster) vs. neoteny (slower), hypermorphosis (further) vs. progenesis (not as far), and predisplacement (begins earlier) vs. postdisplacement (begins later).[5]

The word neoteny is borrowed from the German Neotenie, the latter constructed from the Greek νέος (neos, young) and τείνειν (teinein, tend to). The adjectival form of the word is either "neotenous" or "neotenic".[6] The opposite of neoteny is either called "gerontomorphic"[7] or "peramorphic"[8].

In humans
Neotenous traits in humans

Physical anthropologist Barry Bogin considers Betty Boop to be an example of neoteny.¹

These are neotenous traits in humans: flattened face,² broadened face,⁹ large brain,² hairless body,² hairless face,¹⁰ small nose,¹⁰ reduction of brow ridge,² small teeth,² small upper jaw (maxilla),² small lower jaw (mandible),² epicanthic eye fold⁹ (present in all people in the embryonic stage),¹¹ thinness of skull bones,⁹ limbs proportionately short compared to torso length,⁹ longer leg than arm length,¹² larger eyes,¹³ and upright stance.¹¹ ⁷

Human evolution

Stephen Jay Gould believed that the "evolutionary story" of humans is one where we have been "retaining to adulthood the originally juvenile features of our ancestors".¹⁴ J.B.S. Haldane mirrors Gould's hypothesis by stating a "major evolutionary trend in human beings" is "greater prolongation of childhood and retardation of maturity."²

Delbert D. Thiessen claimed that "neoteny becomes more apparent as early primates evolved into later forms" and that primates have been "evolving toward flat face".¹⁵ Stephen Jay Gould argued "that the whole enterprise of ranking groups by degree of neoteny is fundamentally unjustified." (Gould, 1996, pg. 150).¹⁶

In opposition, M.J. Rantala does not believe neoteny has been the main cause of human evolution, because humans only retain some juvenile traits while relinquishing others.¹⁷ He claims the high leg-to-body ratio (long legs) of adult humans as opposed to human infants shows that there is not holistic trend in humans towards neoteny when compared to the other Great Apes.¹⁷

Australian anthropologist Andrew Arthur Abbie agrees, citing the gerontomorphic fleshy human nose and long human legs as contradicting the neoteny hominid evolution hypothesis, although he does believe humans are generally neotenous.¹⁷ Brian Keith Hall also cites the long legs of humans as a peramorphic trait in sharp contrast to neoteny.⁸

Between sexes

Ashley Montagu notes the following neotenous traits in women relative to men: more delicate skeleton, smoother ligament attachments, smaller mastoid processes, reduced brow ridges, more forward tilt of the head, narrower joints, less hairy, more delicate skin, retention of fetal body hair, smaller body size, more backward tilt of pelvis, greater longevity, lower basal metabolism, faster heartbeat, greater extension of development periods, higher pitched voice and larger tearducts.²
Attractive women's faces

In a cross-cultural study, more neotenized female faces were found to be most attractive to men while less neotenized female faces were found to be less attractive to men, regardless of the females' actual age. [18] Michael R. Cunningham of the Department of Psychology at the University of Louisville found, using a panel of "Asian", "Hispanic" and "White" judges, that the Asian, Hispanic and White female faces found most attractive were those that had "neonate large eyes, greater distance between eyes, and small noses" [19] and his study led him to conclude that "large eyes" were the most "effective" of the "neonate cues". [19] Cunningham also said that "shiny" hair may be indicative of "neonate vitality". [19]

Cunningham noted a "difference" in the preferences of Asian and White judges with Asian judges preferring women with "less mature faces" and smaller mouths than the White judges. [19] Cunningham hypothesized that this difference in preference may stem from "ethnocentrism" since "Asian faces possess those qualities", so Cunningham re-analyzed the data with "11 Asian targets excluded" and concluded that "ethnocentrism was not a primary determinant of Asian preferences." [19] Using a panel of "Blacks" and "Whites" as judges, Cunningham found more neotenous faces were perceived as having both higher "femininity" and "sociability". [19]

In contrast, Cunningham found that faces that were "low in neoteny" were judged as "intimidating". [19] Upon analyzing the results of his study Cunningham concluded that preference for "neonate features may display the least cross-cultural variability" in terms of "attractiveness ratings". [19] In a study of Italian women who have won beauty competitions, it was found that the Italian women who won the beauty competitions had faces characterized by more "babyness" traits compared to the "normal" women used as a reference. [20] In a study of 60 Caucasian female faces at the University of St. Andrews, it was found that the average facial composite of the 15 faces found most attractive differed from the facial composite of the whole by: a reduced lower facial region, a thinner jaw and a higher forehead. [21]

Between races and among primates

Paleontologist Stephen Jay Gould who taught biology and evolution at New York University objected to the ranking of races as more or less neotenous. But Gould argued that if one used the terms set forth by 1920s proponents of racial neoteny, "Orientals", not whites, are "clearly" the most neotenized human race. [16]

Ashley Montagu mirrored this statement when he stated that the "Mongoloid skull, whether Chinese or Japanese" is the most neotenized human skull. [2] Ashley Montagu further claimed that the "European" skull was less neotenized than the Mongoloid, with the "Australian Aborigine" skull less neotenized than the European and the Neanderthal skull even less neotenized than the Australian Aborigine skull. [2] Ashley Montagu claimed that humans have more neotenized skulls than Australopithecus. [22]

Delbert D. Thiessen claimed that Homo Sapiens are more neotenized than Homo Erectus, Homo Erectus was more neotenized than Australopithecus, Great Apes are more neotenized than Old World monkeys and Old World monkeys are more neotenized than New World monkeys. [15]
Nancy Lynn Barrickman of the Department of Evolutionary Psychology at Duke University claimed Brian T. Shea found by multivariate analysis that Bonobos are more neotenized than the common chimpanzee, taking into account such features as the proportionately long torso length of the Bonobo. Ashley Montagu believed that part of the differences seen in the morphology of "modernlike types of man" can be attributed to different rates of "neotenous mutations" in their early populations.

**Mongoloids**

According to Ashley Montagu who taught anthropology at Princeton University, "The Mongoloid skull has proceeded further than in any other people." The Mongoloid skull, whether Chinese or Japanese, has been rather more neotenized than the Caucasian or European. "The female skull, it will be noted, is more pedomorphic in all human populations than the male skull."

In Ashley Montagu's list of "neotenous structural traits in which Mongoloids... differ from Caucasoids", Montagu lists "Larger brain, larger braincase, broader skull, broader face, flat roof of the nose, inner eye fold, more protuberant eyes, lack of brow ridges, greater delicacy of bones, shallow mandibular fossa, small mastoid processes, stocky build, persistence of thymus gland into adult life, persistence of juvenile form of zygomatic muscle, persistence of juvenile form of superior lip muscle, later eruption of full dentition (except second and third molars), less hairy, fewer sweat glands, fewer hairs per square centimeter [and] long torso."

According to Clive Bromhall who has a Ph.D. in zoology from Oxford University, "Mongoloid races are explained in terms of being the most extreme pedomorphic humans."

Richard Grossinger, professor of anthropology at University of Maine at Portland, claimed "The intuition that advanced human development was pedomorphic rather than recapitulationary and accelerated was disturbing to many Eurocentric nineteenth century anthropologists." "If juvenilization was the characteristic for advanced status, then it was clear that the Mongoloid races were more deeply fetalized in most respects and thus capable of the greatest development."

Stephen Oppenheimer of the Institute of Cognitive & Evolutionary Anthropology at Oxford University claimed "An interesting hypothesis put forward by paleontologist Stephen Jay Gould many years ago was that the package of the Mongoloid anatomical changes could be explained by the phenomenon of neoteny, whereby an infantile or childlike body form is preserved in adult life. Neoteny in hominids is still one of the simplest explanations of how we developed a disproportionately large brain so rapidly over the past few million years. The relatively large brain and the forward rotation of the skull on the spinal column, and body hair loss, both characteristic of humans, are found in foetal chimps. Gould suggested a mild intensification of neoteny in Mongoloids, in whom it has been given the name pedomorphy. Such a mechanism is likely to involve only a few controller genes and could therefore happen over a relatively short evolutionary period. It would also explain how the counterintuitive retrousse [turned up at the end] nose and relative loss of facial hair got into the package. "Decrease unnecessary muscle bulk, less tooth mass, thinner bones and smaller physical size; ...this follows the selective adaptive model of Mongoloid evolution."
Bushmen
According to Ashley Montagu, Bushmen have the following neotenous traits relative to Caucasoids: "large brain", light skin pigment, less hairy, round-headed, bulging forehead, small cranial sinuses, flat roof of the nose, small face, small mastoid processes, wide eye separation, median eye fold, short stature and horizontal penis.\cite{2}

Negroids
According to Ashley Montagu, Negroids have the following neotenous traits relative to Caucasoids: flattish nose, flat roof of the nose, small ears, narrower joints, frontal skull eminences, later closure of the premaxillary sutures, less hairy, longer eyelashes and cruciform pattern of the lower second and third molars.\cite{2}

Psychology
Humans have been evolving toward greater "psychological-neoteny".\cite{28} Highly-educated people and eminent scientists usually demonstrate more neotenous psychological traits,\cite{29} and students with more of a "baby face" tend to "outperform" their less-neotenized peers in school.\cite{30} In fact, the ability of an adult human to learn has long been considered a neotenous trait.\cite{31} Physical neotenization in humans has, likewise, caused psychologically neotenous traits in humans: curiosity, playfulness, affection, sociality and an innate desire to cooperate.\cite{32}

Specific neotenies
Populations with a history of dairy farming have evolved to be lactose tolerant in adulthood whereas other populations generally lose the ability to break down lactose as they grow into adults.\cite{33}

Down syndrome
Down syndrome neotenizes the brain and body to the fetal state.\cite{34} Down syndrome is characterized by decelerated maturation (neoteny), incomplete morphogenesis (vestigia) and atavisms.\cite{35} Dr. Weihs considers Down syndrome to be a condition of "neoteny" that makes people "like a baby."\cite{36}
He notes both the physical neoteny of people with Down syndrome: "round in shape," "bowed legs which tend to be short," "slanty eyes," a "long tongue" and "short fingers," and their mental neoteny: "unsexual," "playful," "affectionate," "mischievous" and "imitative."\cite{36}
Youthfulness

Anime and manga

Dr. Thomas Lamarre, professor of East Asian Studies and Art History at McGill University, claimed that after World War II Japanese people as shown in their manga (漫画) and anime (アニメ) became “fascinated” with “neoteny” and “cuteness.”[37]

In other species

• The axolotl is a salamander that retains its juvenile aquatic form throughout adulthood and tiger salamander and Rough-skinned Newt can both retain gills into adulthood.[38]
• flightless birds’ physical proportions resemble those of the chicks of flighted birds;
• A plant species in the genus Oreostylidium neotenized to become mature earlier than other species in its genus in response to selective pressure.[39]

Domestication

Domestication has involved selection for behavioral characteristics that characterize young animals so, since "behavior is rooted in biology", domestication has resulted in an array of similar neotenous physical traits having arisen in various domesticated animals.[40] Such neotenous physical traits in domesticated animals such as dogs, pigs, cats, and recently foxes are floppy ears, changes in reproductive cycle, curly tails, piebald coloration, fewer or shortened vertebra, large eyes, rounded forehead, large ears and shortened muzzle.[41]

References

Sexual selection in human evolution

Charles Darwin described sexual selection as depending "on the advantage which certain individuals have over others of the same sex and species solely in respect of reproduction". In animals, he saw the competition for advantage as occurring between males - the most successful of which were chosen by females. However, in humans, Darwin came to think the evidence pointed toward male choice; he believed sexual selection could explain otherwise puzzling features of the human species, including some aspects of appearance which vary geographically but seem to be trivial and superficial, such as beards.

Some twentieth-century authors had suggested that Darwin was attracted to understanding human evolution through a sexual selection hypothesis because he felt it upheld the unity of humankind against pro-slavery demagoguery by explaining how black people and white people had come to look unalike, while emphasizing they were not separate species.[1] [2] Modern hypotheses which build on Darwin's ideas have mooted a geographical contrast in the intensity and direction of sexual selection between Europe and Africa. The general phenotypic differences between black people and white people are probably the result of both natural selection and sexual selection. Although skin color can be a target of sexual selection the skin color variation in humans is thought to be a result of natural selection along a latitude gradient.[3]

Evolution of humans

Sexual dimorphism

Men are hairier than women and Darwin was of the opinion that hairlessness was related to sexual selection; however, several other explanations have been advanced to explain human hairlessness, a leading one is loss of body hair to facilitate sweating.[4] This idea closely relates to that of the suggested need for increased photoprotection and is part of the most commonly accepted scientific explanation for the evolution of pigmentary traits.[5]

Sexual selection can be difficult to demonstrate as features may result from an equilibrium among competing selective pressures, some involving sexual selection, others natural selections. For example monogamous primates are known to typically exhibit little sexual dimorphism such as particularly large males armed with huge canines; however, powerful big toothed males can provide protection against predators and may be bigger for that reason rather in order to win confrontations over females. Males and females differing in size can specialize in, and more fully exploit, different food resources while avoiding competing with each other; furthermore, body size can be useful in avoiding predators and may also be of assistance in securing a mate - this is further complicated by the consideration that with larger body size the skeleton of mammals becomes much more robust and massive (relatively speaking).[6] Bearing these caveats in mind levels of sexual dimorphism are generally seen as a marker of sexual selection, studies have shown the earliest homininæ were highly dimorphic and that this lessened over the course of
the evolution of Homo, suggesting humans have became more monogamous, in contrast, gorillas who live in harems, have a much stronger sexual dimorphism (see homininae).\[7\]

A study found an evolutionary trend for men to have relatively shorter upper faces may have been caused by sexual selection on the simple ratio of upper face length to broadness as a proxy for facial attractiveness, possibly because women have preferred men who looked masculine but not aggressive.\[8\] [9] In an initial test calculations derived from the research were applied to photographs of male celebrities; Will Smith conformed most closely to the ideal proportions.\[10\]

### Darwin and more recent hypotheses

Charles Darwin conjectured that the male beard, as well as the hairlessness of humans compared to nearly all other mammals, are results of sexual selection. He reasoned that since the bodies of females are more nearly hairless, the loss of fur was due to sexual selection of females at a remote prehistoric time when males had overwhelming selective power, and that it nonetheless affected males due to genetic correlation between the sexes. He also hypothesized that contrasts in sexual selection acting along with natural selection were significant factors in the geographical differentiation in human appearance of some isolated groups as he did not believe that natural selection alone provided a satisfactory answer. Although not explicit, his observation that in Khoisan women “the posterior part of the body projects in a most wonderful manner” \[11\] implies sexual selection for this characteristic. In the *Descent of Man*, Darwin viewed many physical traits which vary around the world as so trivial to survival\[12\] that he concluded some input from sexual selection was required to account for their presence. He noted that variation in these features among the various peoples of the world meant human mate-choice criteria would also have to be quite different if the focus was similar and he himself doubted that, citing\[13\] reports indicating that ideals of beauty did not, in fact, vary in this way around the world. Sexual selection has continued to be suggested as a possible explanation for geographical variation in appearance within the human species, in modern hypotheses marriage practices are proposed as the main determinant of sexual selection. John Manning\[14\] suggests where polygyny is common men face intense competition for wives and are more likely to be completely unsuccessful in reproducing, a result is strong selection of males for traits which are adaptive for successful reproduction. He proposes a link to skin color through selection of males for testosterone mediated traits which confer an ability to successfully compete for females and points to the fact that males have higher rates of many diseases as evidence that the effect of testosterone makes the human immune system less competent to resist pathogens. In this view the antimicrobial properties of melanin help mitigate the susceptibility to disease that polygyny induces by increasing testosterone. Hence the anti-infective qualities of melanin were more important than protection from ultraviolet light in the evolution of the darkest skin types. Manning asserts that skin color is more correlated with the occurrence of polygyny - explicable by it having an anti microbial function - than the latitudinal gradient in intensity of ultraviolet radiation, he points to the lack of very dark skin at equatorial latitudes of the New World and the relatively light skin of Khoisan people in Africa.\[15\] [16]

### Evolutionary psychology

From the viewpoint of evolutionary psychology (championed by David Buss, Steven Pinker, Desmond Morris, Daniel Dennett, and others) modern humans have inherited natural traits that were adaptive in a prehistoric environment, including traits that had different advantages for males versus females (see Sexual selection). Evolutionary theory of sex considers gender differences as a result of distinct specialization of the sexes, performing relationship with preceding generations (inheritance) and with the environment (variability).\[17\] [18]
**Direction and intensity of sexual selection**

Another proposed explanation for the evolution of pigmented traits in humans though sexual selection is by Peter Frost who suggests European hair, eye, and skin color originated during the Last glacial period when intense female-female rivalry for mates led to a series of adaptations for increased mating success. Modern research suggests that across a wide range of cultures a female face is seen as attractive if it has high eyebrows, widely spaced large eyes with dilated pupils, high cheekbones, a small nose, a narrow face with thin cheeks, a large smile, a full lower lip, a small chin, and a full hairstyle. Although these mate-choice criteria are largely universal the aesthetic preferences of men are constrained by the number of potential mates, without an excess to choose from there can be no overall selection.

Men are often unneeded during pregnancy and infant care and so they are usually free to serve the cause of maximizing their reproductive fitness though a return to the mate market; in practice many males will be competing for too few females at any one time. Males can best maximize their reproductive fitness (leave more descendants) in the tropics, there women relied least on men as providers - being able to gather fruits, vegetables, tubers, and eggs for themselves while still caring for infants. In higher latitudes, however, opportunities for food gathering are restricted and women tend to rely on their husband to provide for the family by hunting, consequently the cost of providing for a second wife makes polygyny impossible for all but the ablest hunters. Land supports fewer game animals per unit of land area at high latitude and hunting distance increases proportionately this makes hunters vulnerable to death by exposure, exhaustion, drowning, injuries and starvation.

These risks peak in the 'continental Arctic,' of steppe-tundra, an environment widespread in Europe during the Late Glacial Maximum. It is likely that those hunting mobile game animals on foot in this environment would have very high mortality. The death of many male providers allied to the fact that surviving men were unable to feed more than one wife may have meant a high proportion of women could never marry and reproduce; sexual selection of women for characteristics that would enable them to get a husband was intense. Studies show that recognition of objects does not proceed by attention to all features simultaneously; attention is initially directed to cues of 'brightness', 'colour' or shape'. Priority goes to the strikingly varied and vivid colors tend to be attributes of intense sexual selection. If mate competition is relatively weak, sexual selection focuses primarily on visible markers of mate quality which signify fecundity, as mate competition intensifies the focus will shift from functional to eye-catching novelty rather than biologic 'truth in advertising'.¹⁹

With a glut of potential mates animals are swayed by eye-catching stimuli as when a secondary sexual characteristic is outsized or more vividly colored for effective hyperstimulating of the algorithms for sex-identification. Eyes and facial features that function in personal interaction and identification can be similarly highlighted. Brightly colored phenotypes can diversify under selection pressure into a polymorphism of phenotypes. Hair and eye pigmentation shows a remarkable diversity in Europe and frequency-dependent sexual selection for such diversity is a more likely explanation for it than any side effect of straightforwardly decreasing distribution of melanin following the latitudinal gradient of ultraviolet radiation.

Furthermore, the date of the mutations for the multitude of eye and hair colors found in Europe are closer to the late glacial maximum than when humans first entered Europe.¹⁹ ²⁰ Skin color dimorphism means that the characterization of women as the "fair sex" is in fact accurate; men have darker complexions in comparison to women as a result of differing melanin and hemoglobin levels in outer layers of the skin. Although this constitutive sex difference - which is not due to sun exposure - is less obvious in weakly pigmented peoples a hardwired mental mechanism enables us to recognize the gender of human faces.²¹

The main clue to gender is complexion; people can distinguish a man's face from a woman's by the complexion and contrast between facial pigmentation and eye/lip pigmentation ²² This slight - but significant - difference in pigmentation could explain why Europeans are white skinned. In premodern cultures there is a cross-cultural tendency to associate lighter skin with femininity and a preference for lighter skinned women as mates.²³ In this way strong sexual selection of women is hypothesized to have altered the pigmentation of the entire population. The
Sexual selection in human evolution

dating of the mutations for white skin and hair and eye colors are closer to the late glacial maximum than the original modern human entering of Europe as the UV-latitude hypothesis would presumably predict; however, there are alternative, i.e. non-sexual selection, explanations for this (see below).[5][19]

Criticism

The main critics of hypotheses which suggest that the extremes of skin pigmentation have resulted from sexual selection are those who see skin color as an obvious adaptation to excessive or inadequate ultraviolet radiation, they object that skin pigmentation accompanied loss of body hair while dark pigmentation evolved soon after the genus Homo in Africa, moreover a conspicuous latitude gradient of skin tones follows the out of Africa dispersion, these are conclusive. Therefore - it is argued - natural selection for sufficient ultraviolet penetration to enable vitamin D production while protecting folic acid gave rise to the evolution of skin pigmentation; light skin preference by males in some cultures may have - at most - slightly affected sexual dimorphism.

Indeed the case for human skin color as an adaptation to UV radiation is so clear an example of the mechanism of evolution by natural selection that it is a perfect model to demonstrate it.[5] Deleterious health effects of insufficient vitamin D are also pointed to as confirmation that skin lightening was in response to strong selection pressure for maximizing vitamin D.[24]

A variation of the vitamin D argument has recently gained credence as awareness of the late dates for the origin of European specific skin, eye and hair lightening has grown and made an explanation for humans living in Europe for several thousand years without becoming white required.[25] [26]

The replacement of hunting by agriculture is claimed to have led to a dearth of vitamin D, therefore it was the elimination of game meat, fish, and some plants from the diet which resulted in skin turning white long after modern human settlement in Europe.[27] [28]

An anomaly for this conjecture is that if the consequence of switching from meat to an agricultural diet is skin becoming less pigmented then historically hunter gatherer population in Africa such as the Khoisan and Oromo peoples, who are paler than other sub Saharan Africans and basal to them, ought to have darker skin than historically agriculturist groups.[29] However, a leading proponent of the agriculturally caused pigmentation hypothesis maintains that sexual selection can not account for European pigmentation as it would have almost certainly have resulted in the traits of lighter skin, hair and eyes exhibiting strong sexual dimorphism.[27]

Culture and sexual selection

Another cultural practice which may actually be related to culturally enforced of male-male competition is circumcision, which may reduce younger men's potential to illicitly father a child with an older man's wife. Some forms handicap sperm delivery in an obvious way; sub-incision is where cuts are made in the base of the penis causing sperm to be ejaculated from the base rather than the end (it is performed in several Aboriginal Australian societies). In some African and Micronesian cultures youths have one of their testicles crushed. One suggestion is that lack of a foreskin could make insertion or ejaculation slower, meaning brief, illicit sex is less likely to result in pregnancy. Illicit sex is proposed to be a worry of polygynous males. An anthropological database revealed that predictions of male circumcision tending to be a practice of non-monogamous societies was borne out - 48% of highly polygynous societies practice some form of male genital mutilation, and in societies in which wives live in separate households that increases to 63% while only 14% of the monogamous societies in the database practised genital mutilation of young men.[30]

Geoffrey Miller, drawing on some of Darwin's largely neglected ideas about human behaviour, has hypothesized that human culture arose through a process of sexual selection. He argues that cultural traits such as art, music, dance, verbal creativity and humour are of no survival value. Miller is critical of theories that imply that human culture arose as accidents or by-products of human evolution. He believes that human culture arose through sexual selection
for creative traits. In that view, many human artefacts could be considered subject to sexual selection as part of the extended phenotype, for instance clothing that enhance sexually selected traits. During human evolution, on at least two occasions, hominid brain size increased rapidly over a short period of time followed by a period of stasis. The first period of brain expansion occurred 2.5 million years ago, when *Homo habilis* first began using stone tools. The second period occurred 500,000 years ago, with the emergence of archaic *Homo sapiens*. Miller argues that the rapid increases in brain size would have occurred by a positive feedback loop resulting in runaway selection for larger brains. Tor Nørretranders, in *The Generous Man* conjectures how intelligence, musicality, artistic and social skills, language might have evolved as an example of the handicap principle, analogously with the peacock’s tail, the standard example of that principle. Another hypothesis[31] proposes that human intelligence is a courtship indicator of health and resistance against parasites and pathogens which are deleterious to human cognitive capabilities.[32]

### Human sexual anatomy

The theory of sexual selection has been used to explain a number of human anatomical features. These include rounded breasts, facial hair, pubic hair and penis size. The breasts of primates are flat, yet are able to produce sufficient milk for feeding their young. The breasts of non-lactating human females are filled with fatty tissue and not milk. Thus it has been suggested the rounded female breasts are signals of fertility.[33] The evolutionary biologist Richard Dawkins has speculated that the loss of the penis bone in humans, when it is present in other primates, may be due to sexual selection by females looking for an honest advertisement of good health in prospective mates. Since a human erection relies on a hydraulic pumping system, erection failure is a sensitive early warning of certain kinds of physical and mental ill health.[34] Homo also has by far the largest penis of the great apes and this may be sexually selected in much the same way as the larger testicles of Pan, another possibility is that the size of the human penis has resulted from selection for efficiency in displacing the sperm of rival males during intercourse.

### Implications of differences in penis length and morphology

It has been suggested the evolution of the human penis towards larger size was the result of female choice rather than sperm competition because sperm competition generally favors large testicles and a small penis as in the chimpanzee.[35] However, the human penis has a larger glans ridge than is found in many other primates and this may function to displace other males’ seminal fluid from a vagina by forcing it behind the glans during the thrusting of intercourse and thereby expelling rival semen away from the area of the cervix. A model study showed displacement of semen was directly proportional to the depth of thrusting as an efficient semen displacement device.

### References

Sexual selection in human evolution

[12] the races of man differ from each other and from their nearest allies, in certain characters which are of no service to them in their daily habits of life, and which it is extremely probable would have been modified through sexual selection (Darwin, 1936 [1888], p. 908).
[27] Frank W Sweet The Paleo-Etiology of Human Skin Tone (http://backintyme.com/essays/item/4)

Author's note

[29] Male circumcision is a weapon in the sperm wars (http://richarddawkins.net/articles/2680-male-circumcision-is-a-weapon-in-the-sperm-wars)

Further reading


External links

- Evo and Proud (http://evoandproud.blogspot.com/) - Peter Frost's anthropology blog.
Why Is Sex Fun?: The Evolution of Human Sexuality

Why Is Sex Fun? is a 1997 book by Jared Diamond dealing with the evolutionary development of human sexuality. Diamond addresses some peculiar aspects of human sexuality. These include why women's ovulation is not overtly advertised; why humans have sex in private rather than in public, as is the case in all other mammals; and why the ovaries are u-shaped. The book came five years after Diamond's previous work The Third Chimpanzee and was published in the same year as the well known title Guns, Germs, and Steel. It is dedicated to his wife Marie.

The Evolution of Human Sexuality

Involvement of the father in education, concealed ovulation and menopause in women, sex in private, are quite unique to our species, at least when compared to other Homininae. Testis and Penis size are related to the family structure: monogamy or promiscuity, harem, in human, chimpanzee and gorilla, respectively.

See Aso

- Concealed Ovulation
- Homininae

- Human sexuality
- Longevity
- Menopause
- Penis size
- Sexual selection
- The Third Chimpanzee
External links


References

Hypergamy

Hypergamy (colloquially referred to as "marrying up") is the act or practice of seeking a spouse of higher socioeconomic status, or caste status than oneself.[1]

The term is often used more specifically in reference to a perceived tendency among human cultures for females to seek or be encouraged to pursue male suitors that are higher status than themselves, which often manifests itself as being attracted to comparatively older, wealthier or otherwise more privileged than themselves.[2] According to evolutionary psychologists, females have evolved a preference for higher status males because they offer their prospective children both "better" genes and greater resources, e.g. food and security. Men, who invest less in their children, have less reason to prefer mates with high social status. Some have even argued that men "marry-down" to ensure that their mates have a higher incentive to remain faithful.[3]

The word "hypogamy"[4] typically refers to instances of the inverse occurring: marrying a person of lower social class or status.

Society

Some evolutionary psychologists believe that women exhibit mate-selective preferences for spouses who are greater than them in terms of attained physical attractiveness, educational level, job status, social standing, and capital accumulation. In comparison, males would tend to place higher emphasis on the value of physical attractiveness in a woman alone.[5] [6]

In an anthology about money and relationships by many prominent female writers, the authors expressed that the role money plays in determining how women select long-term male partners is often considered a taboo subject.[7]

Variance

One particular study found no statistical difference in the number of women or men "marrying-up" in a sample of 1109 first-time married couples in the United States.[8]

For citizens of rural India, hypergamy is an opportunity to modernize. Marriages in rural India are increasingly examples of hypergamy.[9] Farmers and other rural workers want their daughters to have access to city life, for with metropolitan connections comes internet access, better job opportunities, and higher caste social circles.[10] A connection in an urban area creates a broader social horizon for the bride's family, and young children in the family can be sent to live with the couple in the city for better schooling. Hypergamy comes with a cost though: the dowry, which often costs as much or more than an entire house.[11] The high price that has to be borne by the parents while marrying a daughter has led to increasing rates of female feticide.[12]
Hypergamy

References


[4] not to be confused with the botanical term hypogamous.


Sexual jealousy

Sexual jealousy is a special form of jealousy in sexual relationships, present in animals that reproduce through internal fertilization, and is based on suspected or imminent sexual infidelity. It is founded on the instinct of keeping genes in the gene pool and expecting sexual partners to care for the offspring. The concept is studied in human and non-human primates in the field of evolutionary psychology.

See sexual jealousy in humans

Further reading


External links

• UCSB's SexInfo: Jealousy [2]

References

Evolutionary psychology of religion

The evolutionary psychology of religion is the study of religious belief using evolutionary psychology principles. It is one approach to the psychology of religion. As with all other organs and organ functions, the brain and cognition's functional structure have been argued to have a genetic basis, and are therefore subject to the effects of natural selection and evolution. Like other organs and tissues, this functional structure should be universally shared amongst humans and should solve important problems of survival and reproduction. Evolutionary psychologists seek to understand cognitive processes, religion in this case, by understanding the survival and reproductive functions they might serve.

Mechanisms of evolution

There is general agreement among scientists that a propensity to engage in religious behavior evolved early in human history. However, there is disagreement on the exact mechanisms that drove the evolution of the religious mind. There are two schools of thought. One is that religion itself evolved due to natural selection and is an adaptation, in which case religion conferred some sort of evolutionary advantage. Alternatively, religious beliefs and behaviors may have emerged as by-products of other adaptive traits without initially being selected for because of their own benefits.

Religion as an adaptation

Richard Sosis and Candace Alcorta have reviewed several of the prominent theories for the adaptive value of religion. Many are "social solidarity theories", which view religion as having evolved to enhance cooperation and cohesion within groups. Group membership in turn provides benefits which can enhance an individual's chances for survival and reproduction.

These social solidarity theories may help to explain the painful or dangerous nature of many religious rituals. Costly-signaling theory suggests that such rituals might serve as public and hard to fake signals that an individual's commitment to the group is sincere. Since there would be a considerable benefit in trying to cheat the system - taking advantage of group living benefits without taking on any possible costs - the ritual would not be something simple that can be taken lightly. Warfare is a good example of a cost of group living, and Richard Sosis, Howard C. Kress, and James S. Boster carried out a cross-cultural survey which demonstrated that men in societies which engage in war do submit to the costliest rituals.

Studies that show more direct positive associations between religious practice and health and longevity are more controversial. Harold G. Koenig and Harvey J. Cohen summarized and assessed the results of 100 evidence-based studies that systematically examined the relationship between religion and human well-being, finding that 79% showed a positive influence. These studies are popular in the media, as seen in a recent NPR program including University of Miami Professor Gail Ironson's findings that belief in God and a strong sense of spirituality were good predictors of viral load and immune cell levels in HIV patients. However, Dr. Richard P. Sloan of Columbia University was quoted in the New York Times as saying that "...there is no really good compelling evidence that there is a relationship between religious involvement and health." There is still debate over the validity of these findings, and they do not necessarily prove a direct cause-and-effect relationship between religion and health. Mark Stbich claims there is a clear correlation but the reason for it is unclear.
Religion as a by-product

Stephen Jay Gould was a proponent of this hypothesis. He and Elisabeth Vrba proposed the term exaptation in 1982 to mean "features that now enhance fitness, but were not built by natural selection for their current role." Gould and R. C. Lewontin compared such features to spandrels, "an architectural term for spaces left over between structural elements of a building". A more complete explanation of this metaphor can be found in Gould and Lewontin's 1979 paper, "The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme". Gould cites religion as an example of an exaptation or spandrel, but he does not himself select a definite trait which he thinks was actually acted on by natural selection. He does, however, bring up Freud's suggestion that our large brains, which evolved for other reasons, led to consciousness. The beginning of consciousness forced humans to deal with the concept of personal mortality. Religion may have been one solution to this problem.

Other researchers have proposed specific psychological processes which may have been co-opted for religion. Pascal Boyer suggests, in his book *Religion Explained*, that there is no simple explanation for religious consciousness. He builds on the ideas of cognitive anthropologists Dan Sperber and Scott Atran, who argued that religious cognition represents a by-product of various evolutionary adaptations, including folk psychology, and purposeful violations of innate expectations about how the world is constructed (for example, bodiless beings with thoughts and emotions) that make religious cognitions striking and memorable.

Pierre Lienard and Pascal Boyer suggest that humans have evolved a "hazard-precaution system" which allows us to detect potential threats in the environment and attempt to respond appropriately. Several features of ritual behaviors, often a major feature of religion, are held to trigger this system. These include the occasion for the ritual, often the prevention or elimination of danger or evil, the harm believed to result from nonperformance of the ritual, and the detailed proscriptions for proper performance of the ritual. Lienard and Boyer discuss the possibility that a sensitive hazard-precaution system itself may have provided fitness benefits, and that religion then "associates individual, unmanageable anxieties with coordinated action with others and thereby makes them more tolerable or meaningful".

Justin L. Barrett in *Why Would Anyone Believe in God?* suggests that belief in God is natural because it depends on mental tools possessed by all human beings. He suggests that the way our minds are structured and develop make belief in the existence of a supreme god with properties such as being superknowing, superpowerful and immortal highly attractive. He also compares belief in God to belief in other minds, and devotes a chapter to looking at the evolutionary psychology of atheism. He suggests that one of the fundamental mental modules in the brain is the Hyperactive Agency Detection Device (HADD), another potential system for identifying danger. This HADD may confer a survival benefit even if it is over-sensitive: it is better to avoid an imaginary predator than be killed by a real one. This would tend to encourage belief in ghosts and spirits.

Memes

Richard Dawkins suggests in *The Selfish Gene* that cultural memes function like genes in that they are subject to natural selection. In *The God Delusion* Dawkins further argues that because religious truths cannot be questioned, their very nature encourages religions to spread like "mind viruses".

This model holds that religion is the byproduct of the cognitive modules in the human brain that arose in our evolutionary past to deal with problems of survival and reproduction. Initial concepts of supernatural agents may arise in the tendency of humans to "overdetect" the presence of other humans or predators (momentarily mistaking a vine for a snake). For instance, a man might report that he felt something sneaking up on him, but it vanished when he looked around.

Stories of these experiences are especially likely to be retold, passed on and embellished due to their descriptions of standard ontological categories (human, artifact, animal, plant, natural object) with counterintuitive properties (humans that are invisible, houses that remember what happened in them, etc.). These stories become even more...
salient when they are accompanied by activation of non-violated expectations for the ontological category (houses that "remember" activates our intuitive psychology of mind; i.e. we automatically attribute thought processes to them).[12]

One of the attributes of our intuitive psychology of mind is that humans are interested in the affairs of other humans. This may result in the tendency for concepts of supernatural agents to inevitably cross connect with human intuitive moral feelings (evolutionary behavioral guidelines). In addition, the presence of dead bodies creates an uncomfortable cognitive state in which dreams and other mental modules (person identification and behavior prediction) continue to run decoupled from reality producing incompatible intuitions that the dead are somehow still around. When this is coupled with the human predisposition to see misfortune as a social event (as someone's responsibility rather than the outcome of mechanical processes) it may activate the intuitive "willingness to make exchanges" module of the human theory of minds resulting in the tendency of humans to try to interact and bargain with their supernatural agents (ritual).[13]

In a large enough group, some individuals will seem better skilled at these rituals than others and will become specialists. As the societies grow and encounter others, competition will ensue and a "survival of the fittest" effect may cause the practitioners to modify their concepts to provide a more abstract, more widely acceptable version. Eventually the specialist practitioners form a cohesive group or guild with its attendant political goals (religion).[13]

Biological mechanisms causing religiosity

The God gene hypothesis proposes that a specific gene (VMAT2) predisposes humans towards spiritual or mystic experiences. Proponent Dean Hamer see this predisposition as increasing optimism which has positive effects on other factors such as health and reproductive success.

References


External links

- International Association for the Cognitive Science of Religion (http://www.iacsr.com)

Evolutionary origin of religions

The evolutionary origin of religions theorizes about the emergence of religious behavior during the course of human evolution.

Nonhuman religious behavior

Humanity's closest living relatives are common chimpanzees and bonobos. These primates share a common ancestor with humans who lived between four and six million years ago. It is for this reason that chimpanzees and bonobos are viewed as the best available surrogate for this common ancestor. Barbara King argues that while non-human primates are not religious, they do exhibit some traits that would have been necessary for the evolution of religion. These traits include high intelligence, a capacity for symbolic communication, a sense of social norms, realization of "self" and a concept of continuity.[1] [2] [3] There is inconclusive evidence that Homo neanderthalensis may have buried their dead which is evidence of the use of ritual. The use of burial rituals is evidence of religious activity, but there is no other evidence that religion existed in human culture before humans reached behavioral modernity.[4]

Elephants are the only other species known to have any recognizable ritual surrounding death.

Marc Bekoff, Professor Emeritus of Ecology and Evolutionary Biology at the University of Colorado, Boulder, argues that many species grieve death and loss.[5]
Setting the stage for human religion

Increased brain size

In this set of theories, the religious mind is one consequence of a brain that is large enough to formulate religious and philosophical ideas. During human evolution, the hominid brain tripled in size, peaking 500,000 years ago. Much of the brain's expansion took place in the neocortex. This part of the brain is involved in processing higher order cognitive functions that are connected with human religiosity. The neocortex is associated with self consciousness, language and emotion. According to Dunbar's theory, the relative neocortex size of any species correlates with the level of social complexity of the particular species. The neocortex size correlates with a number of social variables that include social group size and complexity of mating behaviors. In chimpanzees the neocortex occupies 50% of the brain, whereas in modern humans it occupies 80% of the brain.

Robin Dunbar argues that the critical event in the evolution of the neocortex took place at the speciation of archaic homo sapiens about 500,000 years ago. His study indicates that only after the speciation event is the neocortex large enough to process complex social phenomena such as language and religion. The study is based on a regression analysis of neocortex size plotted against a number of social behaviors of living and extinct hominids.

Stephen Jay Gould suggests that religion may have grown out of evolutionary changes which favored larger brains as a means of cementing group coherence among savannah hunters, after that larger brain enabled reflection on the inevitability of personal mortality.

Tool use

Lewis Wolpert argues that causal beliefs that emerged from tool use played a major role in the evolution of belief. The manufacture of complex tools requires creating a mental image of an object that does not exist naturally before actually making the artifact. Furthermore, one must understand how the tool would be used, which requires an understanding of causality. Accordingly, the level of sophistication of stone tools is a useful indicator of causal beliefs. Wolpert contends use of tools composed of more than one component, such as hand axes, represents an ability to understand cause and effect. However, recent studies of other primates indicate that causality may not be a uniquely human trait. For example, chimpanzees have escaped from pens that were closed with multiple latches, that were previously thought could only have been figured out by humans who understood causality. (Chimpanzees are also known to mourn the dead, and notice things that have only aesthetic value, like sunsets, both of which may be considered to be components of religion or spirituality.) The difference between the comprehension of causality by humans and chimpanzees is one of degree. The degree of comprehension in an animal depends upon the size of the prefrontal cortex: the greater the size of the prefrontal cortex the deeper the comprehension.

Development of language

Religion requires a system of symbolic communication, such as language, to be transmitted from one individual to another. Philip Lieberman states "human religious thought and moral sense clearly rest on a cognitive-linguistic base." From this premise science writer Nicholas Wade states:

"Like most behaviors that are found in societies throughout the world, religion must have been present in the ancestral human population before the dispersal from Africa 50,000 years ago. Although religious rituals usually involve dance and music, they are also very verbal, since the sacred truths have to be stated. If so, religion, at least in its modern form, cannot pre-date the emergence of language. It has been argued earlier that language attained its modern state shortly before the exodus from Africa. If religion had to await the evolution of modern, articulate language, then it too would have emerged shortly before 50,000 years ago."

Another view distinguishes individual religious belief from collective religious belief. While the former does not require prior development of language, the latter does. The individual human brain has to explain a phenomenon in order to comprehend and relate to it. This activity predates by far the emergence of language and may have caused it.
The theory is, belief in the supernatural emerges from hypotheses arbitrarily assumed by individuals to explain natural phenomena that cannot be explained otherwise. The resulting need to share individual hypotheses with others leads eventually to collective religious belief. A socially accepted hypothesis becomes dogmatic backed by social sanction.

**Morality and group living**

Dr. Frans de Waal and Barbara King both view human morality as having grown out of primate sociality. Though morality may be a unique human trait, many social animals, such as primates, dolphins and whales, have been known to exhibit pre-moral sentiments. According to Michael Shermer, the following characteristics are shared by humans and other social animals, particularly the great apes:

"attachment and bonding, cooperation and mutual aid, sympathy and empathy, direct and indirect reciprocity, altruism and reciprocal altruism, conflict resolution and peacemaking, deception and deception detection, community concern and caring about what others think about you, and awareness of and response to the social rules of the group".\[13\]

De Waal contends that all social animals have had to restrain or alter their behavior for group living to be worthwhile. Pre-moral sentiments evolved in primate societies as a method of restraining individual selfishness and building more cooperative groups. For any social species, the benefits of being part of an altruistic group should outweigh the benefits of individualism. For example, lack of group cohesion could make individuals more vulnerable to attack from outsiders. Being part of a group may also improve the chances of finding food. This is evident among animals that hunt in packs to take down large or dangerous prey.

All social animals have hierarchical societies in which each member knows its own place. Social order is maintained by certain rules of expected behavior and dominant group members enforce order through punishment. However, higher order primates also have a sense of reciprocity and fairness. Chimpanzees remember who did them favors and who did them wrong. For example, chimpanzees are more likely to share food with individuals who have previously groomed them.\[14\]

Chimpanzees live in fission-fusion groups that average 50 individuals. It is likely that early ancestors of humans lived in groups of similar size. Based on the size of extant hunter-gatherer societies, recent Paleolithic hominids lived in bands of a few hundred individuals. As community size increased over the course of human evolution, greater enforcement to achieve group cohesion would have been required. Morality may have evolved in these bands of 100 to 200 people as a means of social control, conflict resolution and group solidarity. According to Dr. de Waal, human morality has two extra levels of sophistication that are not found in primate societies. Humans enforce their society's moral codes much more rigorously with rewards, punishments and reputation building. Humans also apply a degree of judgment and reason not otherwise seen in the animal kingdom.

Psychologist Matt J. Rossano argues that religion emerged after morality and built upon morality by expanding the social scrutiny of individual behavior to include supernatural agents. By including ever-watchful ancestors, spirits and gods in the social realm, humans discovered an effective strategy for restraining selfishness and building more cooperative groups.\[15\] The adaptive value of religion would have enhanced group survival.\[16\] \[17\] Rossano is referring here to collective religious belief and the social sanction that institutionalized morality. Individual religious belief is initially epistemological, not ethical, in nature.
Evolutionary psychology of religion

There is general agreement among cognitive scientists that religion is an outgrowth of brain architecture that evolved early in human history. However, there is disagreement on the exact mechanisms that drove the evolution of the religious mind. The two main schools of thought hold that either religion evolved due to natural selection and has selective advantage, or that religion is an evolutionary byproduct of other mental adaptations. Stephen Jay Gould, for example, believed that religion was an exaptation or a spandrel, in other words that religion evolved as byproduct of psychological mechanisms that evolved for other reasons.

Such mechanisms may include the ability to infer the presence of organisms that might do harm (agent detection), the ability to come up with causal narratives for natural events (etiology), and the ability to recognize that other people have minds of their own with their own beliefs, desires and intentions (theory of mind). These three adaptations (among others) allow human beings to imagine purposeful agents behind many observations that could not readily be explained otherwise, e.g. thunder, lightning, movement of planets, complexity of life, etc. The emergence of collective religious belief identified the agents as deities that standardized the explanation. Some scholars have suggested that religion is genetically "hardwired" into the human condition. One controversial hypothesis, the God gene hypothesis, states that some variants of a specific gene, the VMAT2 gene, predispose to spirituality.

Another view is based on the concept of the triune brain: the reptilian brain, the limbic system, and the neocortex, proposed by Paul D. MacLean. Collective religious belief draws upon the emotions of love, fear, and gregariousness and is deeply embedded in the limbic system through sociobiological conditioning and social sanction. Individual religious belief utilizes reason based in the neocortex and often varies from collective religion. The limbic system is much older in evolutionary terms than the neocortex and is, therefore, stronger than much in the same way as the reptilian is stronger than both the limbic system and the neocortex. Reason is pre-empted by emotional drives. The religious feeling in a congregation is emotionally different from individual spirituality even though the congregation is composed of individuals. Belonging to a collective religion is culturally more important than individual spirituality though the two often go hand in hand. This is one of the reasons why religious debates are likely to be inconclusive.

Prehistoric evidence of religion

When humans first became religious remains unknown, but there is credible evidence of religious behavior from the Middle Paleolithic era (300–500 thousand years ago) and possibly earlier.

Paleolithic burials

The earliest evidence of religious thought is based on the ritual treatment of the dead. Most animals display only a casual interest in the dead of their own species. Ritual burial thus represents a significant advancement in human behavior. Ritual burials represent an awareness of life and death and a possible belief in the afterlife. Philip Lieberman states "burials with grave goods clearly signify religious practices and concern for the dead that transcends daily life."

The earliest evidence for treatment of the dead comes from Atapuerca in Spain. At this location the bones of 30 individuals believed to be Homo heidelbergensis have been found in a pit. Neanderthals are also contenders for the first hominids to intentionally bury the dead. They may have placed corpses into shallow graves along with stone tools and animal bones. The presence of these grave goods may indicate an emotional connection with the deceased and possibly a belief in the afterlife. Neanderthal burial sites include Shanidar in Iraq and Krapina in Croatia and Kebara Cave in Israel.

The earliest known burial of modern humans is from a cave in Israel located at Qafzeh. Human remains have been dated to 100,000 years ago. Human skeletons were found stained with red ochre. A variety of grave goods were found at the burial site. The mandible of a wild boar was found placed in the arms of one of the skeletons.
Evolutionary origin of religions

Lieberman states:

"Burial rituals incorporating grave goods may have been invented by the anatomically modern hominids who emigrated from Africa to the Middle East roughly 100,000 years ago".\[29\]

Matt Rossano suggests that the period in between 80,000–60,000 years after humans retreated from the Levant to Africa was a crucial period in the evolution of religion.\[30\]

The use of symbolism

The use of symbolism in religion is a universal established phenomenon. Archeologist Steven Mithen contends that it is common for religious practices to involve the creation of images and symbols to represent supernatural beings and ideas. Because supernatural beings violate the principles of the natural world, there will always be difficulty in communicating and sharing supernatural concepts with others. This problem can be overcome by anchoring these supernatural beings in material form through representational art. When translated into material form, supernatural concepts become easier to communicate and understand.\[31\] Due to the association of art and religion, evidence of symbolism in the fossil record is indicative of a mind capable of religious thoughts. Art and symbolism demonstrates a capacity for abstract thought and imagination necessary to construct religious ideas. Wentzel van Huyssteen states that the translation of the non-visible through symbolism enabled early human ancestors to hold beliefs in abstract terms.\[32\]

Some of the earliest evidence of symbolic behavior is associated with Middle Stone Age sites in Africa. From at least 100,000 years ago, there is evidence of the use of pigments such as red ochre. Pigments are of little practical use to hunter gatherers, thus evidence of their use is interpreted as symbolic or for ritual purposes. Among extant hunter gatherer populations around the world, red ochre is still used extensively for ritual purposes. It has been argued that it is universal among human cultures for the color red to represent blood, sex, life and death.\[33\]

The use of red ochre as a proxy for symbolism is often criticized as being too indirect. Some scientists, such as Richard Klein and Steven Mithen, only recognize unambiguous forms of art as representative of abstract ideas. Upper paleolithic cave art provides some of the most unambiguous evidence of religious thought from the paleolithic. Cave paintings at Chauvet depict creatures that are half human and half animal.

Origins of organized religion

Social evolution of humans\[13\]\[34\]

<table>
<thead>
<tr>
<th>Period years ago</th>
<th>Society type</th>
<th>Number of individuals</th>
</tr>
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<tbody>
<tr>
<td>100,000–10,000</td>
<td>Bands</td>
<td>10s–100s</td>
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<td>10,000–5,000</td>
<td>Tribes</td>
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<td>5,000–3,000</td>
<td>Chiefdoms</td>
<td>1,000s–10,000s</td>
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<td>3,000–1,000</td>
<td>States</td>
<td>10,000s–100,000s</td>
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<td>1,000–present</td>
<td>Empires</td>
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Organized religion traces its roots to the neolithic revolution that began 11,000 years ago in the Near East but may have occurred independently in several other locations around the world. The invention of agriculture transformed many human societies from a hunter gatherer lifestyle to a sedentary lifestyle. The consequences of the neolithic revolution included a population explosion and an acceleration in the pace of technological development. The transition from foraging bands to states and empires precipitated more specialized and developed forms of religion that reflected the new social and political environment. While bands and small tribes possess supernatural beliefs, these beliefs do not serve to justify a central authority, justify transfer of wealth or maintain peace between unrelated individuals. Organized religion emerged as a means of providing social and economic stability through the following
Evolutionary origin of religions

ways:

- Justifying the central authority, which in turn possessed the right to collect taxes in return for providing social and security services to the state.
- Bands and tribes consist of small number of related individuals. However states and nations are composed of thousands of unrelated individuals. Jared Diamond argues that organized religion served to provide a bond between unrelated individuals who would otherwise be more prone to enmity. He argues that the leading cause of death among hunter gatherer societies is murder.\(^{[34]}\)
- Religions that revolved around moralizing gods may have facilitated the rise of large, cooperative groups of unrelated individuals.\(^{[35]}\)

The states born out of the Neolithic revolution, such as those of Ancient Egypt and Mesopotamia, were theocracies with chiefs, kings and emperors playing dual roles of political and spiritual leaders.\(^{[13]}\) Anthropologists have found that virtually all state societies and chiefdoms from around the world have been found to justify political power through divine authority. This suggests that political authority co-opts collective religious belief to bolster itself.

Invention of writing

Following the neolithic revolution, the pace of technological development (cultural evolution) intensified due to the invention of writing 5000 years ago. Symbols that became words later on made effective communication of ideas possible. Printing invented only over a thousand years ago increased the speed of communication exponentially and became the main spring of cultural evolution. Writing is thought to have been first invented in either Sumeria or Ancient Egypt and was initially used for accounting. Soon after, writing was used to record myth. The first religious texts mark the beginning of religious history. The Pyramid Texts from ancient Egypt are one of the oldest known religious texts in the world, dating to between 2400–2300 BCE.\(^{[36]}\) Writing played a major role in sustaining and spreading organized religion. In pre-literate societies, religious ideas were based on an oral tradition, the contents of which were articulated by shamans and remained limited to the collective memories of the society’s inhabitants. With the advent of writing, information that was not easy to remember could easily be stored in sacred texts that were maintained by a select group (clergy). Humans could store and process large amounts of information with writing that otherwise would have been forgotten. Writing therefore enabled religions to develop coherent and comprehensive doctrinal systems that remained independent of time and place.\(^{[39]}\) Writing also brought a measure of objectivity to human knowledge. Formulation of thoughts in words and the requirement for validation made mutual exchange of ideas and the sifting of generally acceptable from not acceptable ideas possible. The generally acceptable ideas became objective knowledge reflecting the continuously evolving framework of human awareness of reality that Karl Popper calls ‘verisimilitude’ – a stage on the human journey to truth. (For reference see ‘Objective Knowledge’ published in UK authored by Sir Karl Popper.)

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External links

• Robert Wright’s "The Evolution of God" (http://www.evolutionofgod.net/)
• Evolutionary Religious Studies (http://evolution.binghamton.edu/religion/index.html) at Binghamton University, An introduction to the study of religion from an evolutionary perspective.
• A 1998 speech at Biota 2 by Douglas Adams on the Origin of God (http://www.youtube.com/watch?v=hDC_NcihiV8)
• Wilhelm Schmidt and the origin of religion (http://www.answersingenesis.org/creation/v14/i3/schmidt.asp)
  – an opposing viewpoint

Human Behavior and Evolution Society

The Human Behavior and Evolution Society, or HBES, is an interdisciplinary, international society of researchers, primarily from the social and biological sciences, who use modern evolutionary theory to help to discover human nature - including evolved emotional, cognitive and sexual adaptations. It was founded October 29, 1988 at the University of Michigan.

The official academic journal of the society is Evolution and Human Behavior, and the society has held annual conferences since 1989. As of 2009, the president is Steven Gangestad, of the Department of Psychology, University of New Mexico. The membership consists of scholars from many fields, such as psychology, anthropology, medicine, law, philosophy, biology, economics and sociology. Despite the diversity, HBES members "all speak the common language of Darwinism."[1]

External links

• Official Website [2]

References

Dunbar's number

Dunbar's number is suggested to be a theoretical cognitive limit to the number of people with whom one can maintain stable social relationships. These are relationships in which an individual knows who each person is, and how each person relates to every other person. Proponents assert that numbers larger than this generally require more restrictive rules, laws, and enforced norms to maintain a stable, cohesive group. No precise value has been proposed for Dunbar's number. It has been proposed to lie between 100 and 230, with a commonly used value of 150. Dunbar's number states the number of people one knows and keeps social contact with, and it does not include the number of people known personally with a ceased social relationship, nor people just generally known with a lack of persistent social relationship, a number which might be much higher and likely depends on long-term memory size.

Dunbar's number was first proposed by British anthropologist Robin Dunbar, who theorized that "this limit is a direct function of relative neocortex size, and that this in turn limits group size ... the limit imposed by neocortical processing capacity is simply on the number of individuals with whom a stable inter-personal relationship can be maintained." On the periphery, the number also includes past colleagues such as high school friends with whom a person would want to reacquaint oneself if they met again.

Research background

Primatologists have noted that, due to their highly social nature, non-human primates must maintain personal contact with the other members of their social group, usually through social grooming. Such social groups function as protective cliques within the physical groups in which the primates live. The number of social group members a primate can track appears to be limited by the volume of the neocortex. This suggests that there is a species-specific index of the social group size, computable from the species' mean neocortical volume.

In a 1992 article, Dunbar used the correlation observed for non-human primates to predict a social group size for humans. Using a regression equation on data for 38 primate genera, Dunbar predicted a human "mean group size" of 148 (casually rounded to 150), a result he considered exploratory due to the large error measure (a 95% confidence interval of 100 to 230).

Dunbar then compared this prediction with observable group sizes for humans. Beginning with the assumption that the current mean size of the human neocortex had developed about 250,000 years ago, during the Pleistocene, Dunbar searched the anthropological and ethnographical literature for census-like group size information for various hunter–gatherer societies, the closest existing approximations to how anthropology reconstructs the Pleistocene societies. Dunbar noted that the groups fell into three categories — small, medium and large, equivalent to bands, cultural lineage groups and tribes — with respective size ranges of 30–50, 100–200 and 500–2500 members each.

Dunbar's surveys of village and tribe sizes also appeared to approximate this predicted value, including 150 as the estimated size of a Neolithic farming village; 150 as the splitting point of Hutterite settlements; 200 as the upper bound on the number of academics in a discipline's sub-specialization; 150 as the basic unit size of professional armies in Roman antiquity and in modern times since the 16th century; and notions of appropriate company size.

Dunbar has argued that 150 would be the mean group size only for communities with a very high incentive to remain together. For a group of this size to remain cohesive, Dunbar speculated that as much as 42% of the group's time would have to be devoted to social grooming. Correspondingly, only groups under intense survival pressure, such as subsistence villages, nomadic tribes, and historical military groupings, have, on average, achieved the 150-member mark. Moreover, Dunbar noted that such groups are almost always physically close: "... we might expect the upper limit on group size to depend on the degree of social dispersal. In dispersed societies, individuals will meet less often and will thus be less familiar with each, so group sizes should be smaller in consequence." Thus, the 150-member group would occur only because of absolute necessity—due to intense environmental and economic pressures.
Dunbar, in *Grooming, Gossip, and the Evolution of Language*, proposes furthermore that language may have arisen as a "cheap" means of social grooming, allowing early humans to efficiently maintain social cohesion. Without language, Dunbar speculates, humans would have to expend nearly half their time on social grooming, which would have made productive, cooperative effort nearly impossible. Language may have allowed societies to remain cohesive, while reducing the need for physical and social intimacy.[4]

Dunbar's number has since become of interest in anthropology, evolutionary psychology,[5] statistics, and business management. For example, developers of social software are interested in it, as they need to know the size of social networks their software needs to take into account; and in the modern military, operational psychologists seek such data to support or refute policies related to maintaining or improving unit cohesion and morale.

A recent study has suggested that Dunbar's number is applicable to online social networks as well.[6]

### Alternative numbers

Dunbar's number is not derived from systematic observation of the number of relationships that people living in the contemporary world have. As noted above, it comes from extrapolation from non-human primates and from inspection of selected documents showing network sizes in selected pre-industrial villages and settlements in less-developed countries.

Anthropologist H. Russell Bernard and Peter Killworth and associates have done a variety of field studies in the United States that came up with an estimated mean number of ties, 290, that is roughly double Dunbar's estimate. The Bernard–Killworth median of 231 is lower, due to upward straggle in the distribution: this is still appreciably larger than Dunbar's estimate. The Bernard–Killworth estimate of the maximum likelihood of the size of a person's social network is based on a number of field studies using different methods in various populations. It is not an average of study averages but a repeated finding.[7][8] Nevertheless, the Bernard–Killworth number has not been popularized as widely as Dunbar's.

### Popularization

- In a 1985 paper titled "Psychology, Ideology, Utopia, & the Commons,"[9] psychologist Dennis Fox proposed the same concept as it is applied to anarchy, politics, and the tragedy of the commons.
- The number has been used in the study of Internet communities, especially MMORPGs such as Ultima Online, and social networking websites such as Facebook[10] (Dunbar himself is doing a study on Facebook to be released in 2010[11]) and MySpace.[12]
- The Swedish tax authority planned to reorganize its functions in 2007 with a maximum 150 people per office, referring to Dunbar's research.[13]
- It has also been popularized as the "monkeysphere," a neologism coined by David Wong in an article, *What is the Monkeysphere?*, which introduces this concept in a humorous manner.[14]

### References

Further reading


External links

- A pre-publication version (http:www.bbsonline.org/documents/a/00/00/05/65/bbs00000565-00/bbs.dunbar.html) of *Coevolution of neocortical size, group size and language in humans*. (See also Bibliography section there.)
- University of Liverpool Research Intelligence No. 17, August 2003 (http://www.liv.ac.uk/researchintelligence/issue17/brain teaser.html) – "The ultimate brain teaser" – an article on Dunbar's research.
- Mospos blog entry (http://www.blog.mopsos.com/archives/000075.html) – Communities of practice and Dunbar's number
- Life With Alacrity blog entry (http://www.lifewithalacrity.com/2004/03/the_dunbar numb.html) – Applying Dunbar's number to on-line gaming, social software, collaboration, trust, security, privacy, and internet tools, by Christopher Allen.
- Monkey Sphere (http://www.cracked.com/article_14990 what-monkeysphere.html) The Monkey Sphere Cracked Article
Suicide (Latin *suicidium*, from *sui caedere*, "to kill oneself") is the act of intentionally causing one's own death. Suicide is often committed out of despair or attributed to some underlying mental disorder, such as depression, bipolar disorder, schizophrenia, alcoholism, or drug abuse.[7] Pressures or misfortunes such as financial difficulties or troubles with interpersonal relationships often play a significant role.[8]

Over one million people die by suicide every year. The World Health Organization (WHO) estimates that it is the thirteenth leading cause of death worldwide[9] and the National Safety Council rates it sixth in the United States.[10] It is a leading cause of death among teenagers and adults under 35.[11][12] The rate of suicide is far higher in men than in women, with males worldwide three to four times more likely to kill themselves than females.[13][14] There are an estimated 10 to 20 million non-fatal attempted suicides every year worldwide.[15]

Views on suicide have been influenced by broader cultural views on existential themes such as religion, honor, and the meaning of life. The Abrahamic religions traditionally consider suicide an offense towards God due to the belief in the sanctity of life. It was often regarded as a serious crime and that view remains commonplace in modern Western thought. However, before the rise of Christianity, suicide was not seen as automatically immoral in ancient Greek and Roman culture. Conversely, during the samurai era in Japan, seppuku was respected as a means of atonement for failure or as a form of protest. Sati is a Hindu funeral practice, now outlawed, in which the widow was expected to immolate herself on her husband's funeral pyre, either willingly or under pressure from the family and society.[16] In the 20th and 21st centuries, suicide in the form of self-immolation has been used as a medium of protest, and the form of kamikaze and suicide bombings as a military or terrorist tactic.

Medically assisted suicide (euthanasia, or the right to die) is a controversial issue in the modern ethics landscape. The defining characteristic is the focus on people who are terminally ill, in extreme pain, or possessing (actual or
perceived) minimal quality of life resulting from an injury or illness.

Self-sacrifice on behalf of another is not necessarily considered suicide; the subjective goal is not to end one's own life, but rather to save the life of another. However, in Émile Durkheim's theory, such acts are termed "altruistic suicides."[17]

**Classification**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euthanasia</td>
<td>Individuals who wish to end their own lives may enlist the assistance of another party to achieve death. The other person, usually a family member or physician, may help carry out the act when the individual lacks the physical capacity to do so alone, even if supplied with the means. Assisted suicide is a contentious moral and political issue in many countries, as seen in the scandal surrounding Dr. Jack Kevorkian, a US medical practitioner who supported euthanasia and was convicted of having helped patients end their own lives, for which served an eight year prison term.[18]</td>
</tr>
<tr>
<td>Murder–suicide</td>
<td>A murder–suicide is an act in which an individual kills one or more other persons immediately before or at the same time as him or herself. The motivation for the murder in murder–suicide can be purely criminal in nature or be perceived by the perpetrator as an act of care for loved ones in the context of severe depression.</td>
</tr>
<tr>
<td>Suicide attack</td>
<td>A suicide attack is an act in which an attacker perpetrates an act of violence against others, typically to achieve a military or political goal, which simultaneously results in his or her own death. Suicide bombings are often regarded as an act of terrorism by the targeted community. Historical examples include the assassination of Czar Alexander II, the kamikaze attacks launched by Japanese air pilots during the Second World War, and larger scale attacks, such as the September 11th attacks.</td>
</tr>
<tr>
<td>Mass suicide</td>
<td>Some suicides are performed under social pressure or coordinated among a group of individuals. Mass suicides can take place with as few as two people, often referred to as a suicide pact. An example of a larger group is the 1978 &quot;Jonestown&quot; cult suicide, in which 918 members of the Peoples Temple, an American cult led by Jim Jones, ended their lives by drinking grape Flavor Aid laced with cyanide. [19][20][21]</td>
</tr>
<tr>
<td>Suicide pact</td>
<td>A suicide pact describes the suicides of two or more individuals in an agreed upon plan. The plan may be to die together, or separately and closely timed. Suicide pacts are generally distinct from mass suicides in that the latter refers to a larger number of people who kill themselves together for a common ideological reason, often within a religious, political, military or paramilitary context. In contrast, suicide pacts typically involve small groups of more intimately related people (commonly spouses, romantic partners, family members, or friends), whose motivations are intensely personal and individual.</td>
</tr>
<tr>
<td>Defiance or protest</td>
<td>Suicide is sometimes committed as an act of defiance or political protest such as the recent suicide of Mohamed Bouazizi in Tunisia whose treatment at the hands of the authorities led to a revolt that overthrew the ruling regime aand touched off the Arab Spring. During the sectarian strife in Northern Ireland known as &quot;The Troubles&quot; a hunger strike was launched by the provisional IRA, demanding that their prisoners be reclassified as prisoners of war rather than as terrorists. The infamous 1981 hunger strikes, led by Bobby Sands resulted in 10 deaths. The cause of death was recorded as &quot;starvation, self-imposed&quot; rather than suicide by the coroner; this was modified to simply &quot;starvation&quot; on the death certificates after protest from the deceased striker's families.[22]</td>
</tr>
<tr>
<td>Dutiful suicide</td>
<td>Dutiful suicide is an act of fatal self violence at one's own hands done in the belief that it will secure a greater good, rather than to escape harsh or impossible conditions. It can be voluntary, to relieve some dishonor or punishment, or imposed by threats of death or reprisals on one's family or reputation as in the forced suicide of German general Erwin Rommel during World War II. He was found to have foreknowledge of the July 20 Plot on Hitler's life and was threatened with public trial, execution, and reprisals on his family unless he took his own life. It is a traditional practice in some cultures, such as the heavily ritualized Japanese custom of seppuku.</td>
</tr>
<tr>
<td>Escape</td>
<td>In extenuating situations where continuing to live would be intolerable, some people use suicide as a means of escape. Some inmates in Nazi concentration camps are known to have killed themselves by deliberately touching the electrified fences.[24] A person who has committed a crime may commit suicide in order to escape disgrace, prosecution, capture, or incarceration. Nazi leader Hermann Göring committed suicide with cyanide capsules rather than be hanged after his conviction at the Nuremberg Trials. Some shooting sprees, including the school shootings at Columbine High School and Virginia Tech, concluded with the perpetrators committing suicide.</td>
</tr>
</tbody>
</table>
Risk factors

Clinical studies have shown that underlying mental disorders are present in 87% to 98% of suicides, however there are a number of other factors are correlated with suicide risk, including, drug addiction, availability of means, family history of suicide, previous head injury[27][28]

Socio-economic factors such as unemployment, poverty, homelessness, and discrimination may trigger suicidal thoughts.[29] Poverty may not be a direct cause but it can increase the risk of suicide, as impoverished individuals are a major risk group for depression.[30] A history a childhood physical or sexual abuse[31] or time spent in foster care.[32][33][34]

Hopelessness, the feeling that there is no prospect of improvement in one’s situation is a strong indicator of suicide with the results of one study showing that 91% of those who scored a 10 or higher on the Beck Hopelessness Scale would eventually commit suicide.[35] Perceived burdensomeness[36] a feeling that one’s existence is a burden to others such as family members is often coupled with hoplessness as are the feelings of loneliness,[37] either subjectively (i.e., the feeling), or objectively (i.e., living alone or being without friends and lacking social support[38] ) and the feeling of not belonging[39] as strong mediators of suicidal ideation.

Advocacy of suicide has been cited as a contributing factor. Intelligence may also be a factor. Initially proposed as a part of an evolutionary psychology explanation, which posited a minimum intelligence required for one to commit suicide, the positive correlation between IQ and suicide has been replicated in a number of studies.[40][41][42][43][44] Some scientists doubt however that intelligence can be a cause of suicide.[45] and intelligence is no longer a predictor of suicide when regressed with national religiousness and perceptions of personal health.[46] According to the American Psychiatric Association, “religiously unaffiliated subjects had significantly more lifetime suicide attempts and more first-degree relatives who committed suicide than subjects who endorsed a religious affiliation.”[47] Moreover, individuals with no religious affiliation had fewer moral objections to suicide than believers.[47]

One study found that a lack of social support, a deficit in feelings of belongingness and living alone were crucial predictors of a suicide attempt.[48] One study found that among prison inmates, suicide was more likely among inmates who had committed a violent crime.[49]

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**Precipitating Circumstances for Suicide**

A representative listing of circumstances for suicide in 16 states in the United States. This chart does not include all possible circumstances.

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Medical conditions

In various studies a significant association was found between suicidality and underlying medical conditions including chronic pain, mild brain injury (MBI) or traumatic brain injury (TBI). The prevalence of increased suicidality persisted after adjusting for depressive illness and alcohol abuse. In patients with more than one medical condition the risk was particularly high, suggesting a need for increased screening for suicidality in general medical settings.

Sleep disturbances such as insomnia and sleep apnea have been cited in various studies as risk indicators for depression and suicide. In some instances the sleep disturbance itself may be the risk factor independent of depression.

A careful medical evaluation is recommended for all people presenting with psychiatric symptoms as many medical conditions are associated with psychiatric symptomatology. The major medical conditions presenting with psychiatric symptoms in order of frequency were infectious, pulmonary, thyroid, diabetic, hematopoietic, hepatic and CNS diseases. Conservative estimates are, that 10% of all psychological symptoms may be due to undiagnosed medical conditions with the results of one study, suggesting that about 50% of individuals with a serious mental illness "have general medical conditions that are largely undiagnosed and untreated and may cause or exacerbate psychiatric symptoms."

Mental disorders

Certain mental disorders are often present at the time of suicide. It is estimated that from 87% to 98% of suicides are committed by people with some type of mental disorder. Broken down by type: mood disorders are present in 30%, substance abuse in 18%, schizophrenia in 14%, and personality disorders in 13% of suicides. About 5% of people with schizophrenia die of suicide. Major depression and alcoholism are the specific disorders most strongly correlated with suicide risk. Risk is greatest during the early stages of illness among people with mood disorders, such as major depression or bipolar disorder.

Depression is among the most commonly diagnosed psychiatric disorders, increasingly diagnosed across various segments of the worldwide population. 17.6 million Americans are affected each year; approximately 1 in 6 people. Within the next twenty years, depression is expected to become the leading cause of disability in developed nations and the second leading cause of disability worldwide. While the psychological and medical communities no longer classify acts of self-harm as suicide attempts, recent research has indicated that the presence of self-injurious behavior may be correlated to increased suicide risk. While there is a correlation between self-harm and suicide, it is not believed to be causal; both are most likely a joint effect of depression. This may also be classified as Deliberate self-harm and is most common in younger people but has been increasing in recent years in people of all ages.

Most people who attempt suicide do not complete the act on their first attempt. However, a history of suicide attempts is correlated with increased risk of eventual completion of a suicide.

Biology

Some mental disorders identified as risk factors for suicide often may have an underlying biological basis. Serotonin is a vital brain neurotransmitter; in those who have attempted suicide it has been found that they have lower serotonin levels, and individuals who have completed suicide have the lowest levels. This dysregulation in the serotonin pathway has been identified, in the ventromedial prefrontal cortex. This alteration in the brain has been found to be a risk factor for suicide independent of a history of a major depression "indicating that it is involved in the predisposition to suicide in many psychiatric disorders."

There is evidence that there may be an underlying neurobiological basis for suicide risk independent of the inheritable genetic factors responsible for the major psychiatric disorders associated with suicide. Genetic inheritance accounts for roughly 30–50% of the variance in suicide risk between individuals.
parent who has committed suicide is a strong predictor of suicide attempts.\[{84}\} [85] [86]

Epigenetics, the study of changes in genetic expression in response to environmental factors which do not alter the underlying DNA, may also play a role in determining suicide risk.\[{87}\} [88] [89]

**Perceived burdensomeness to others**

Several studies have found perceived burdensomeness to others to be a particularly strong risk factor. It also differentiates between attempted vs. completed suicide and predicts lethality of suicide method unlike feelings of hopelessness and emotional pain. Likely related to this, completed suicides are characterized by altruistic feelings while non-lethal self-injuries are characterized by feelings of anger or self-punishment.\[{90}\]

**Substance abuse**

Substance abuse is the second most common risk factor for suicide after major depression and bipolar disorder.\[{91}\] Both chronic substance misuse as well as acute substance abuse are associated with suicide.\[{92}\] This is attributed to the intoxicating, disinhibiting, and dissociative effects of many psychoactive substances. When combined with personal grief, such as bereavement, the risk of suicide is greatly increased.\[{93}\] More than 50% of suicides have some relation to alcohol or drug use and up to 25% of suicides are committed by drug addicts and alcoholics. This figure is even higher with alcohol or drug use among adolescents, playing a role in up to 70% of suicides. It has been recommended that all drug addicts or alcoholics undergo investigation for suicidal thoughts due to their high risk of suicide.\[{94}\] An investigation in the New York Prison Service found that 90% of inmates who committed suicide had a history of substance abuse.\[{95}\]

<table>
<thead>
<tr>
<th>Substance abused</th>
<th>Effects related to suicide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cocaine</strong></td>
<td>Misuse of drugs such as cocaine have a high correlation with suicide. Suicide is most likely to occur during the &quot;crash&quot; or withdrawal phase in chronic cocaine-dependent users. Polysubstance misuse is more often associated with suicide in younger adults, whereas suicide from alcoholism is more common in older adults. In San Diego it was found that 30% of suicides by people under the age of 30 had used cocaine. In New York City in the early 1990s, during the height of a crack epidemic, 1 in 5 people who committed suicide were found to have recently consumed cocaine. The &quot;come down&quot; or withdrawal phase of cocaine use can result in intense, acute depressive symptoms as well as other distressing mental effects, all of which contribute to an increased risk of suicide.[{96}} [97]]</td>
</tr>
<tr>
<td><strong>Methamphetamine</strong></td>
<td>Methamphetamine use has a strong association with depression and suicide as well as a range of other adverse effects on physical and mental health.[{98}]</td>
</tr>
<tr>
<td><strong>Opioids</strong></td>
<td>Heroin users have a death rate nearly 13 times that of their non-using peers. Deaths among heroin users attributed to suicide range from 3% to 35%, though determining the difference between a suicide and an accidental overdose can be impossible without evidence of state of mind. Overall, heroin users are 14 times more likely than their non-using peers to die from suicide.[{99}] Major depressive disorder was found in 25% of entrants to treatment for heroin dependence in Australia.[{100}]</td>
</tr>
<tr>
<td><strong>Benzodiazepines</strong></td>
<td>Chronic use or abuse of prescribed benzodiazepines is associated with depression as well as increased suicide risk. Care should be taken when prescribing to at-risk individuals and patient populations.[{101}} [102] [103] Depressed adolescents who were taking benzodiazepines were found to have a greatly increased risk of self harm or suicide, though the sample size in this study was too small to provide generalizable conclusions. The effects of benzodiazepines in individuals under the age of 18 is not well understood. Additional caution may be required for depressed adolescents using benzodiazepines.[{104}] Benzodiazepine dependence often results in an increasingly deteriorating clinical picture which includes social deterioration leading to comorbid alcoholism and drug abuse. Suicide is a common outcome of chronic benzodiazepine dependence. Benzodiazepine misuse or misuse of other CNS depressants increases the risk of suicide in drug misusers.[{105}} [106] 11% of males and 23% of females with a sedative hypnotic misuse habit commit suicide.[{107}] Benzodiazepine withdrawal also leads to an increased risk of suicide.[{108}]</td>
</tr>
</tbody>
</table>
### Cigarette smoking
There have been various studies showing a positive link between smoking, suicidal ideation and suicide attempts. In a study conducted among nurses, those smoking between 1 to 24 cigarettes per day had twice the suicide risk; 25 cigarettes or more, 4 times the suicide risk, as compared with those who had never smoked. In a study of 300,000 male U.S. Army soldiers, a definitive link between suicide and smoking was observed with those soldiers smoking over a pack a day having twice the suicide rate of non-smokers.

### Alcohol
Alcohol misuse is associated with a number of mental health disorders, and alcoholics have a very high suicide rate. It has been found that drinking 6 drinks or more per day results in a sixfold increased risk of suicide. High rates of major depressive disorder occur in heavy drinkers and those who misuse alcohol. Controversy has previously surrounded whether those who misused alcohol who developed major depressive disorder were self medicating (which may be true in some cases) but recent research has now concluded that chronic excessive alcohol intake itself directly causes the development of major depressive disorder in a significant number of alcoholics.

### Problem gambling
Problem gambling is often associated with increased suicidal ideation and attempts compared to the general population. Early onset of problem gambling increases the lifetime risk of suicide. However, gambling-related suicide attempts are usually made by older people with problem gambling. Both comorbid substance use and comorbid mental disorders increase the risk of suicide in people with problem gambling. A 2010 Australian hospital study found that 17% of suicidal patients admitted to the Alfred Hospital's emergency department were problem gamblers.

### Media coverage
Various studies have suggested that how the media presents depictions of suicide may have a negative effect and trigger the possibility of suicide contagion also known as the Werther effect named after the protagonist in Goethe's, *The Sorrows of Young Werther* who committed suicide. This risk is greater in adolescents who may romantacize death. It appears that while news media has a significant effect that of entertainment media is equivocal. The opposite of the Werther effect is the Papageno effect in which coverage of effective coping mechanisms, coping in adverse circumstances, as covered in the media about suicidal ideation, may have protective effects. The term is based upon a character in Mozart’s opera *The Magic Flute* named Papageno who fearing the loss of a loved one was going to commit suicide until three boys showed him different ways to cope.
Methods

The leading method of suicide varies dramatically between countries. The leading methods in different regions include hanging, pesticide poisoning, and firearms. A 2008 review of 56 countries based on WHO mortality data found that hanging was the most common method in most of the countries, accounting for 53 percent of the male suicides and 39 percent of the female suicides. Worldwide 30% of suicides are from pesticides. The use of this method however varies markedly from 4% in Europe to more than 50% in the Pacific region. In the United States 52% of suicides involve the use of firearms. Asphyxiation (such as with a suicide bag) and poisoning are fairly common as well. Together they comprised about 40% of U.S. suicides. Other methods of suicide include blunt force trauma (jumping from a building or bridge, self-defenestrating, stepping in front of a train, or car collision, for example). Exsanguination or bloodletting (slitting one's wrist or throat), intentional drowning, self-immolation, electrocution, and intentional starvation are other suicide methods. Individuals may also intentionally provoke another person into administering lethal action against them, as in suicide by cop.

Whether or not exposure to suicide is a risk factor for suicide is controversial. A 1996 study was unable to find a relationship between suicides among friends, while a 1986 study found increased rates of suicide following the televisation of news stories regarding suicide.

Prevention

Suicide prevention is a term used for the collective efforts to reduce the incidence of suicide through preventive measures. Various strategies restrict access to the most common methods of suicide, such as firearms or toxic substances like pesticides, and have proved to be effective in reducing suicide rates. Studies supported by empirical data have indicated that adequate prevention, diagnosis and treatment of depression and alcohol and substance abuse can reduce suicide rates, as does follow-up contact with those who have made a suicide attempt. Although crisis hotlines are common there is little evidence to support or refute their effectiveness.

The Best Practices Registry (BPR) For Suicide Prevention is a registry of various suicide intervention programs maintained by the American Association of Suicide Prevention. The programs are divided, with those in Section I listing evidence-based programs: interventions which have been subjected to indepth review and for which evidence has demonstrated positive outcomes. Section III programs have been subjected to review.

In various countries, individuals who are at imminent risk of harming themselves or others may voluntarily check themselves into a hospital emergency department this may also be done on an involuntary basis on the referral of various individuals acting in an official capacity such as the police. This is referred to by various names such as being "committed" or sectioned. They will be placed on suicide watch until an emergency physician or mental health professional determines whether inpatient care at a mental health care facility is warranted and may hold the individual for a period of usually three days duration. A court hearing may be held to determine the individual's
Suicide competence. In most states, a psychiatrist may hold the person for a specific time period without a judicial order. If the psychiatrist determines the person to be a threat to himself or others, the person may be admitted involuntarily to a psychiatric treatment facility. After this time the person must be discharged or appear in front of a judge.\[^{145}\]

**Screening**

The U.S. Surgeon General has suggested that screening to detect those at risk of suicide may be one of the most effective means of preventing suicide in children and adolescents.\[^{146}\] There are various screening tools in the form of self-report questionnaires to help identify those at risk such as the Beck Hopelessness Scale and Is Path Warm?. A number of these self-report questionnaires have been tested and found to be valid for use among adolescents and young adults.\[^{147}\] There is however a high rate of false-positive identification and those deemed to be at risk should ideally have a follow-up clinical interview.\[^{148}\] The predictive quality of these screening questionnaires has not been conclusively validated so it is not possible to determine if those identified at risk of suicide will actually commit suicide.\[^{149}\] Asking about or screening for suicide does not appear to increase the risk.\[^{150}\]

In approximately 75 percent of completed suicides the individuals had seen a physician within the year before their death, including 45 to 66 percent within the prior month. Approximately 33 to 41 percent of those who completed suicide had contact with mental health services in the prior year, including 20 percent within the prior month. These studies suggest an increased need for effective screening.\[^{151}\][^{152}\][^{153}\][^{154}\][^{155}\]

**Treatment**

There are various treatment modalities to reduce the risk of suicide by addressing the underlying conditions causing suicidal ideation, including, depending on case history, medical\[^{156}\] pharmacological\[^{157}\] and psychotherapeutic talk therapies.\[^{158}\]

The conservative estimate is that 10% of individuals with psychiatric disorders may have an undiagnosed medical condition causing their symptoms,\[^{159}\] upwards of 50% may have an undiagnosed medical condition which if not causing is exacerbating their psychiatric symptoms.\[^{160}\][^{161}\] Illegal drugs and prescribed medications may also produce psychiatric symptoms.\[^{162}\] Effective diagnosis and if necessary medical testing which may include neuroimaging\[^{163}\] to diagnose and treat any such medical conditions or medication side effects may reduce the risk of suicidal ideation as a result of psychiatric symptoms, most often including depression, which are present in up to 90-95% of cases.\[^{164}\]

Recent research has shown that Lithium has been effective with lowering the risk of suicide in those with bipolar disorder to the same levels as the general population.\[^{165}\] Lithium has also proven effective in lowering the suicide risk in those with unipolar depression as well.\[^{166}\]

There are multiple evidence-based psychotherapeutic talk therapies available to reduce suicidal ideation such as dialectical behaviour therapy (DBT) for which multiple studies have reported varying degrees of clinical effectiveness in reducing suicidality. Benefits include a reduction in self-harm behaviours and suicidal ideations.\[^{167}\][^{168}\] Cognitive Behavior Therapy for Suicide Prevention (CBT-SP) is a form of DBT adapted for adolescents at high risk for repeated suicide attempts.\[^{169}\]
Suicide

Epidemiology

Worldwide suicide rates have increased by 60 percent in the past 45 years, mainly in the developing countries and is currently the tenth leading cause of death[7] with about a million people dying by suicide annually, a global mortality rate of 16 suicides per 100,000 people, or a suicide every 40 seconds.[171] According to 2007 data, suicides in the U.S. outnumber homicides by nearly 2 to 1. Suicide ranks as the 11th leading cause of death in the country, ahead of liver disease and Parkinson’s.[172]

Gender

Suicide rate per 100,000 males (left) and female (right) (data from 1978–2008).

<table>
<thead>
<tr>
<th>no data</th>
<th>5–5.8</th>
<th>12–19</th>
<th>26–29.5</th>
<th>33–36.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5.8–8.5</td>
<td>19–22.5</td>
<td>29.5–33</td>
<td>&gt;36.5</td>
</tr>
<tr>
<td>1–5</td>
<td>8.5–12</td>
<td>22.5–26</td>
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</table>


In the Western world, males die much more often by means of suicide than do females, although females attempt suicide more often. Some medical professionals believe this stems from the fact that males are more likely to end their lives through effective violent means, while women primarily use less severe methods such as overdosing on medications. In most countries, drug overdoses account for about two-thirds of suicides among women and one-third among men.[72]

Alcohol and drug use

In the United States 16.5 percent of suicides are related to alcohol.[173] Alcoholics are 5 to 20 times more likely to kill themselves while the misuse of other drugs increases the risk 10 to 20 times. About 15 percent of alcoholics commit suicide, and about 33 percent of suicides in the under 35 age group have a primary diagnosis of alcohol or other substance misuse; over 50 percent of all suicides are related to alcohol or drug dependence. In adolescents alcohol or drug misuse plays a role in up to 70 percent of suicides.[94] [174]
Ethnicity

National suicide rates differ significantly between countries and amongst ethnic groups within countries. For example, in the U.S., non-Hispanic Caucasians are nearly 2.5 times more likely to kill themselves than African Americans or Hispanics. In the United Kingdom suicide rates vary significantly between different parts of the country. In Scotland, for example, the suicide rate is approximately double that of England.

Social aspects

Legislation

In some jurisdictions, an act or incomplete act of suicide is considered to be a crime. More commonly, a surviving party member who assisted in the suicide attempt will face criminal charges.

In Brazil, if the help is directed to a minor, the penalty is applied in its double and not considered as homicide. In Italy and Canada, instigating another to suicide is also a criminal offense. In Singapore, assisting in the suicide of a mentally handicapped person is a capital offense. In India, abetting suicide of a minor or a mentally challenged person can result in a maximum 1 year prison term with a possible fine.

In Germany, the following laws apply to cases of suicide:

- Active euthanasia (killing on request) is prohibited by article 216 of the StGB (Strafgesetzbuch, German Criminal Code), punishable with six months to five years in jail
- German law interprets suicide as an accident and anyone present during suicide may be prosecuted for failure to render aid in an emergency. A suicide legally becomes an emergency when a suicidal person loses consciousness. Failure to render aid is punishable under article 323c of the StGB, with a maximum one year jail sentence.

Switzerland has recently taken steps to legalize assisted suicide for the chronically mentally ill. The high court in Lausanne, in a 2006 ruling, granted an anonymous individual with longstanding psychiatric difficulties the right to end his own life. At least one leading American bioethicist, Jacob Appel of Brown University, has argued that the American medical community ought to condone suicide in certain individuals with mental illness.

Religious views

In most forms of Christianity, suicide is considered a sin, based mainly on the writings of influential Christian thinkers of the Middle Ages, such as St. Augustine and St. Thomas Aquinas; suicide was not considered a sin under the Byzantine Christian code of Justinian, for instance. In Catholic doctrine, the argument is based on the commandment "Thou shalt not kill" (made applicable under the New Covenant by Jesus in Matthew 19:18), as well as the idea that life is a gift given by God which should not be spurned, and that suicide is against the "natural order" and thus interferes with God's master plan for the world. However, it is believed that mental illness or grave fear of suffering diminishes the responsibility of the one completing suicide. Counter-arguments include the following: that the sixth commandment is more accurately translated as "thou shalt not murder", not necessarily applying to the self; that God has given free will to humans; that taking one's own life no more violates God's Law than does curing a disease; and that a number of suicides by followers of God are recorded in the Bible with no dire condemnation.

Judaism focuses on the importance of valuing this life, and as such, suicide is tantamount to denying God's goodness in the world. Despite this, under extreme circumstances when there has seemed no choice but to either be killed or forced to betray their religion, Jews have committed individual suicide or mass suicide (see Masada, First French
Suicide

suicide is not allowed in Islam; however, martyring oneself for Allah (during combat) is not considered the same as completing suicide. Suicide in Islam is seen as a sign of disbelief in God.

In Hinduism, suicide is generally frowned upon and is considered equally sinful as murdering another in contemporary Hindu society. Hindu Scriptures state that one who commits suicide will become part of the spirit world, wandering earth until the time one would have otherwise died, had one not committed suicide. However, Hinduism accept a man's right to end one's life through the non-violent practice of fasting to death, termed Prayopavesa. But Prayopavesa is strictly restricted to people who have no desire or ambition left, and no responsibilities remaining in this life. Jainism has a similar practice named Santhara.

Philosophy

Some see suicide as a legitimate matter of personal choice and a human right (colloquially known as the right to die movement). Supporters of this position maintain that no one should be forced to suffer against their will, particularly from conditions such as incurable disease, mental illness, and old age that have no possibility of improvement. Proponents of this view reject the belief that suicide is always irrational, arguing instead that it can be a valid last resort for those enduring major pain or trauma. This perspective is most popular and has a good deal of support in continental Europe, where euthanasia and other such topics are commonly discussed in parliament.

A narrower segment of this group considers suicide something between a grave but condoneable choice in some circumstances and a sacrosanct right for anyone (even a young and healthy person) who believes they have rationally and conscientiously come to the decision to end their own lives. Notable supporters of this school of thought include German pessimist philosopher Arthur Schopenhauer, Friedrich Nietzsche, and Scottish empiricist David Hume. Bioethicist Jacob Appel has become the leading advocate for this position in the United States.

Adherents of this view often advocate the abrogation of statutes that restrict the liberties of people known to be suicidal, such as laws permitting their involuntary commitment to mental hospitals.

Locations

Some landmarks have become known for high levels of suicide attempts. The four most popular locations in the world are reportedly San Francisco's Golden Gate Bridge, Toronto's Bloor Street Viaduct (before the construction of the Luminous Veil), Japan's Aokigahara Forest and England's Beachy Head. In 2005 the Golden Gate Bridge had a count exceeding 1,200 jumpers since its construction in 1937. In 1997 the Bloor Street Viaduct had one suicide every 22 days, and in 2002 Aokigahara had a record of 78 bodies found within the forest, replacing the previous record of 73 in 1998. The suicide rate of these places is so high that numerous signs, urging potential victims of suicide to seek help, have been posted.
Advocacy
Advocacy of suicide has occurred in many cultures and subcultures. The Japanese military during World War II encouraged and glorified kamikaze attacks, and Japanese society as a whole has been described as suicide 'tolerant' (see Suicide in Japan).

William Francis Melchert-Dinkel, 47 years old in May 2010, from Faribault, Minnesota, a licensed nurse from 1991 until February 2009, stands accused of encouraging people to commit suicide while he watched on a webcam.[204][205][206][207]

A study by the British Medical Journal found that Web searches for information on suicide are likely to return sites that encourage, and even facilitate, suicide attempts.[208] There is some concern that such sites may push the suicidal over the edge.[209] Some people form suicide pacts with people they meet online. Becker writes, "Suicidal adolescent visitors risk losing their doubts and fears about committing suicide. Risk factors include peer pressure to commit suicide and appointments for joint suicides. Furthermore, some chat rooms celebrate chatters who committed suicide."[211]

Language
Because suicide was a crime in various countries, including in England and Wales which decriminalized it in 1961, the word 'commit' has traditionally been used in reference to it. Organisations such as the BBC and the Samaritans have stopped using this word because of its negative connotation. 'Attempt' suicide or other phrases are preferred.[212]

Other species
"Suicide" has been observed in salmonella seeking to overcome competing bacteria by triggering an immune system response against them.[213] Suicidal defences by workers are also noted in a Brazilian ant Forelius pusillus where a small group of ants leaves the security of the nest after sealing the entrance from the outside each evening.[214] Pea aphids, when threatened by a ladybug, can explode themselves, scattering and protecting their brethren and sometimes even killing the lady bug.[215] Some species of termites have soldiers that explode, covering their enemies with sticky goo.[216][217] There have been anecdotal reports of dogs, horses, and dolphins committing suicide, but with little conclusive evidence.[218] There has been little scientific study of animal suicide.[219]

Footnotes
[10] see the PDF (http://www.nsc.org/news_resources/injury_and_death_statistics/Pages/TheOddsofDyingFrom.aspx)
[13] http://books.google.co.uk/books?id=VB3Oezl0I44&pg=PA311&dq=rates+of+suicide+of+men+are+three+to+four+times+higher+than+for+women&hl=en&ei=ke2dTuCAZH6sQ89yu5C&A=s=X&oi=book_result&ct=result&resnum=4&ved=0CDQ6AEwAw#v=onepage&q=f=false

[47] Michael Martin. "Religious Affiliation and Suicide Attempt" (http://ajp.psychiatryonline.org/cgi/content/abstract/161/12/2303). Cambridge University Press. . Retrieved 13 November 2010. "Religiously unaffiliated subjects had significantly more lifetime suicide attempts and more first-degree relatives who committed suicide than subjects who endorsed a religious affiliation. Unaffiliated subjects were younger, less often married, less often had children, and had less contact with family members. Furthermore, subjects with no religious affiliation perceived fewer reasons for living, particularly fewer moral objections to suicide. In terms of clinical characteristics, religiously unaffiliated subjects had more lifetime impulsivity, aggression, and past substance use disorder."


Suicide


[78] J. John Mann, M.D., Neurobiological Aspects of Suicide


[84] PMID 271079606.


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[194] Schopenhauer I On Suicide (http://comp.uark.edu/~mpianal/schopenhauer.htm)
[207] "William Melchert-Dinkel charged with encouraging suicides (http://www.timesonline.co.uk/tol/news/uk/crime/article7107061.ece), The Sunday Times
Further reading


External links

- Suicide (http://www.dmoz.org/Health/Mental_Health/Disorders/Suicide/) at the Open Directory Project
Fields of evolutionary psychology

Evolutionary developmental psychology

Evolutionary developmental psychology, (or EDP), is the application of the basic principles of Darwinian evolution, particularly natural selection, to explain contemporary human development. It involves the study of the genetic and environmental mechanisms that underlie the universal development of social and cognitive competencies and the evolved epigenetic (gene-environment interactions) processes that adapt these competencies to local conditions. It assumes that not only are behaviors and cognitions that characterize adults the product of natural selection pressures operating over the course of evolution, but so also are characteristics of children's behaviors and minds.

It further proposes that an evolutionary account would provide some insight into not only predictable stages of ontogeny, but into specific differences between individuals as well. Such a perspective suggests that there are multiple alternative strategies to recurring problems that human children would have faced throughout our evolutionary past and that individual differences in developmental patterns aren’t necessarily idiosyncratic reactions, but are predictable, adaptive responses to environmental pressures.

Brief history of EDP

Traditionally, evolutionary psychologists tended to focus their research and theorizing primarily on adults, especially on behaviors related to socializing and mating. There was much less of a focus on psychological development, as it relates to Darwinian evolution. Developmental psychologists, for their part, have been wary of the perceived genetic determinism of evolutionary thinking, which seemed critical of all the major theories in developmental psychology.

Pioneers of EDP have worked to integrate evolutionary and developmental theories, without totally discarding the traditional theories of either. They argue that a greater understanding of the “whys” of human development will help us acquire a better understanding of the “hows” and “whats” of human development.

Some basic assumptions of EDP

1. All evolutionarily-influenced characteristics develop, and this requires examining not only the functioning of these characteristics in adults but also their ontogeny.
2. All evolved characteristics develop via continuous and bidirectional gene-environment interactions that emerge dynamically over time.
3. Development is constrained by genetic, environmental, and cultural factors.
4. An extended childhood is needed in which to learn the complexities of human social communities and economies.
5. Many aspects of childhood serve as preparations for adulthood and were selected over the course of evolution (deferred adaptations).
6. Some characteristics of infants and children were selected to serve an adaptive function at specific times in development and not as preparations for adulthood (ontogenetic adaptations).
7. Children show a high degree of plasticity, or flexibility, and the ability to adapt to different contexts.
Domain-Specificity vs. Domain-Generality

A fundamental issue is how best to characterize the cognitive mechanisms that afford humans such flexibility in problem-solving. Authors Leda Cosmides and John Tooby would argue that human beings simply possess a greater number of content-specific modules, each of which specializes in solving a specific type of adaptive problem. And it is the sheer number of these content-specific modules which lends humans such great problem-solving flexibility.

Other authors, such as Robert Burgess and Kevin B. MacDonald, while agreeing that content-specific modules exist, favor a differing view. They would say instead that the flexibility of human problem-solving ability is owed primarily to powerful domain-generality, and that humans use the same non-specific cognitive machinery for a multitude of different tasks. It is also important to point out that this is not an either/or argument for the legitimacy of the domain-specific or the domain-general position, but is concerned simply with the importance of both in regards to our problem-solving capabilities.

Relevant journals

- Evolution and Development[^1] Research relevant to interface of evolutionary and developmental biology

Further reading


References
Evolutionary developmental psychopathology

Evolutionary developmental psychopathology is an approach to the understanding of psychiatric disorders based on the following:

• human adaptations were forged to function in past environments rather than the current environment;
• investigations of brain-damaged patients should be included in the modeling of disorders to facilitate the mapping of psychological functions on to brain systems;
• investigations of behavioural abnormalities should be combined with those on information-processing abnormalities in a scheme that acknowledges both cognition and affect as components of information processing;
• investigation of specific signs and symptoms, rather than syndromes, as symptoms such as delusions and hallucinations, for example, are observed in patients who currently fall into a number of diagnostic categories, including schizophrenia and affective psychosis;
• the expectation that complex psychological processes will be broken down into simpler tasks that can be performed by mindless agents;
• research should be particularly attentive to any data showing sexual dimorphism and changes in psychological functioning and neural architecture across the lifespan, and therefore to comparisons between adults, adolescents, and children.

External links

• Theory of Evolutionary Psychopathology (Documents No. 8 and 9 in English) [1]

References

Evolutionary educational psychology

**Evolutionary educational psychology** is the study of the relation between inherent folk knowledge and abilities and accompanying inferential and attributional biases as these influence academic learning in evolutionarily novel cultural contexts, such as schools and the industrial workplace. The fundamental premises and principles of this discipline are presented below.

### The premises of evolutionary educational psychology

The premises state there are

- **(a)** aspects of mind and brain that have evolved to draw the individuals’ attention to and facilitate the processing of social (folk psychology), biological (folk biology), physical (folk physics) information patterns that facilitated survival or reproductive outcomes during human evolution (Cosmides & Tooby, 1994; Geary, 2005; Gelman, 1990; Pinker, 1997; Shepard, 1994; Simon, 1956);
- **(b)** although plastic to some degree, these primary abilities are inherently constrained to the extent associated information patterns tended to be consistent across generations and within lifetimes (e.g., Caramazza & Shelton, 1998; Geary & Huffman, 2002);
- **(c)** other aspects of mind and brain evolved to enable the mental generation of potential future social, ecological, or climatic conditions and enable rehearsal of behaviors to cope with variation in these conditions, and are now known as general fluid intelligence, or $g_F$ (including skill at everyday reasoning/problem solving; Chiappe & MacDonald, 2005; Geary, 2005; Mithen, 1996); and
- **(d)** children are inherently motivated to learn in folk domains, with the associated attentional and behavioral biases resulting in experiences that automatically and implicitly flesh out and adapt these systems to local conditions (Gelman, 1990; Gelman & Williams, 1998; Gelman, 2003).

### The principles of evolutionary educational psychology

The principles represent the foundational assumptions for an evolutionary educational psychology. The gist is knowledge and expertise that is useful in the cultural milieu or ecology in which the group is situated will be transferred across generations in the form of cultural artifacts, such as books, or learning traditions, as in apprenticeships (e.g., Baumeister, 2005; Richerson & Boyd, 2005; Flinn, 1997; Mithen, 1996). Across generations, the store of cultural knowledge accumulates and creates a gap between this knowledge base and the forms of folk knowledge and abilities that epigenetically emerge with children’s self-initiated activities.

There must of course be an evolved potential to learn evolutionarily novel information and an associated bias to seek novelty during the developmental period and indeed throughout the life span; this may be related to the openness to experience dimension of personality (Geary, 1995, 2002, in press).

However, the cross-generational accumulation of knowledge across cultures, individuals, and domains (e.g., people vs. physics) has resulted in an exponential increase in the quantity of secondary knowledge available in modern societies today. For most people, the breadth and complexity of this knowledge will very likely exceed any biases to learn in evolutionary novel domains.
The creation of knowledge vs. the learning of knowledge

A related issue concerns the traits that enable the creation of biologically secondary knowledge and thus culture and the extent to which these traits overlap with the ability to learn knowledge created by others.

Stated differently, Is the goal of education to have children recreate the process of discovery, to learn the products of discovery, or some combination? Some educators have advocated a focus on the process of discovery without full consideration of the constellation of traits and opportunity that contribute to the creation of secondary knowledge (e.g., Cobb, Yackel, & Wood, 1992). In fact, research on creative-productive individuals suggests that the full constellation of traits that facilitate the discovery and creation of secondary knowledge is rare and not likely reproducible on a large scale (Simonton, 1999a, 1999b, 2003; Sternberg, 1999; Wai, Lubinski, & Benbow, 2005).

Summary

Premises

• 1.) Natural selection has resulted in an evolved motivational disposition to attempt to gain access to and control of the resources that have covaried with survival and reproductive outcomes during human evolution.
• 2.) These resources fall into three broad categories: social, biological, and physical which correspond to the respective domains of folk psychology, folk biology, and folk physics.
• 3.) Attentional, perceptual, and cognitive systems, including inferential and attributional biases, have evolved to process information in these folk domains and to guide control-related behavioral strategies. These systems process restricted classes of information associated with these folk domains.
• 4.) To cope with variation in social, ecological, or climatic conditions, systems that enabled the mental generation of these potential future conditions and enabled rehearsals of behaviors to cope with this variation evolved and the supporting attentional and cognitive mechanisms are known as general fluid intelligence and everyday reasoning.
• 5.) Children are biologically biased to engage in activities that recreate the ecologies of human evolution; these are manifested as social play, and exploration of the environment and objects. The accompanying experiences interact with the inherent but skeletal folk systems and flesh out these systems such that they are adapted to the local social group and ecology.

Principles

• 1.) Scientific, technological, and academic advances initially emerged from the cognitive and motivational systems that support folk psychology, folk biology, and folk physics. Innovations that enabled better control of ecologies or social dynamics or resulted in a coherent (though not necessarily scientifically accurate) understanding of these dynamics are likely to be retained across generations as cultural artifacts (e.g., books) and traditions (e.g. apprenticeships). These advances result in an ever growing gap between folk knowledge and the theories and knowledge base of the associated sciences and other disciplines (e.g., literature).
• 2.) Schools emerge in societies in which scientific, technological, and intellectual advances result in a gap between folk knowledge and the competencies needed for living in the society.
• 3.) The function of schools is to organize the activities of children such that they acquire the biologically secondary competencies that close the gap between folk knowledge and the occupational and social demands of the society.
• 4.) Biologically secondary competencies are built from primary folk systems and the components of fluid intelligence that evolved to enable individuals to cope with variation and novelty.
• 5.) Children's inherent motivational bias to engage in activities that will adapt folk knowledge to local conditions will often conflict with the need to engage in activities that will result in secondary learning.
• 6.) The need for explicit instruction will be a direct function of the degree to which the secondary competency differs from the supporting primary systems.
References

- Geary, D.C. (2007). Educating the Evolved Mind\textsuperscript{[8]}. In J. S. Carlson & J. R. Levin(Eds.), Psychological Perspectives on Contemporary Educational Issues (p. 28). Greenwich, CT: Information Age Publishing. (Cited with permission by author)
- Gelman, R. (1990). First principles organize attention to and learning about relevant data: Number and animate-inanimate distinction as examples\textsuperscript{[15]}. Cognitive Science, 14, 79-106.
Evolutionary educational psychology


Further reading


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[19] http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/16460.ctl
[22] http://psychology.ucdavis.edu/simonton/dksabstracts.html#205
Evolutionary ethics

Evolutionary ethics could be either a form of descriptive ethics or normative ethics.

Descriptive evolutionary ethics consists of biological approaches to ethics (morality) based on the role of evolution in shaping human psychology and behavior. Such approaches may be based in scientific fields such as evolutionary psychology, sociobiology, or ethology with a focus on understanding and explaining observed ethical preferences or choices and their origins.

On the other hand, normative evolutionary ethics may represent a more independent attempt to use evolution, alone or partially, to justify an ethical system. This project has not, according to one view, been especially successful; for example, Richard Dawkins describes how we must rise above our selfish genes to behave morally (that is, evolution has endowed us with various instincts, but we need some other moral system to decide which ones to empower or control). Dawkins has since expressed interest in what Sam Harris calls a science of morality, which starts with the assumption that "morality" refers to "facts about the flourishing of conscious creatures".

History

In the chapter On the Development of the Intellectual and Moral Faculties During Primeval and Civilised Times of The descent of man (1871) Charles Darwin set out to explain the origin of human morality in order to show that there was no absolute gap between man and animals. For Darwin, morality was a problem of natural history. He believed that a moral sense (altruism) would have little selective advantage for the individual, but it would be adaptive for the group. He did not construct a new system of Evolutionary Ethics.\[1\]

David Hume first described what is now known as the is-ought problem: making unjustified claims about what ought to be on the basis of statements about what is. The problem is the justification of an ethical system. The problem is not what we ought to do, but why. Thomas Huxley allows that ethical sentiments have evolved but denies that this provides a basis for morality (Evolution and Ethics,1893):

> The propounders of what are called the "ethics of evolution," when the "evolution of ethics" would usually better express the object of their speculations, adduce a number of more or less interesting facts and more or less sound arguments, in favour of the origin of the moral sentiments, in the same way as other natural phenomena, by a process of evolution. I have little doubt, for my part, that they are on the right track; but as the immoral sentiments have no less been evolved, there is, so far, as much natural sanction for the one as the other. The thief and the murderer follow nature just as much as the philanthropist. Cosmic evolution may teach us how the good and the evil tendencies of man may have come about; but, in itself, it is incompetent to furnish any better reason why what we call good is preferable to what we call evil than we had before.\[2\]

Huxley's criticism alluded to the is-ought problem developed earlier by David Hume and the related naturalistic fallacy developed later by G. E. Moore. The moral philosopher Henry Sidgwick (1838–1900) claimed that evolution was irrelevant for ethics because it could not be used as a justification for ethics. British philosopher G. E. Moore (Principia Ethica) demonstrated that all systems of naturalistic ethics, including evolutionary ethics, are flawed. He first pointed out that even if evolution is progress, it cannot be concluded that the more advanced organisms are more advanced in every respect. So, it is impossible to infer particular moral judgements from that fact. Furthermore, the view that "we ought to move in the direction of evolution simply because it is the direction of evolution" was invalid because it was an example of the naturalistic fallacy, that is the fallacy of defining 'the good' by reference to some other thing.
American philosopher William James wrote about natural selection: "The entire modern deification of survival per se, survival returning into itself, survival naked and abstract, with the denial of any substantive excellence in what survives, except for more survival still, is surely the strangest intellectual stopping-place ever proposed by one man to another". John Dewey was also a critic of evolutionary ethics, although both philosophers accepted the fact of evolution. Dewey added that the discovery of the evolutionary origin of particular moral sentiments is not identical with the discovery of the foundation of an ethical system.

Evolutionary biologist and geneticist Theodosius Dobzhansky was highly critical of evolutionary ethics: "No theory of evolutionary ethics can be acceptable unless it gives a satisfactory explanation of just why the promotion of evolutionary development must be regarded as the summum bonum" and "even if the direction of evolution were demonstrated to be "good", man is likely to prefer to be free rather than to be reasonable.

Analytic philosophy
Logical positivist philosopher A. J. Ayer stated in *Language, Truth and Logic* (1936) that moral judgements are pure expressions of feeling. They are unverifiable and cannot be true or false. In 1986, Michael Ruse summarized the role of evolution as the source of ethical feelings:

Our moral sense, our altruistic nature, is an adaptation—a feature helping us in the struggle for existence and reproduction—no less than hands and eyes, teeth and feet. It is a cost-effective way of getting us to cooperate, which avoids both the pitfalls of blind action and the expense of a superbrain of pure rationality.

In applying science to metaethics, Ruse writes:

In a sense … the evolutionist's case is that ethics is a collective illusion of the human race, fashioned and maintained by natural selection in order to promote individual reproduction. … ethics is illusory inasmuch as it persuades us that it has an objective reference. This is the crux of the biological position.

Descriptive evolutionary ethics
Descriptive evolutionary ethics is empirical research into moral attitudes and beliefs (humans) or moral behaviour (animals) in an evolutionary framework. Examples can be found in the field of evolutionary psychology. Evolutionary psychology attempts to explain major features of psychology in terms of species-wide evolved (via natural selection) predispositions. Ethical topics addressed include altruistic behaviors, deceptive or harmful behaviors, an innate sense of fairness or unfairness, feelings of kindness or love, self-sacrifice, feelings related to competitiveness and moral punishment or retribution, moral "cheating" or hypocrisy, and inclinations for a wide variety of actions judged morally good or bad by (at least some within) a given society.

A key issue of evolutionary psychology has been how altruistic feelings and behaviors could have evolved when the process of natural selection is based on the multiplication over time only of those genes that adapt better to changes in the environment of the species. Theories addressing this have included kin selection and reciprocal altruism (both direct and indirect, and on a society-wide scale). Group selection theories have also been advanced.

Normative evolutionary ethics
Normative evolutionary ethics aims at defining which acts are right or wrong, and which things are good or bad in an evolutionary context. It is not merely describing, but it is prescribing goals, values and obligations. For example eugenics is a form of normative evolutionary ethics, because it defines what is 'good' on the basis of genetics and the theory of evolution. Social Darwinism is a more wide ranging topic. However, to the extent it promotes ethical values and policies based on the theory of evolution, it can also be classified as a normative evolutionary ethics. According to philosopher G. E. Moore (see above) all systems of naturalistic ethics, including normative
evolutionary ethics, do commit the *naturalistic fallacy*. The naturalistic fallacy does not apply to descriptive evolutionary ethics because no ethical statements are inferred from facts. Also, the naturalistic fallacy does not apply to weaker forms of normative evolutionary ethics, namely those which are *consistent* with evolution, but not *derivable* from evolution.

**Criticisms**

P. G. Woolcock argues[8] that all normative evolutionary ethics are invalid. For example the argument

1. The human species can survive only if we let severely physically and mentally handicapped infants and children die.
2. Therefore: we ought to let severely physically and mentally handicapped infants die.

is a fallacy because the first statement is a purely descriptive premise containing no values, and a value pops up in the conclusion. It is the famous naturalistic fallacy (G. E. Moore). Additionally, the first premise is almost certainly false. We could make the argument valid by adding a second premise, namely:

1b We ought to do whatever is necessary to ensure the survival of the human species

but then we would no longer be deducing a value conclusion from a purely factual premise, because 1b has a value component. This can also be explained in this way: if the definition of "good" is "whatever furthers human survival", then it should be nonsensical to ask "Is human survival itself good?", but is seems a perfectly meaningful question. This is Moore's *open-question* argument.

Another fallacy according to Woolcock is the confusion between an *instrumental* and a *categorical* justification. Consider the argument "We ought to be altruistic because evolution has selected altruism over millions of years as a reliable guide to what is good". Evolutionary theory, however, tell us only that altruism is good for the survival of our species, not that the survival of the human species is good. A categeorical justification would justify people's actions regardless of what their goals are.

**The future**

Given the current state of knowledge, Huxley's statement with regards to "why what we call good is preferable to what we call evil" is still accurate with regards to individual human tastes and predispositions. Yet research in the fields of evolutionary psychology and primatology is beginning to reveal, in the general case, what is good and bad for our species in order for it to thrive and, in turn, more likely be happy. Evolutionary psychology's primary focus is to derive, especially through the deep analysis of hunter-gatherer culture and primate models, what is the most accurate description of general human predispositions (i.e. our innate "hard-wiring"). And as this understanding grows, it will become more and more feasible to redesign culture itself to be more "user friendly" to its human members. After all, in the ultimate sense, culture (like a computer) is a tool to serve its users. Noted primatologist Frans De Waal asserts, "In the words of Edward Wilson, biology holds us "on a leash" and will let us stray only so far from who we are. We can design our life any way we want, but whether we will thrive depends on how well the life fits human predispositions."[9] Thus, the goals of evolutionary psychology overlap with the science of morality.
Notes

[1] Paul Lawrence Farber, 1994, *The Temptations of Evolutionary Ethics*, chapter 1
[3] Quoted by Farber, 1994, p. 112

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Further reading

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• Wilson, D. S., E. Dietrich, et al. (2003). On the inappropriate use of the naturalistic fallacy in evolutionary 
   psychology. *Biology and Philosophy* 18: 669-682. Full text (http://biology.binghamton.edu/dwilson/Wilson 
   publications/DSW14.pdf)
   dwilson/Wilson publications/DSW16.pdf)

**External links**

• The Evolution of Ethics: An Introduction to Cybernetic Ethics (http://www.evolutionaryethics.com/) by S. E. 
  Bromberg
• Evolutionary Ethics (http://www.iep.utm.edu/e/evol-eth.htm) at the Internet Encyclopedia of Philosophy
• Morality and Evolutionary Biology (http://plato.stanford.edu/entries/morality-biology) entry by William 
  FitzPatrick in the *Stanford Encyclopedia of Philosophy*
• Biological Altruism (http://plato.stanford.edu/entries/altruism-biological) entry by Samir Okasha in the 
  *Stanford Encyclopedia of Philosophy*
Evolutionary psychology research groups and centers

The following is a list of evolutionary psychology research groups and centers.

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**Human nature**

*We do not know what our nature permits us to be. – Jean-Jacques Rousseau, *Emile**

**Human nature** refers to the distinguishing characteristics, including ways of thinking, feeling and acting, that humans tend to have naturally.

The questions of what these characteristics are, what causes them and how this causation works, and how fixed human nature is, are amongst the oldest and most important questions in western philosophy. These questions have particularly important implications in ethics, politics and theology. This is partly because human nature can be regarded as both a source of norms of conduct or ways of life, as well as presenting obstacles or constraints on living a good life.

The complex implications of such questions are also dealt with in art and literature, while the multiple branches of the Humanities together form an important domain of inquiry into human nature, and the question of what it means to be human.

The branches of contemporary science associated with the study of human nature include anthropology, sociology, sociobiology and psychology, particularly evolutionary psychology and developmental psychology. The so-called "nature versus nurture" debate is a broadly inclusive and well-known instance of a discussion about human nature in the natural sciences.

**Brief history of the concept**

The concept of nature as a standard by which to make judgments was a basic presupposition in Greek philosophy. Specifically, "almost all" classical philosophers accepted that a good human life is a life in accordance with nature. [1]

On this subject, the approach of Socrates, sometimes considered to be a teleological approach, came to be dominant by late classical and medieval times. This approach understands human nature in terms of final and formal causes. Such understandings of human nature see this nature as an "idea," or "form" of a human. [2] By this account, human nature really causes humans to become what they become, and so it exists somehow independently of individual humans. This in turn has sometimes been understood as also showing a special connection between human nature and divinity.

The existence of this invariable human nature is however a subject of much historical debate, continuing into modern times. Against this idea of a fixed human nature, the relative malleability of man has been argued especially strongly in recent centuries—firstly by early modernists such as Thomas Hobbes and Jean-Jacques Rousseau, and since the mid-19th century, by thinkers such as Hegel, Marx, Nietzsche, Sartre, structuralists and postmodernists.

Still more recent scientific perspectives such as behaviorism, determinism, and the chemical model within modern psychiatry and psychology, claim to be neutral regarding human nature. (As in all modern science they seek to explain without recourse to metaphysical causation.) They can be offered to explain its origins and underlying mechanisms, or to demonstrate capacities for change and diversity which would arguably violate the concept of a fixed human nature.
**Socratic philosophy**

Philosophy in classical Greece is the ultimate origin of the western conception of the nature of a thing. The philosophical study of human nature itself originated, according to Aristotle at least, with Socrates, who turned philosophy from study of the heavens to study of the human things.\(^3\) Socrates is said to have studied the question of how a person should best live, but he left no written works. It is clear from the works of his students Plato and Xenophon, and also what was said by Aristotle (Plato's student) about him, that Socrates was a rationalist and believed that the best life and the life most suited to human nature involved reasoning. The Socratic school was the dominant surviving influence in philosophical discussion in the Middle Ages, amongst Islamic, Christian and Jewish philosophers.

The human soul in the works of Plato and Aristotle has a divided nature, divided in a specifically human way. One part is specifically human and rational, and divided into a part which is rational on its own, and a spirited part which can understand reason. Other parts of the soul are home to desires or passions similar to those found in animals. In both Aristotle and Plato spiritedness, *thumos*, is distinguished from the other passions or *epithumiai*.\(^4\) The proper function of the "rational" was to rule the other parts of the soul, helped by spiritedness. By this account, using one's reason is the best way to live, and philosophers are the highest types of humans.

Aristotle, Plato's most famous student, made some of the most famous and influential statements about human nature. In his works, apart from using a similar scheme of a divided human soul, some clear statements about human nature are made:

- Man is a conjugal animal, meaning an animal which is born to couple when an adult, thus building a household (*oikos*) and in more successful cases, a clan or small village still run upon patriarchal lines.\(^5\)
- Man is a political animal, meaning an animal with an innate propensity to develop more complex communities the size of a city or town, with a division of labor and law-making. This type of community is different in kind from a large family, and requires the special use of human reason.\(^6\)
- Man is a mimetic animal. Man loves to use his imagination (and not only to make laws and run town councils). He says "we enjoy looking at accurate likenesses of things which are themselves painful to see, obscene beasts, for instance, and corpses." And the "reason why we enjoy seeing likenesses is that, as we look, we learn and infer what each is, for instance, 'that is so and so.'"\(^7\)

For Aristotle, reason is not only what is most special about humanity compared to other animals, but it is also what we were meant to achieve at his or her best. Much of Aristotle's description of human nature is still influential today, but the particular teleological idea that humans are "meant" or intended to be something, has become much less popular in modern times.\(^8\)

For the Socrates, human nature, and all natures, are metaphysical concepts. Aristotle developed the standard presentation of this approach with his theory of four causes. Human nature is an example of a formal cause according to Aristotle. Their teleological concept of nature is associated with humans having a divine component in their psyches, which is most properly exercised in the lifestyle of the philosopher, which is thereby also the happiest and least painful life.

**Modernism**

One of the defining changes occurring at the end of the Middle Ages, is the end of the dominance of Aristotelian philosophy, and its replacement by a new approach to the study of nature, including human nature. In this approach, all attempts at conjecture about formal and final causes was rejected as useless speculation. Also, the term "law of nature" now applies any regular and predictable pattern in nature, not literally a law made by a divine law-maker, and in the same way "human nature" becomes not a special metaphysical cause, but simply whatever can be said to be typical tendencies of humans.
Although this new realism applied to the study of human life from the beginning, for example in Machiavelli’s works, the definitive argument for the final rejection of Aristotle was associated especially with Francis Bacon, and then René Descartes, whose new approach returned philosophy or science to its pre-Socratic focus upon non-human things. Thomas Hobbes, then Giambattista Vico, and David Hume all claimed to be the first to properly use a modern Baconian scientific approach to human things.

Hobbes famously followed Descartes in describing humanity as matter in motion, just like machines. He also very influentially described man's natural state (without science and artifice) as one where life would be nasty, short and brutish. Following him, John Locke's philosophy of empiricism also saw human nature as a tabula rasa. In this view, the mind is at birth a "blank slate" without rules, so data is added, and rules for processing them are formed solely by our sensory experiences.\[9\]

Jean Jacques Rousseau pushed the approach of Hobbes to an extreme and criticized it at the same time. He was a contemporary and acquaintance of Hume, writing before the French Revolution and long before Darwin and Freud. He shocked Western Civilization with his Second Discourse by proposing that humans had once been solitary animals, without reason or language or communities, and had developed these things due to accidents of pre-history. (A proposal which was also made, less famously, by Giambattista Vico.) In other words, Rousseau argued that human nature was not only not fixed, but not even approximately fixed compared to what had been assumed before him. Humans are political, and rational, and have language now, but originally they had none of these things.\[10\] This in turn implied that living under the management of human reason might not be a happy way to live at all, and perhaps there is no ideal way to live. Rousseau is also unusual in the extent to which he took the approach of Hobbes, asserting that primitive humans were not even naturally social. A civilized human is therefore not only imbalanced and unhappy because of the mismatch between civilized life and human nature, but unlike Hobbes, Rousseau also became well known for the suggestion that primitive humans had been happier, “noble savages.”\[11\]

Rousseau's conception of human nature has been seen as the origin of many intellectual and political developments of the 19th and 20th centuries.\[12\] He was an important influence upon Kant, Hegel and Marx, and the development of German Idealism, Historicism, and Romanticism.

What human nature did entail, according to Rousseau and the other modernists of the 17th and 18th centuries, were animal-like passions that led humanity to develop language and reasoning, and more complex communities (or communities of any kind according to Rousseau).

In contrast to Rousseau, David Hume was a critic of the over-simplifying and systematic approach of Hobbes and Rousseau and some others whereby, for example, all human nature is assumed to be driven by variations of selfishness. Influenced by Hutcheson and Shaftesbury, he argued against over-simplification. On the one hand he accepted that for many political and economic subjects people could be assumed to be driven by such simple selfishness, and he also wrote of some of the more social aspects of "human nature" as something which could be destroyed, for example if people did not associate in just societies. On the other hand he rejected what he called the "paradox of the sceptics" saying that no politician could have invented words like "'honourable' and 'shameful,' 'lovely' and 'odious,' 'noble' and 'despicable,'" unless there was not some natural "original constitution of the mind."\[13\]

Hume, like Rousseau, was controversial in his own time for his modernist approach, following the example of Francis Bacon and Thomas Hobbes, of avoiding consideration of metaphysical explanations for any type of cause and effect. He was accused of being an atheist. Concerning human nature also, he wrote for example:

We needn't push our researches so far as to ask 'Why do we have humanity, i.e. a fellow-feeling with others?'
It's enough that we experience this as a force in human nature. Our examination of causes must stop somewhere.\[13\]

After Rousseau and Hume, the nature of philosophy and science changes, branching into different disciplines and approaches, and the study of human nature changes accordingly. Rousseau's proposal that human nature is malleable became a major influence upon international revolutionary movements of various kinds, while Hume's approach has
been more typical in Anglo-Saxon countries including the United States.

**Natural science**

As the sciences concerned with humanity split up into more specialized branches, many of the key figures of this evolution expressed influential understandings about human nature.

Darwin gave a widely accepted scientific argument for what Rousseau had already argued from a different direction, that humans and other animal species have no truly fixed nature, at least in the very long term. However he also gave modern biology a new way of understanding how human nature does exist in a normal human time-frame, and how it is caused.

Sigmund Freud, the founder of psychoanalysis, famously referred to the hidden pathological character of typical human behavior. He believed that the Marxists were right to focus on what he called "the decisive influence which the economic circumstances of men have upon their intellectual, ethical and artistic attitudes." But he thought that the Marxist view of the class struggle was too shallow, assigning to recent centuries conflicts that were, rather, primordial. Behind the class struggle, according to Freud, there stands the struggle between father and son, between established clan leader and rebellious challenger. Freud also popularized his notions of the id and the desires associated with each supposed aspect of personality.

E.O. Wilson's sociobiology and closely related theory of evolutionary psychology give scientific arguments against the "tabula rasa" hypotheses of Hobbes, Locke, and Rousseau. In his book, *Consilience: The Unity of Knowledge* (1998), Edward O. Wilson claimed that it was time for a cooperation of all the sciences to explore human nature. He defined human nature as a collection of epigenetic rules: the genetic patterns of mental development. Cultural phenomena, rituals, etc. are products, not part of human nature. Artworks, for example are not part of human nature, but our appreciation of art is. And this art appreciation, or our fear for snakes, or incest taboo (Westermarck effect) can be studied by the methods of reductionism. Until now these phenomena were only part of psychological, sociological and anthropological studies. Wilson proposes it can be part of interdisciplinary research.

An example of this fear is discussed in the book *An Instinct for Dragons*,\(^{[14]}\) where anthropologist David E. Jones suggests a hypothesis that humans, just like other primates, have inherited instinctive reactions to snakes, large cats and birds of prey. Folklore dragons have features that are combinations of these three, which would explain why dragons with similar features occur in stories from independent cultures on all continents. Other authors have suggested that especially under the influence of drugs or in children's dreams, this instinct may give rise to fantasies and nightmares about dragons, snakes, spiders, etc., which makes these symbols popular in drug culture and in fairy tales for children. The traditional mainstream explanation to the folklore dragons does however not rely on human instinct, but on the assumption that fossils of, for example, dinosaurs gave rise to similar fantasies all over the world.

**Metaphysics and ethics**

Differing understandings of human nature lead to different conclusions about ethics, or in other words the philosophical question of how people should best live. Some of the most important differences between different understandings of human nature and ethics involve different metaphysical understandings about how human nature relates to nature as a whole, sometimes considered as "creation" or the "cosmos".

- Philosophical naturalism (which includes materialism and rationalism) encompasses a set of views that humans are purely natural phenomena; sophisticated beings that evolved to our present state through natural mechanisms such as evolution. Humanist philosophers determine good and evil by appeal to universal human qualities, but other naturalists regard these terms as mere labels placed on how well individual behavior conforms to societal expectations, and is the result of our psychology and socialization.
- Abrahamic religions (most notably Judaism, Christianity and Islam) hold that a human is a spiritual being which was deliberately created by a single God in his image (according to the former two), and exists in continued
relationship with God. Good and evil are defined in terms of how well humans conform to God's character or God's law.

- Polytheistic or animistic notions vary, but generally regard humans as citizens in a world populated by other intelligent spiritual or mythological beings, such as gods, demons, ghosts, etc. In these cases, human evil is often regarded as the result of supernatural influences or mischief (although it may have many other causes as well).
- Holistic, pantheistic, and panentheistic spiritual traditions regard humanity as existing within God or as a part of the divine cosmos. In this case, human "evil" is usually regarded as the result of ignorance of this universal Divine nature. Traditions of this kind include the Indian religions such as Buddhism and Hinduism and other forms of Eastern philosophy, and also schools of western philosophy such as Stoicism, Neoplatonism, or Spinoza's pantheistic cosmology. Certain kinds of polytheism, animism, and monism have similar interpretations.
- Astrologers believe that a person's personality and many of the challenges they will face in life are determined by the placements of the planets, each represents different aspects of their mental and physical nature. At the time of birth they may use many different techniques to "guesstimate" the issues that will unfold throughout their lives and the actions that can be taken to gain the best results.

Free will and determinism

The issue of free will and determinism underlies much of the debate about human nature. Free will, or agency, refers to the ability of humans to make genuinely free choices (in some sense). As it relates to humans, the thesis of determinism implies that human choices are fully caused by internal and external forces.

- Incompatibilism holds that determinism and free will are contradictory (i.e. both cannot be true). Incompatibilist views can either deny or accept free will.
  - Incompatibilist views holding to free will include:
    - Libertarianism holds that the human perception of free choice in action is genuine, rather than seemingly genuine, so that some of our actions are performed without there being any compulsion by internal or external forces to do so (i.e., indeterminism).
    - Thomism holds that humans have a genuine experience of free will, and this experience of free will is evidence of a soul that transcends the mere physical components of the human being.
  - Incompatibilist views that deny free will include:
    - Determinism refers to the logic that humans, like all physical phenomena, are subject to cause and effect. Determinism also holds that our actions stem from environmental, biological, or theological factors. A common misconception is that all determinists are fatalists, who believe that deliberation is pointless as the future is already caused, when in fact most determinists hold the idea that we should deliberate on our actions and that deliberating on our actions is part of the complex interplay between cause and effect.
    - Predestination is the position that God orchestrates all the events in the universe, human and otherwise, according to his will; however he does it in a way that includes the free choices of humans.
    - Biological determinism and social determinism are the views that human actions are determined by their biology and social interaction, respectively. The debate between these two positions is known as nature versus nurture.
  - Compatibilism is the view that free will and determinism can conceptually coexist. Compatibilist views include:
    - Human compatibilism is the view that they are compatible because free will is merely the hypothetical ability to choose differently if one is differently disposed according to the physical factors of determinism.
    - Molinism is the view that God is able to predestine all events on Earth because he knows in advance what people will freely choose.
    - Contemporary compatibilists seek definitions of free will that permit determinism.
**Spiritual versus natural**

Another often-discussed aspect of human nature is the existence and relationship of the physical body with a spirit or soul that transcends the human's physical attributes, as well as the existence of any transcendent purpose. In this area, there are three dominant views:

- The philosophical naturalist position is that humans are entirely natural, with no spiritual component or transcendent purpose. Subsets of the naturalist view include the materialist and physicalist positions, which hold that humans are entirely physical. However, some naturalists are also dualists about mind and body. Naturalism, combined with the natural and social sciences, views humans as the unplanned product of evolution, which operated in part by natural selection on random mutations. Philosophical naturalists do not believe in a supernatural afterlife. Philosophical naturalism is often promoted by many prominent philosophers and thinkers. The philosophical naturalist often will view religious belief as similar to superstition and as the product of unsound or magical thinking.

- In contrast to materialism, there is the Platonic or idealist position. It can be expressed in many ways, but in essence it is the view that there is a distinction between appearance and reality, and that the world we see around us is simply a reflection of some higher, divine existence, of which the human (and perhaps also the animal) soul/mind or spirit may be part. In his *Republic*, Book VII, Plato represents humankind as prisoners chained from birth inside an underground cave, unable to move their heads, and therefore able to see only the shadows on the walls created by a fire outside the cave, shadows that, in their ignorance, the cave dwellers mistake for reality. For Plato, therefore, the soul is a spirit that uses the body. It is in a non-natural state of union, and longs to be freed from its bodily prison (cf. *Republic*, X, 611).

- Between materialism and idealism lies the thought of St. Thomas Aquinas, whose system of thought is known as Thomism. His thought is, in essence, a synthesis of Christian theology and the philosophy of Aristotle. Aristotle describes man as a "rational animal," i.e., a single, undivided being that is at once animal (material) and rational (intelectual soul). Drawing from Aristotelian hylomorphism, the soul is seen as the substantial form of the body (matter). The soul, as the substantial form, is what is universal, or common, to all humanity, and therefore, is indicative of human nature; that which differentiates one person from another is matter, which Aquinas refers to as the principle of individuation. The human soul is characterized as spiritual, immortal, substantial, and subsistent: it is the spiritual and vital principle of the human being, but is also dependent on the body in a variety of ways in order to possess these characteristics. Thus, no division is made between the "physical" and the "spiritual," though they are in fact distinct. This position differentiates Thomism from both materialism and idealism. Unlike idealism, it holds that the visible universe is not a mere shadow of a transcendent reality, but instead is fully real in and of itself. However, unlike materialism, Thomism holds that empiricism and philosophy, when properly exercised, lead inevitably to reasonable belief in God, the human soul, and moral objectivism. Thus, to a Thomist, it is obvious from the evidence that there is a God and an eternal soul.

In addition to these traditional philosophical distinctions between the soul and body, recent adaptations in humanistic psychology attempt to explain the natural transcendent purpose of human life. Richard Shweder of the University of Chicago separated human morality into three components: the ethic of autonomy, the ethic of community, and the ethic of divinity. The idea of religious fundamentalist countries is to uphold the ethic of divinity, which consists of protecting the divinity that exists in each person, even if that means imposing religious and moral laws on people of other faiths. Abraham Maslow, one of the founders of humanistic psychology attempted to demonstrate that spiritual life can be rationally explained as a naturalistic meaning. He claims that "peak experiences," moments of extreme self-transcendence, are the same amongst religious and secular people alike. Peak experiences make people see beyond the two-dimensional world of self-advancement and try live a nobler life. Religions can thus be explained in a naturalistic sense as the coordination of transcendent ideas in order to maximize "peak experiences."[15]
Psychology and biology

A long standing question in philosophy and science is whether there exists an invariant human nature. For those who believe there is a human nature, further questions include:

- What determines/constrains human nature?
- To what extent is human nature malleable?
- How does it vary between people and populations?

Since human behavior is so diverse, it can be difficult to find absolutely invariant human behaviors that are of interest to philosophers. A lesser (but still scientifically valid) standard for evidence pertaining to "human nature" is used by scientists who study behavior. Biologists look for evidence of genetic predisposition to behavioral patterns. Human behavior can be influenced by the environment, so penetrance of genetically predisposed behavioral traits is not expected to reach 100%. A type of human behavior for which there is a strong genetic predisposition can be considered to be part of human nature. In other words, human nature is not seen as something that forces individuals to behave in a certain way, but as something that makes individuals more inclined to act in a certain way than in another.

An enduring evolutionary psychology controversy often revolves around "human nature." Common evolutionary psychology explanations posit that the mind is made up of a massive number of interacting adaptations or "mental modules," the genes for which are a common human inheritance and result in a common human phenotype in the typical environments in which humans find themselves, and which constitute "human nature." This view has been critiqued as essentialist, as neglecting "natural" genetic, environmental and individual variation (and that the closest you can come is norms of reaction), and as equivocating between the levels of genes, developmental programs, and actual human psychology/culture, and between individuals and population averages.[16]

Arguments for invariance

All individuals and all societies have a similar facial grammar. Everyone smiles the same, and the way we use our eyes to convey cognition or flirtatiousness is the same. Human females find male faces that are rated more masculine and aggressive, less feminine and sensitive, more attractive during ovulation, the stage of their menstrual cycle when women are most fertile.[17]

No success has ever been scientifically demonstrated in re-assigning an individual's handedness. Although individuals may change their external behavior (picking up scissors with their right hand instead of the left, for instance), their internal inclination never changes. Even people who lose a limb, who physically do not possess the ability to pick up scissors with their left hand, will try to do so if they are "left-handed." The percentage of left-handers in all cultures at all times remains constant (because left-handedness is a recessive trait.)

Newborn babies, far too young to have been acculturated to do so, have measurable behaviors such as being more attracted to human faces than other shapes and having a preference for their mother's voice over any other voice.

In his book Human Universals,[18] Donald E. Brown presents his case and identifies approximately 400 specific behaviors that are essentially invariant among all humans.
Arguments for social malleability

The Duke of Wellington is said to have become indignant upon hearing someone refer to habit as "second nature." He replied, "It is ten times nature!"

William James likewise referred to habit as the fly-wheel of society. Habits, though, are by definition acquired, and different habits will be both the effect and the cause of very different societies.

Different human societies have held very different moral codes. Thus, regardless of whether objective morality exists or not, humans are clearly capable of imposing a wide variety of different moral codes on themselves.

Some have argued that the role for nurture comes not from the absence of impulses in human nature but from the plethora of such impulses—so many, and so contradictory, that nurture must sort them out and put them into a hierarchy.

Some believe there is no single universal law of behavior that holds true for all human beings. There are many such laws that apply to the majority of individuals (for example, the majority of individuals try to avoid dying), but there are always exceptions (some individuals commit suicide). Most animals, including humans, have an innate self-preservation instinct (fear of injury and death). The fact that humans may override this basic instinct is seen as evidence that human nature is subordinate to the human mind, and/or various outside factors. However, this may not be entirely unique to the human mind, as certain animals are observed to willfully commit suicide.

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Further reading

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- Newcastle University debate on Steven Pinker’s book The Blank Slate (http://www.thegreatdebate.org.uk/GArticles.html)
• Pojman, Louis P., Who Are We? (Oxford University Press, 2005).
International Association for the Cognitive Science of Religion

The International Association for the Cognitive Science of Religion (IACSR) (founded in 2006), is a scholarly association dedicated to the promotion of the Cognitive Science of Religion. The IACSR is an interdisciplinary association, including scholars from a wide variety of disciplines in the human, social, natural and health sciences that are interested in the academic, scientific study of religious phenomena. The IACSR seeks to advance the naturalistic study of religion. It is strictly scientific and does not encourage or welcome those who are interested in dialogue between science and religion, attempt to find religion in science and science in religion, or attempt to validate religious or spiritual doctrines through cognitive science.[1]


History

The IACSR was founded in 2006, and the inaugural meeting took place in Aarhus University, in Denmark.

Second General Assembly: January 7, 2006, Aarhus University, Denmark.
Second General Assembly: May 30, 2008, Aarhus University, Denmark.
Third General Assembly: August 16, 2010, University of Toronto, Canada.
Other IACSR meetings:
July 29, 2009, at the Free University of Amsterdam, in conjunction with the annual meeting of the Cognitive Science Society.

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External links

- Official home page of the IACSR [7]

Notes


Just-so story

A just-so story, also called the ad hoc fallacy, is a term used in academic anthropology, biological sciences, social sciences, and philosophy. It describes an unverifiable and unfalsifiable narrative explanation for a cultural practice, a biological trait, or behavior of humans or other animals. The use of the term is an implicit criticism that reminds the hearer of the essentially fictional and unprovable nature of such an explanation. Such tales are common in folklore and mythology (where they are known as etiological myths — see etiology).

This phrase was popularized by the publication in 1902 of Rudyard Kipling's Just So Stories, containing fictional and deliberately fanciful tales for children, in which the stories pretend to explain animal characteristics, such as the origin of the spots on the leopard.[1]

Some hypotheses that have been labeled as "just so stories" by critics do indeed have some empirical support.[2] [3]

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Mental environment

The mental environment refers to the sum of all societal influences upon mental health. The term is often used in a context critical of the mental environment in industrialized societies. It is argued that just as industrial societies produce physical toxins and pollutants which harm humans physical health, they also produce psychological toxins (e.g. television, excessive noise, violent marketing tactics) that cause psychological damage.\[1\] [2]

This poor mental environment may help explain why rates of mental illness are reportedly higher in industrial societies than in the developing world.

The idea has its roots in evolutionary psychology, as the deleterious consequences of a poor mental environment can be explained by the mismatch between the mental environment humans evolved to exist within and the one they exist within today.

References


Psychological adaptation

A psychological adaptation, also called an Evolved psychological mechanism or EPM, is an aspect of a human or other animal's psychology that is the result of evolutionary pressures. It could serve a specific purpose, have served a purpose in the past (see vestigiality), or be a side-effect of another EPM (see spandrel (biology)). Evolutionary psychology proposes that the human psychology mostly comprises psychological adaptations, in opposition to blank slate models of human psychology such as the standard social science model, [1] popular throughout most of the twentieth century.

Evolutionary psychologist, David Buss, lays out six properties of evolved psychological mechanisms (EPM's):

1. An EPM exists in the form that it does because it solved a specific problem of survival or reproduction recurrently over evolutionary history.
2. An EPM is designed to take in only a narrow slice of information
3. The input of an EPM tells an organism the particular adaptive problem it is facing
4. The input of an EPM is transformed through decision rules into output
5. The output of an EPM can be physiological activity, information to other psychological mechanisms, or manifest behaviors
6. The output of an EPM is directed toward the solution to a specific adaptive problem

Further important properties include the following:

- EPM's provide nonarbitrary criteria, (i.e. adaptive function) for "carving the mind at its joints," (i.e. evolved structure).
- EPM's tend to aid in solving specific adaptive problems, (e.g. food selection, mate selection, intrasexual competition, etc.)
- EPM's are believed to be numerous, which contributes to human behavioral flexibility. An analogy would be like a carpenter who, instead of having one tool that does everything, has many tools, each with a specific function for a specific task, (e.g. a hammer for pounding nails, a saw for cutting wood, etc.)
Some EPM's are domain-specific, (i.e. evolved to solve specific, recurrent adaptive problems), while others are domain-general, (i.e. evolved to aid the individual in dealing with novelty in the environment).

The least controversial EPMs are those commonly known as instincts, including interpreting stereoscopic vision and suckling a mother's breast.

References


External links


References

[1] http://salmon psy.plym.ac.uk/Year1/psy150/sociobiology.htm#debate
Social defeat

Social defeat refers to losing a confrontation among conspecific animals, or any kind of hostile dispute among humans, in either a dyadic or in a group-individual context, generating very significant consequences in terms of control over resources, access to mates and social positions.

Background

Research on social stress has developed a variety of different approaches, developing a wealthy body of literature, providing a richness of perspectives. However, most of the theories developed have either a lack of ecological validity (similarity with natural conditions and stressors) or are not amenable to scientific investigation (difficult to test and verify).

On the one side, social psychological approaches to human aggression have developed a multitude of perspectives, based on observations of human phenomena like bullying, mobbing, physical and verbal abuse, relational and indirect aggression, etc. Despite the richness of theories developed, the body of knowledge generated have not satisfied scientific requirements of testability and verifiability.

By the other side, animal studies of within-species aggression developed in 2 main branches: A) approaches based on laboratory experiments, on controlled conditions, allowing the measurement of behavioral, endocrine and neurological variables, but with the shortcoming of applying unnatural stressors (like food-shocks, confinement stress, etc) in unnatural conditions (the cage, a poor artificial environment); B) approaches based on observations of animals in naturalistic settings, which avoided artificial environments and unnatural stresses, but usually not allowing the measurement of physiological effects or the manipulation of relevant variables.

In real life situations, animals (as well as humans) have to cope with stresses generated within their own species, during their interactions with conspecifics, especially due to recurrent struggles over the control of limited resources, mates and social positions (Bjorkqvist, 2001; Rohde, 2001; Allen & Badcock, 2003).

Social defeat is a source of chronic stress in animals and humans, capable of causing significant changes in behaviour, brain functioning, physiology, neurotransmitter and hormone levels, and health (Bjorkqvist, 2001; Rohde, 2001; Allen & Badcock, 2003).

History

The social defeat approach was originated from animal experiments, using the "resident-intruder" paradigm, in which an animal was placed in the cage of another animal or group of animals of the same species, in a manner that allowed a non-lethal conflict.

If animals are allowed to fight on a single occasion only, it is usually regarded as a model of acute stress; if they are allowed to fight on several different occasions, on different days, consecutive or not, it is regarded as a model of chronic stress. After the defeat or in the interval between fights, the subordinate animal may also be exposed to threats from the dominant one, by having to stay in a cage or compartment beside or nearby the dominant, exposed to its visual or olfactory cues.

Later, the social defeat approach was also applied to observations of animal within-species aggression, in the wild, which suggested that the hypotheses generated on artificial laboratory settings can also be applied in observed in natural settings, confirming the predictions of the model.
In humans

It has been proposed that animal models of social conflict may be useful for studying a number of psychiatric disorders, including major depression, generalized anxiety, post-traumatic stress disorder, drug abuse, aggressive psychopathologies, eating disorders and even schizophrenia (Bjorkqvist, 2001; Selten & Cantor-Graae, 2005; Rohde, 2001).

The social defeat model has been extended to include observations of human aggression, bullying, relational aggression, chronic subordination and humiliation. The social defeat model attempts to extend animal studies to include human behaviour as well, in contrast to the social psychology study of aggression, in which comparisons are drawn exclusively from experiments involving humans (Bjorkqvist, 2001; Rohde, 2001).

Bullying has interesting parallels with animal models of social defeat, the bully being equivalent to the dominant animal and the victim the subordinate one. At stake are possessions of material objects, money, etc, social position in the group, represented by in-group prestige, and the consequent lack of access to mates, including for socio-sexual behaviors like copulation. Human victims typically experience symptoms like low self-esteem (due to low regard by the group), feelings of depression (due to unworthiness of efforts), social withdrawal (reduced investments in the social environment), anxiety (due to a threatening environment), and they can also be shown to experience a plethora of physiological effects, e.g. increased corticosterone levels, and also a shift towards sympathetic balance in the autonomic nervous system (Bjorkqvist, 2001).

Research about human aggression, usually conducted by psychologists or social psychologists, resembles to a great extent the research about social defeat and animal aggression, usually conducted by biologists or physiological psychologists. However, there is the problem of the use of different terminologies for similar concepts, which hinders communication between the two bodies of knowledge (Bjorkqvist, 2001).

Behavioral and Physiological effects

Social defeat is a very potent stressor and can lead to a variety of behavioral effects, like social withdrawal (reduced interactions with conspecifics), lethargy (reduced locomotor activity), reduced exploratory behavior (of both open field and novel objects), anhedonia (reduced reward-related behaviors), decreased socio-sexual behaviors (including decreased attempts to mate and copulate after defeat), various motivational deficits, decreased levels of testosterone (due to a decline in the functionality of the Laydig cells of the testes), increased tendencies to stereotyped behaviours and self-administration of drugs and alcohol (Rygula et al, 2005; Huhman, 2006).

Research also implicates that the referred behavioral effects are moderated by neuroendocrine phenomena involving serotonin, dopamine, epinephrine, norepinephrine, and in the hypothalamic-pituitary-adrenal axis, locus ceruleus and limbic systems (Bjorkqvist, 2001; Rygula et al, 2005; Selten & Cantor-Graae, 2005; Marinia et al, 2006; Huhman, 2006).

Both animal and human studies suggest that the social environment has a strong influence on the consequences of stresses. This finding seems to be especially true in the case of social stresses, like social defeat (Bjorkqvist, 2001; Rygula et al, 2005; de Jong et al, 2005).

In animal studies, animals housed collectively showed reduced symptoms after defeat, in comparison with those housed alone; and animals that live in more stable groups (with stable hierarchies, less intra-group aggression) exhibit reduced effects after a defeat, in comparison with those housed in a more unstable group (de Jong et al, 2005).

In human studies, individuals with greater support seem to be protected against excessive neuroendocrine activation, thereby reducing the adverse effects of stresses in general, and especially stresses of social origin.

This apparent confusion, in which social defeat generates behavioral and neuroendocrine effects, both of which depending on social contextual variables, raises the question of how to interpret this data. A useful concept is the concept of "causal chain", in which recurrent evolutionary events, in this case intra-specific competition, generates
Social defeat

selective pressures that last for thousands of generations, influencing a whole species. This way physiological phenomena may evolve, in this case the referred neuro-endocrine phenomena, to facilitate adaptive patterns of action by individuals, in this case the referred behavioral effects. According to this framework, selective pressures generated by intra-specific competition can be considered as the ultimate cause, the neuroendocrine phenomena can be considered to be the proximate causes (sometimes also called mechanisms or moderators) and the observed behavioral alterations are considered the effects (the end events in the causal chain)(Gilbert et alii, 2002; Allen & Badcock, 2003; Rygula et alli, 2005).

Some authors, for example Randolph Nesse, warn us that patterns of behavior commonly considered inappropriate or even pathological may well have adaptive value. According to this view, several authors propose that behaviors considered abnormal may be in fact part of an adaptive response to stresses experienced in modern or at least in old environments, for example social stress from chronic subordination or interpersonal conflicts (Gilbert et alli, 2002; Allen & Badcock, 2003).

References


Folk biology

Folk biology or folkbiology is the cognitive study of how people classify and reason about the organic world. Humans everywhere classify animals and plants into obvious species-like groups. The relationship between a folk taxonomy and a scientific classification can assist in understanding how evolutionary theory deals with the apparent constancy of “common species” and the organic processes centering on them. From the vantage of evolutionary psychology, such natural systems are arguably routine “habits of mind,” a sort of heuristic used to make sense of the natural world.

References


External links


References

[1] http://jeannicod.ccsd.cnrs.fr/documents/disk0/00/00/02/67/ijn_00000267_00/ijn_00000267_00.pdf
Standard social science model

The term the Standard Social Science Model (SSSM) was first introduced to a wide audience by John Tooby and Leda Cosmides in the 1992 edited volume *The Adapted Mind*[^1] to describe the "blank slate," social constructionist, or "cultural determinist" perspective that they claim is the dominant theoretical paradigm in the social sciences as they developed during the 20th century. According to this alleged paradigm, the mind is a general-purpose cognitive device shaped almost entirely by culture.[^2]

**Alleged proponents**

Evolutionary psychologists name several prominent scientists as supposed proponents of the standard social science model, including Franz Boas, Margaret Mead, B. F. Skinner, Richard Lewontin, John Money, and Steven J. Gould.[^3]

**Alternative theoretical paradigm: The Integrated Model**

Evolutionary psychologists have argued[^4] that the SSSM is now out of date and that a progressive model for the social sciences requires evolutionarily-informed models of nature-nurture interactionism, grounded in the computational theory of mind. Tooby and Cosmides refer to this new model as the Integrated Model (IM).

Tooby and Cosmides[^5] provide several comparisons between the SSSM and the IM, including the following:

<table>
<thead>
<tr>
<th>Standard Social Science Model</th>
<th>Integrated Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans born a blank slate</td>
<td>Humans are born with a bundle of emotional, motivational and cognitive adaptations</td>
</tr>
<tr>
<td>Brain a &quot;general-purpose&quot; computer</td>
<td>Brain is a collection of modular, domain specific processors</td>
</tr>
<tr>
<td>Culture/socialization programs behavior</td>
<td>Behavior is the result of interactions between evolved psychological mechanisms and cultural &amp; environmental influences</td>
</tr>
<tr>
<td>Cultures free to vary any direction on any trait</td>
<td>Culture itself is based on a universal human nature, and is constrained by it</td>
</tr>
<tr>
<td>Biology is relatively unimportant to understand behavior</td>
<td>An analysis of interactions between nature and nurture is important to understand behavior</td>
</tr>
</tbody>
</table>

**Criticisms**

Richardson (2007) argues that evolutionary psychologists developed the SSSM as a rhetorical technique:[^6] “The basic move is evident in Cosmides and Tooby’s most aggressive brief for evolutionary psychology. They want us to accept a dichotomy between what they call the "Standard Social Science Model" (SSSM) and the "Integrated Causal Model" (ICM) they favor ... it offers a false dichotomy between a manifestly untenable view and their own.”[^7] Wallace (2010) has also suggested the SSSM to be a false dichotomy and claims that “scientists in the EP tradition wildly overstate the influence and longevity of what they call the Standard Social Science Model (essentially, behaviorism)”[^8]
References


External links

• Tooby and Cosmides briefly define the SSSM in their Evolutionary Psychology Primer (http://cogweb.ucla.edu/ep/EP-primer.html).

Sources


Further reading

• Schmaus, Warren. 2003. "Is Durkheim the Enemy of Evolutionary Psychology?".Philosophy of the Social Sciences.33;25
Tinbergen's four questions

Tinbergen's four questions, named after Nikolaas Tinbergen, are complementary categories of explanations for behavior. It suggests that an integrative understanding of behavior must include both a proximate and ultimate (functional) analysis of behavior, as well as an understanding of both phylogentic/developmental history and the operation of current mechanisms. [1]

Four categories of questions and explanations

When asked about the purpose of sight in humans and animals, even elementary school children can answer that animals have vision to help them find food and avoid danger (adaptation). Biologists have three additional explanations: sight is caused by a particular series of evolutionary steps (phylogeny), the mechanics of the eye (causation), and even the process of an individual’s development (ontogeny). Although these answers may be very different, they are consistent with each other. This idea was hashed out in the 1960s when Tinbergen delineated the four questions based on Aristotle's four types of causes. This schema constitutes a basic framework of the overlapping behavioral fields of ethology & anthropology, behavioral ecology, sociobiology & evolutionary psychology, and comparative psychology.

Table of Categories

<table>
<thead>
<tr>
<th>How vs. Why Questions</th>
<th>Dynamic View</th>
<th>Static View</th>
</tr>
</thead>
<tbody>
<tr>
<td>How vs. Why Questions</td>
<td>How an individual organism's structures function</td>
<td>Explanation of current form in terms of a historical sequence</td>
</tr>
<tr>
<td>Evolutionary View</td>
<td>Ontogeny</td>
<td>Mechanism</td>
</tr>
<tr>
<td>Why a species evolved the structures (adaptations) it has</td>
<td>Developmental explanations for changes in individuals, from DNA to their current form</td>
<td>Mechanistic explanations for how an organism's structures work</td>
</tr>
<tr>
<td>Phylogeny</td>
<td>The history of the evolution of sequential changes in a species over many generations</td>
<td>Adaptation</td>
</tr>
<tr>
<td>Adaptation</td>
<td>A species trait that evolved to solve a reproductive or survival problem in the ancestral environment</td>
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</table>

Evolutionary (ultimate) explanations

1 Function (adaptation)

Darwin’s theory of evolution by natural selection is the only scientific explanation for why an animal's behavior is usually well adapted for survival and reproduction in its environment. The literature conceptualizes the relationship between function and evolution in two ways. On the one hand, function and evolution are often presented as separate and distinct explanations of behavior. [2] On the other hand, the definition of adaptation, a central concept in evolution, is a trait that is functional to the reproductive success of the organism and that is the result of natural selection; that is, function and evolution are inseparable. Given this, it is best to conceptualize function as an evolutionary explanation. The term “function” is preferable to “adaptation”, because it is understandable to students prior to an explanation of evolution. Many examples are well-known. For instance, in the winter birds fly south where there's food and warmth, and mammalian mothers nurture their young, thereby having more surviving offspring.

Ultimate function corresponds to Aristotle's final cause.
Tinbergen’s four questions

2 Phylogeny (evolution)

Phylogeny captures all evolutionary explanations other than function/adaptation. There are several reasons why natural selection may fail to achieve optimal design (Mayr 2001:140–143; Buss et al. 1998). One entails random processes such as mutation and environmental events acting on small populations. Another entails the constraints resulting from early evolutionary development. Each organism harbors traits, both anatomical and behavioral, of previous phylogenetic stages, since many traits are retained as species evolve. Reconstructing the phylogeny of a species often makes it possible to understand the "uniqueness" of recent characteristics: Earlier phylogenetic stages and (pre-) conditions which persist often also determine the form of more modern characteristics. For instance, the vertebrate eye (including the human eye) has a blind spot, whereas octopus eyes do not. In those two lineages, the eye was originally constructed one way or the other. Once the vertebrate eye was constructed, there were no intermediate forms that were both adaptive and would have enabled it to evolve without a blind spot.

Proximate explanations

3 Causation (mechanism)

Proximate causal mechanisms correspond to Aristotle's material cause. Some prominent classes of proximate causal mechanisms include:

- Brain: For example, Broca’s area, a small section of the human brain, has a critical role in linguistic capability.
- Hormones are chemicals used to communicate among cells of an individual organism. Testosterone, for instance, stimulates aggressive behavior in a number of species.
- Pheromones are chemicals used to communicate among members of the same species. Some species (e.g., dogs and some moths) use pheromones to attract mates.

In examining living organisms, biologists are confronted with diverse levels of complexity (e.g. chemical, physiological, psychological, social). They therefore investigate causal and functional relations within and between these levels. A biochemist might examine, e.g., the influence of social and ecological conditions on the release of certain neurotransmitters and hormones, and the effects of such releases on behavior. E.g., stress during birth has a tokolytic (contraction-suppressing) effect. However, awareness of neurotransmitters and the structure of neurons is not by itself enough to understand higher levels of neuroanatomic structure or behavior: "The whole is more than the sum of its parts." All levels must be considered as being equally important: cf. transdisciplinarity, Nicolai Hartmann's "Laws about the Levels of Complexity."

4 Development (ontogeny)

In the latter half of the twentieth century, social scientists debated whether human behavior was the product of nature (genes) or nurture (environment in the developmental period, including culture). The consensus among biologists now is that behavior is the product of gene-environment interaction, in which the whole can be more than the sum of the parts, that is, the genetic and environmental components. By way of contrast, tallness may simply be the sum of "tall genes" and an environment rich in food.

An example of interaction (as distinct from the sum of the components) involves familiarity from childhood. In a number of species, individuals prefer to associate with familiar individuals but prefer to mate with unfamiliar ones (Alcock 2001:85–89, Incest taboo, Incest). By inference, genes affecting living together interact with the environment differently from genes affecting mating behavior. A homely example of interaction involves plants: Some plants grow toward the light (phototropism) and some away from gravity (gravitropism). Such species react differently to the same environment because of different genes.

Many forms of developmental learning have a critical period, for instance, for imprinting among geese and language acquisition among humans. In such cases, genes determine the timing of the environmental impact.
A related concept is labeled “biased learning” (Alcock 2001:101–103) and “prepared learning” (Wilson, 1998:86–87). For instance, after eating food that subsequently made them sick, rats are predisposed to associate that food with smell, not sound (Alcock 2001:101–103). Many primate species learn to fear snakes with little experience (Wilson, 1998:86–87).[4]

See developmental biology and developmental psychology.

**Causal relationships**

The figure shows the causal relationships among the categories of explanations. The left-hand side represents the evolutionary explanations at the species level; the right-hand side represents the proximate explanations at the individual level. In the middle are those processes’ end products—genes (i.e., genome) and behavior, both of which can be analyzed at both levels.

Evolution, which is determined by both function and phylogeny, results in the genes of a population. The genes of an individual interact with its developmental environment, resulting in mechanisms, such as a nervous system. A mechanism (which is also an end-product in its own right) interacts with the individual’s immediate environment, resulting in its behavior. Here we return to the population level. Over many generations, the success of the species’ behavior in its ancestral environment (or more technically, the environment of evolutionary adaptedness [EEA]) may result in evolution as measured by a change in its genes.

In sum, there are two processes—one at the population level and one at the individual level—which are influenced by environments in three time periods.

**Examples**

**Vision**

Four ways of explaining visual perception:

- **Function:** To find food and avoid danger.
- **Phylogeny:** The vertebrate eye initially developed with a blind spot, but the lack of adaptive intermediate forms prevented the loss of the blind spot.
- **Causation:** The lens of the eye focuses light on the retina.
- **Development:** Neurons need the stimulation of light to wire the eye to the brain (Moore, 2001:98–99).
Westermarck effect

Four ways of explaining the Westermarck effect, the lack of sexual interest in one’s siblings (Wilson, 1998:189–196):

- Function: To discourage inbreeding, which decreases the number of viable offspring.
- Phylogeny: Found in a number of mammalian species, suggesting initial evolution tens of millions of years ago.
- Causation: Little is known about the neuromechanism.
- Development: Results from familiarity with another individual early in life, especially in the first 30 months for humans. The effect is manifested in nonrelatives raised together, for instance, in kibbutzs.

Use of the four-question schema as "periodic table"

The four-question schema is used as the central organizing device in some texts but not others. For instance, it is used in one of the most widely used animal behavior texts (Alcock, 2001) but not in one of the most widely used evolutionary psychology texts (Buss, 2004:12). An advantage of the schema is that it highlights gaps in knowledge, analogous to the role played by the periodic table of elements in the early years of chemistry:

The "periodic table of life sciences" becomes clear, when the following levels are graphed against the questions: the bio-molecule, cell, organ, individual and group level (see also Nicolai Hartmann's "Laws about the Levels of Complexity").

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<thead>
<tr>
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<tbody>
<tr>
<td>a. Molecule</td>
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<tr>
<td>b. Cell</td>
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<td></td>
<td></td>
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<tr>
<td>c. Organ</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>d. Individual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Family</td>
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<td></td>
<td></td>
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<tr>
<td>f. Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Society</td>
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This "bio-psycho-social" table is a framework of reference, which demonstrates the associations between all non-human biological (levels a–f), as well as all anthropological and human sciences (levels a–g). Especially in anthropological and human sciences it helps to structure interdisciplinary discussions, teaching and research (i.e. "Fundamental Theory of Anthropology"). In the Table the questions and planes in *italics* are also the subject of the humanities. In this "periodic table of human sciences", all anthropological disciplines (paragraph C in the table of the pdf-file below), their questions (paragraph A: see pdf-file) and results (paragraph B: see pdf-file) can be intertwined and allocated with each other [for examples how these aspects go into those little boxes in the matrix, see e.g. the paragraphs A, B and C in the table "The Four Central Questions ... using Ethology as an Example" [5] (pdf)].

This "bio-psycho-social" orientation framework is the basis for the development of an interdisciplinary consensus: It is the starting point for a systematical order for anthropological and human sciences, and also the basis for a consistent networking and structuring of their results (see also Interdisciplinarity). In terms of epistemology: Since the answers to the reference planes and to all four central questions must fit together without contradictions, misconceptions can thus be revealed by inconsistencies. The periodic table can help in estimating how much interdisciplinarity is implemented in specific scientific approaches.
Notes

[3] "Phylogeny" often emphasizes the evolutionary genealogical relationships among species (Alcock 2001:492; Mayr, 2001:289) as distinct from the categories of explanations. Although the categories are more relevant in a conceptual discussion, the traditional term is retained here.
[4] "Biased learning" is not necessarily limited to the developmental period.

References


External links

Diagrams on Tinbergen's four questions

• The Four Areas of Biology (http://www-personal.umich.edu/~nesse/Nesse-Tinbergen4Q.pdf) pdf
• The Four Areas and Levels of Inquiry (http://homepage.uibk.ac.at/~c720126/humanethologie/ws/medicus/block1/4BQ_E.pdf) pdf
• Tinbergen's four questions within the "Fundamental Theory of Human Sciences" (http://homepage.uibk.ac.at/~c720126/humanethologie/ws/medicus/block1/TheoryHumanSci.ppt) ppt
The Adapted Mind

The Adapted Mind: Evolutionary Psychology and the Generation of Culture is an edited volume, first published in 1992 by Oxford University Press, edited by Jerome Barkow, Leda Cosmides and John Tooby.[1] It is widely considered the foundational text of evolutionary psychology (EP), and outlines Cosmides & Tooby's integration of concepts from evolutionary biology and cognitive psychology, as well as many other concepts that would become important in adaptationist research.

Outline

For all practical purposes the book can be divided in two parts. The first part (pp. 1-159) lays out the theoretical foundations of evolutionary psychology. It consists of the introduction, written by Cosmides, Tooby and Barkow, an essay written by Tooby and Cosmides entitled The psychological foundations of culture, and an essay written by anthropologist Donald Symons entitled On the use and misuse of Darwinism in the study of human behavior. The second part (pp. 160-637) is a collection of empirical research papers meant to introduce the reader to some topics of interest in evolutionary psychology, such as mating, social and developmental psychology, perceptual adaptations etc. It includes contributions from the best known evolutionary psychologists of the time such as Steven Pinker, David Buss, Martin Daly, Margo Wilson and others.

Psychological foundations of culture

By far the most important text in the volume is "The Psychological Foundations of Culture", by Tooby and Cosmides. The first forty pages or so of this essay are devoted to an extensive critique of what the authors call the 'SSSM', short for 'Standard Social Science Model'. The term refers to a metatheory that the authors claim has dominated the behavioral and social sciences throughout the twentieth century, blending radical environmentalism with blind empiricism. The SSSM has retained and reified the nature/nurture dichotomy, and its practitioners have meticulously amassed evidence over the years which 'proves' that the overwhelming majority of psychological phenomena fall in the 'nurture' category. Only some instinctive and primitive biological drives like hunger and thirst have been retained in the 'nature' category.

Resolving the nature/nurture debate

Most commonly, they continue, evidence for such a preponderance of nurture over nature is drawn from the ethnographic record. A phenomenon (e.g. marriage, religion, reciprocity etc.) is taken to be of purely environmental or cultural origin if it can be shown to manifest in different forms in different cultures or locales. But this reflects an assumption that biological phenomena are instinctive and inflexible - incapable of taking on different forms.

In the section entitled 'Selection regulates how environments shape organisms' (pp.82-87), Tooby and Cosmides argue that this view of nature/nurture is deeply flawed. They begin with the statement that natural selection is necessarily responsible for complex biological adaptations, including that extremely complex class of biological phenomena that are human psychological mechanisms.

The assumption that only the genes evolved reflects a widespread misconception about the way natural selection acts. Genes are the so-called units of selection, which are inherited, selected, or eliminated, and so they are indeed something that evolves. But every time one gene is selected over another, one design for a developmental program is selected over another as well; by virtue of its structure, this developmental program interacts with some aspects of the environment rather than others, rendering certain environmental features causally relevant to development. So, step by step, as natural selection constructs the species' gene set (chosen from the available mutations), it constructs in tandem the species' developmentally relevant environment (selected from the set of all properties of the world). Thus, both the genes and the developmentally relevant environment are the product of evolution' (p.84).[1]
With both our genes and our environment "biological" in nature, the nature/nurture dichotomy lacks any meaning. In its place Tooby and Cosmides propose a distinction between "open" and "closed" developmental programs, which refers to the extent to which our various psychological mechanisms can vary in their manifest form depending on the input they receive during development. Some psychological mechanisms (e.g. our visual faculties) will normally assume the same manifest form regardless of the environments they encounter during development (closed developmental programs), while others (e.g. our language faculties) will vary in their manifest form in accordance to the environmental input they receive during development (open developmental mechanisms). However, they argue, whether a mechanism is closed or open, as well as the range of forms it can assume if it is open, is something that is encoded in genetic instructions that have been fine-tuned through millions of years of evolution.

**Domain specificity**

Another major theme of the essay is the critique of what Tooby and Cosmides call 'domain-general psychological mechanisms': the psychological faculties which according to the SSSM comprise the human mind. These are general-purpose mechanisms, devoid of situational content, and function equally well regardless of behavioral domain. For example the so called 'problem-solving methods' with which cognitive psychologists have traditionally busied themselves are abstract rational strategies (e.g. break the problem into smaller parts or start working backwards from the desired end to the present state) that supposedly work the same regardless of if one wants to play a game of chess, order a pizza or find a sexual partner. This academic preoccupation with domain-general mechanisms, they suggest, stems directly from the folk notion of man as a rational being that has largely lost or suppressed its animalesque instincts and now operates primarily according to reason.

Tooby and Cosmides devote the larger part of their essay to establishing that the human mind cannot consist exclusively or even primarily, of domain-general mechanisms. The argument may be summarised as follows: since domain-general mechanisms come without innate content, they must work out the solution to each problem from scratch through costly and potentially lethal trial-and-error. Domain-specific mechanisms, on the other hand, come with content that is specialized for their domain (e.g. mating, foraging, theory of mind etc.) and can therefore immediately dismiss a staggering number of plausible courses of action (which by definition a domain-general mechanism would have to examine one by one) for one or a few favoured alternatives. For this reason domain-specific mechanisms are faster and more effective than their domain-general counterparts and we should expect natural selection to have favoured them.

The authors conclude that the flexible and highly intelligent appearance of human behaviour is not the result of domain-general mechanisms having taken over from older domain-specific mechanisms (or 'instincts'), but the exact opposite; human domain-specific mechanisms have proliferated to the point where man has become competent in an unprecedented number of domains, and can therefore usually employ some motley assortment of these specialized mechanisms for his own novel needs (e.g. he has combined lingual, visual and motor skills to invent the written word, for which no specialized psychological mechanism exists).
Significance

Upon its release The Adapted Mind met with a cool reception from the scientists who had been involved in evolutionary explanations of human behavior since the late 1970’s. Five years prior to the publication of the book Tooby, Cosmides and especially Symons had launched a series of polemical papers in which they rejected the then established models of sociobiology and behavioral ecology.

Contents

Introduction: Evolutionary Psychology and Conceptual Integration. Leda Cosmides, John Tooby and Jerome H. Barkow, p.3.

I. THE EVOLUTIONARY AND PSYCHOLOGICAL FOUNDATIONS OF THE SOCIAL SCIENCES

II. COOPERATION

III. THE PSYCHOLOGY OF MATING AND SEX

IV. PARENTAL CARE AND CHILDREN

V. PERCEPTION AND LANGUAGE AS ADAPTATIONS

VI. ENVIRONMENTAL AESTHETICS

VII. INTRAPSYCHIC PROCESSES

VIII. NEW THEORETICAL APPROACHES TO CULTURAL PHENOMENA
External links

Evolutionary Psychology: A Primer [6], by Leda Cosmides & John Tooby.

References

Glenn Daniel Wilson (born December 29, 1942 in Christchurch, New Zealand) is a psychologist best known for his work on attitude and personality measurement, sexual attraction, deviation and dysfunction, partner compatibility, and psychology applied to performing arts.

In 2001, Wilson was ranked among the 10 most frequently cited British psychologists in scientific journals. He is a Fellow of the British Psychological Society and makes frequent media appearances as a psychology expert, especially in TV news and documentaries.

**Biography**

After graduating MA with 1st-class honors at the University of Canterbury, Christchurch, Wilson moved to London in 1967 to study for his PhD under the supervision of Professor Hans Eysenck, with whom he subsequently collaborated on a number of research projects and co-authored six books. He also co-authored the *Eysenck Personality Profiler*, a standard personality test used in clinical research and industry. With John Patterson, he devised the *Wilson-Patterson Conservatism Scale*, which remains one of the most widely used measures in social attitude research. His 1973 theory that a heritable trait reflecting fear of uncertainty underlies social attitudes in all fields has much empirical support. Together with G.Knyazev and H.Slobodskaya of the Russian Academy of Medical Sciences, Wilson has researched the EEG correlates of personality and produced a theory of the evolution of brain oscillations.

Wilson was a pioneer of evolutionary approaches to understanding human sex differences and mating behavior, attracting some hostility when this was unfashionable in the 1970s. His use of the bust-waist ratio as an objective
index of female sexual attractiveness\textsuperscript{10} presaged the waist-hip ratio, now widely accepted as an oestrogen (fertility) marker. His studies of sex fantasy yielded the Wilson Sex Fantasy Questionnaire,\textsuperscript{11} often used in research and forensic psychology. Noting that men and women had different finger length patterns, Wilson introduced the 2D/4D digit ratio as a marker of exposure to prenatal testosterone,\textsuperscript{12} research on which has burgeoned in recent decades.\textsuperscript{13} His work, with Jon Cousins, in developing the compatibility quotient (CQ) as a predictor of relationship success\textsuperscript{14} has resulted in his characterization as "the father of modern compatibility testing".\textsuperscript{15} With Qazi Rahman, Wilson has published research supporting the conclusion that sexual orientation is of constitutional origin.\textsuperscript{16}

An interest in music and singing (he is a part-time professional baritone) led to courses on Psychology of Performance, which he has taught both in the US and UK. His book Psychology for Performing Artists,\textsuperscript{17} now in its 2nd edition, is a standard text in music and drama schools.

From 1994 until 2008, Wilson was Reader in Personality at the Institute of Psychiatry, King's College, University of London. He has held visiting appointments at several American institutions, including California State University, Los Angeles, Stanford University, San Francisco State University, Sierra Nevada College and the University of Nevada, Reno, where he was Adjunct Professor for many years. He is currently Visiting Professor of Psychology at Gresham College, London.

Notes
\textsuperscript{6} Bouchard, T.J. et al. (2003), Evidence for the construct validity and heritability of the Wilson-Patterson Conservatism Scale, Personality and Individual Differences, 34, 959-969.
\textsuperscript{11} Wilson, G.D. (2010) Interpretation guidelines to Wilson's Sex Fantasy Questionnaire, Cymeon Pty
\textsuperscript{15} Houran, J. Online Dating Magazine (http://www.onlinedatingmagazine.com/features/compatibilitytesting.html).

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• Eysenck, H.J. & Wilson, G.D. - The Experimental Study of Freudian Theories, 1973
• Wilson, G.D. - Improve Your IQ, 1974
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• Wilson, G.D. - *Your Personality Quiz Book*, 1994
• Wilson, G.D. & McLaughlin, C. - *Better Sex*, 1995
• Wilson, G.D. & McLaughlin, C. - *Winning with Body Language*, 1996
• Evans, A. & Wilson, G.D. - *Fame: The Psychology of Stardom*, 1999

**External links**

• Dr Glenn Wilson, homepage (http://www.drglennwilson.com/)
**Standard social science model**  
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**Tinbergen's four questions**  
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