DETERMINISM, GENETIC

Genetic determinism is the notion that an individual's genetic makeup equates to behavioral destiny. This definition is slightly different from one stating that all human beings have the same genetic blueprint. The classic textbook *Gray's Anatomy* illustrates and, indeed, medical scientists rely for treatment upon, a genetically determined, universal description of the human body. All normally developed humans have eyes for seeing, hearts for pumping blood, and so on, as specified by this genetic blueprint.

Behavioral genetic determinism is an extreme form of nativism that emphasizes the innateness of knowledge. Historically, nativism has been contrasted with empiricism, which emphasizes the environment as the source of knowledge, learning, and behavior. A modern doctrine of empiricism is found in British philosophy of the 1700s and 1800s, which argued that humans are born with no innate mental content, equating the mind to a blank slate for experience to write upon. Modern nativism did not emerge until Charles Darwin (1809–1882) proposed in 1859 that, through natural selection, humans are descended from other life forms. In the social sciences, initial support for nativism was provided by William James (1842–1910), who argued that humans have more instincts than animals, thus shattering the dichotomy between instinct and reason. At that time it was believed that animals were instinctive and unintelligent, whereas humans were rational and intelligent. The pendulum swung back to empiricism when behaviorism, a new paradigm in psychology, emerged and endorsed domain-general learning through simple conditioning procedures as the source of all knowledge. Psychology, anthropology, and sociology endorsed this position for much of the twentieth century.

Contrasting genetically determined versus environmentally determined explanations of behavior is analogous to the long-standing debate that incorrectly pits nature (genes, instincts, adaptations, biology) against nurture (environment, experience, general learning mechanisms, culture). Anthropologist Edward Hagen (2005) argues, however, that nature is a product of nurture, and that nurture is a product of nature. To illustrate this statement, one must examine evolution through natural selection. Hagen compares natural selection to a learning algorithm that uses information from the environment to select gene combinations that aid in reproduction. These gene combinations are stored in the genome as this learned information forms the basis of an adaptation. Because adaptations are the product of environmental influences, and are designed by natural selection over evolutionary history, it would be uninformed to discuss genes or adaptations without knowledge of the context in which they evolved. In this way, nature is a product of nurture.

At the same time, nurture is a product of nature. It is unlikely that a truly blank-slate version of the mind would be able to learn anything from the environment. This was the nativist argument advanced by anthropologist John Tooby and psychologist Leda Cosmides (1992) regarding the functional design of the mind. Tooby and Cosmides argued that learning and behavior depend on content-dependent information processing mechanisms and that once a specialized psychological architecture is in place, adaptive challenges can be met with ease. All humans have a universal, species-typical mind, in the same way that all humans have a universal, species-typical physical anatomy.

One way to illustrate this universal architecture is to examine fear. In an experiment designed by psychologist Susan Mineka and colleagues (1980), infant rhesus monkeys were exposed to one of two videotaped scenarios, one depicting a monkey reacting in terror to a snake, the other depicting a monkey reacting in terror to flowers. Monkeys that viewed the tape showing the reaction to a snake quickly acquired a fear of snakes, but monkeys that viewed the tape showing the same reaction to flowers did not acquire a fear of flowers. It appears that humans also are prepared to learn quickly which features in the environment are threatening and ignore those features that are not. Common phobias in humans include spiders, darkness, and snakes, all of which were adaptive threats in ancestral environments. Learning is not an explanation of behavior, but behavior requiring explanation. The explanation lies in an evolved psychology and the specific problems this psychology has been designed to solve.

Disgust also provides an example of the nature/nurture interaction. Psychologist Paul Ekman (1980) demonstrated that disgust is an emotion that is experienced universally, and the facial expression showing disgust is a reaction that is recognized universally by others. Paul Rozin and April Fallon (1987) hypothesized that disgust is a human adaptation designed to prevent parasites and disease from entering the body. Rotten meat is disgusting to all humans because if consumed it would probably lead to illness. Many species of flies, however, find rotten meat appealing because flies have different evolved mechanisms. Not all cues are as obvious to the human senses as rotten meat, however. With thousands of potentially edible fruits and plants, it would have been beneficial to use the reactions of others when deciding what to eat, rather than relying on a trial-and-error learning system. If a harmful substance is sensed, the body will expel and withdraw from the substance and the disgust face will be made. Other individuals will benefit from this disgust reaction only if they are equipped to pair the disgust face

to the disgusting substance, and learn to avoid it. Again, learning is guided by a universal psychological architecture and explained according to the adaptive challenges it has been designed to solve.

If all humans have the same design of the mind, does that mean human behavior is genetically determined? Adaptations have a genetic basis. However, Hagen argues that because the mind contains many adaptations, all of which respond to cues in the environment, the mind could encompass an enormous number of states with an enormous number of behavioral outcomes. Because humans have an evolved fear of snakes does not mean that everyone is destined to fear all snakes in all situations. Many people have an affinity for snakes, even allowing them into their home as pets. Adaptations do not limit behavior, but instead enable behavior and create behavioral flexibility because a larger set of adaptations can respond with a greater array of behavioral outcomes. Insights from biology, cognitive science, ecology, anthropology, and psychology have been combined to examine genes from an adaptationist perspective in the emerging discipline of evolutionary psychology. Strict genetic determinism is rejected in favor of an account of human behavior that includes both genetic and environmental influences.

SEE ALSO *Determinism; Determinism, Reciprocal; Evolutionary Psychology; Nature vs. Nurture; Phenotype*

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Lucas D. Schipper
Todd K. Shackelford

DETERMINISM, NONADDITIVE

The principle of *nonadditive determinism* derives from the literature on integrative, multilevel analyses, which extend across levels of organization (e.g., psychological, physiological, cellular) and analysis (e.g., behavioral, neurophysiological, molecular). The principle of nonadditive determinism specifies that properties of the whole are not always readily predictable from the properties of the parts (see Cacioppo and Berntson 1992). Some properties of crystals (e.g., table salt) cannot be predicted from the characteristics of the individual elements (sodium and chloride) in isolation. Those properties become known only when the elements are found in association or interaction with others. A behavioral example comes from the considerable individual differences that are apparent in the effects of drugs. Some individuals are more affected by, and at greater risk for addiction to, cocaine or other drugs of abuse. Similarly, studies with primates have shown that some monkeys work harder and self-administer more cocaine than others (Morgan et al. 2002). This is not mere random variation, but relates to the animal's social status—submissive animals show higher levels of cocaine self-administration than dominant animals. This is now understood to be attributable to reciprocal interactions between social dominance, brain dopamine function, and drug reward processes. The important point is that social status, which serves as the informative and organizing construct in this literature, could not be determined in the absence of behavioral measures in a social context.

Even if the properties of, for example, Beethoven's Ninth Symphony can be fully specified through reference to lower-level physical characteristics (i.e., time-varying frequencies), the composition's aesthetic features may be more readily apparent or appreciated through higher-level auditory perception. This presence of higher-level aesthetic processes defines a functional quality of the acoustic signals that might otherwise escape recognition. It also serves to focus attention on the important interactions among levels of organization and analysis that may ultimately contribute to the development of a science of aesthetics.

Reciprocal determinism is a related construct. Reciprocal determinism is the mutual back-and-forth interaction among distinct levels of organization (e.g., behavioral and cellular) that requires consideration of both levels for a comprehensive understanding of either. Hormones, for example, can have notable psychological effects, but it is also the case that psychological variables can powerfully impact hormone levels. It is this reciprocal back-and-forth interaction among levels that often under-