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and
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Encyclopedia of Animal Cognition and Behavior
10.1007/978-3-319-47829-6_1064-1

Instinct

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Abstract

In the *Origin of Species*, Darwin (1809–1882) endorsed what he took to be the common notion of instinct: "An action, which we ourselves should require experience to enable us to perform, when performed by an animal, more especially by a very young one, without any experience, and when performed by many individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive" (Darwin *1859*, p. 207). He then proposed that instinctive behavior in animals could be explained using the resources of his theory, such behavior essentially being no different than other adaptations. Darwin's characterization of instinct would have been recognized by many naturalists writing long before the nineteenth century and long thereafter.

Theories of Instinct Prior to the Nineteenth Century

In the second century of the common era, Claudius Galen (130–210) performed what became known much later as the deprivation experiment. He took a young goat from its mother by cesarean section, thus preventing any opportunity for learning. He and his colleagues then placed before the young kid several bowls of food stuff – wine, oil, milk, honey, etc. After sniffing at each of the bowls, it started lapping up the milk. He and his assistants gave a yell, seeing realized what Hippocrates had said: "the natures of animals are untutored" (Galen *1824*). Galen's procedure, while not without problems, yet meets the general requirements of the "deprivation experiment," which Konrad Lorenz (1903–1989), in the twentieth century, specified as the empirical foundation for his own conception of instinct: deprive an animal of any opportunity to learn and if it yet exhibits a species-specific pattern of behavior, then that behavior is innate and can be called "instinctive" (Lorenz *1965*, pp. 83–100). In the Medieval Period, Avicenna (980–1037) developed a theory of instinct based on Aristotle's notion of incidental perceptibles – e.g., the white milk being incidentally perceived as sweet. The distinctive and skillful behaviors of animals convinced him that their souls had an estimative faculty, an internal sense that detected meanings (*intentiones*) not available in the immediate data of the external senses. This awareness resulted from a divine inspiration that the Latin translator variously rendered as *cautela naturalis* and *instinctus insitus* (Avicenna *1968*–1972, vol. 2, pp. 37 and 73). Thomas Aquinas (1225–1274), in his own commentary on Aristotle, described this faculty of the animal soul as a "natural estimative power (*aestimativa naturalis*) given to animals through which they are directed, in their actions and passions, to seek or avoid things appropriate to their nature" (Aquinas, lec. 13).

In the seventeenth century, René Descartes (1596–1650) rejected the notion of the medieval Aristotelians that animals had a particular kind of soul with capacities of sensory cognition. Descartes regarded animal behavior as explicable according to mechanistic laws. Yet both Descartes and the Aristotelians agreed that complex animal behavior (e.g., birds' building their nests or bees' their cells) had to be explained by instincts, which they understood as fixed patterns of behavior determined by the Creator for the welfare of his creatures.

A reaction set in against the very idea of animal instinct during the eighteenth century. The Abbé de Condillac (1715–1780) argued for a continuity between animal and human intelligence, holding that intelligence arose simply from the association of ideas, which were only less vivid images derived from sensation. So that what was taken as innately determined behavior could better be understood as originally intelligent behavior that had become habitual (Condillac *1798*, vol. 3, pp. 435–439). Jean-Antoine Guer (1713–1764) also adopted this sensationalist epistemology. He asserted that the ascription of instinct to animals confounded any attempt at reasonable explanation, for "nothing is easier to say about whatever animals do than they do it from instinct" (Guer *1749*, vol. 2, pp. 191–192). The sensationalist position ultimately derived from the rejection by Locke and other empiricists of innate ideas, whether in humans or animals (Richards *1979*).

Those researchers that studied animal behavior with care had strong evidence on their side. Hermann Samuel Reimarus (1694–1768), for instance, pressed the kind of experimental observations undertaken by Galen, namely, that animals exhibited arrays of fully formed, complex behaviors before they had any opportunity to learn them: chicks shortly after emerging from the egg could peck at grain with coordinated movement and caterpillars that had never seen a cocoon skillfully wove one in the same design as their ancestors. Automatic behavior that characterized most members of a species seemed hardly different from anatomical traits and was so regarded by early evolutionists (Richards *1987*).

Early Evolutionary Conceptions of Animal Instinct

Erasmus Darwin (1731–1802), grandfather of Charles, trained as a physician at Edinburgh medical school, whose faculty had, during Darwin's student years, received their own education at Leyden, where the mechanistic ideas of Herman Boerhaave (1668–1738) largely prevailed. In his medical treatise *Zoonomia* (1794), Darwin joined a mechanistic materialism with a sensationalist physiology. He proposed that a subtle fluid – the so-called *spirit of animation* – coursed through the brain and nerves causing contractions of muscle fibers. This fluid reacted to both internal and external stimuli and operated according to principles of association, so that "all animal motions which have occurred at the same time, or in immediate succession, become so connected, that when one of the them is reproduced, the other has a tendency to accompany or succeed it" (Darwin *1796*, vol. 1, p. 320). The nervous fluid formed ideas within the brains both of animals and humans, ideas that were only faint copies of sensations (pp. 105–107). Darwin's sensationalist psychology thus allowed him to assume continuity between animal intelligence and human intelligence. It also allowed him to assume that those patterns of behavior usually assumed as instinctive actually arose from intelligence and habit. For instance, he regarded nest-building in birds as the result of observation and "their knowledge of those things, that are most agreeable to their touch in respect to warmth, cleanliness, and stability" (pp. 171–173). It took a bit more ingenuity, however, to explain those patterns of behavior that some animals expressed just after birth, without obvious opportunity to learn, for example, the coordinated pecking and swallowing by newly hatched chicks. But Darwin was not without imaginative resources. He supposed that the chick, while still ensconced in the egg, would be continually gaping and gulping embryonic fluid, thus induced to practice and learn the very behaviors it would exhibit after hatching (pp. 138–139). (In the 1920s, the radical behaviorist Z. Y. Kuo made similar objections to the isolation experiment. Using examples comparable to those of Darwin, Kuo argued that conditioned learning could occur even while the chick was still in the egg. See Kuo *1929*). Despite his sensationalist biological assumptions, Darwin advanced a powerful evolutionary conception. His theory allowed for traits acquired by ancestors to be passed to offspring; like Lamarck, he was convinced of the inheritance of acquired characteristics. Anatomical traits acquired by parents through exercise – e.g., the blacksmith's strong arms – could be passed to offspring, with the tendency to vigorous arm movement, for instance, already begun in the womb. Embryology allowed Darwin to project the processes of learning back to the very beginning:

> All warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end! (Darwin *1796*, vol. 1, p. 509)

While Darwin's evolutionary account did not mesh well with his sensationalist psychology when trying to explain stereotyped patterns of behavior, another early evolutionist, also of sensationalist inclinations, was much more successful in giving an evolutionary account of instinctive behavior.

Jean-Baptiste de Lamarck's (1744–1829) three-volume *Flore françoise* (1778) helped advance him to membership in the French Academy. His systematic survey of French plants brought him to the attention of Georges Leclerc, Comte de Buffon (1707–1788) at the Jardin des Plantes, where Lamarck was later appointed to the chair of botany in 1788. After the Revolution he was made professor of zoology in the *Muséum national d'Histoire naturelle*, where he was put in charge of insects and invertebrates. His extensive study and classification of mollusks brought him international celebrity among his peers. In 1800, this conventional, if highly technically competent, zoologist gave a talk at the *Muséum* that set him on a radical path. In his "Discours de ouverture," Lamarck proposed that animals adjusted their behaviors to changing environmental circumstances and that the resultant modifications of organs would be heritable, producing new alterations in species (Lamarck *1801*). Shortly thereafter he added another principle to account for the slow change in species over time. In his *Recherches sur l'organisation des corps vivans* (1802), he maintained that the imponderable fluids of caloric and electricity, acting on mucilaginous materials in the earth, could generate small, living monads and that the continued activity of these fluids would produce gradually more complex organisms. These two principles became the anchors of his *Philosophie zoologique* (1809), where his evolutionary theory came to completion (Lamarck *1809*). The imponderable fluids would continuously bubble up new organisms and push them to greater complexity, while habit becoming instinct would alter organs keying them into environmental niches.

In his *Discours d'ouverture* of 1814, Lamarck defined instinct as "that singular power which operates without premeditation and from the consequences of felt emotion" (Lamarck *1972*, pp. 179–185). He distinguished it from both intelligent acts, which do not always attain their desired end, and mere habits that were not driven by a felt need. Moreover, specific instincts characterized a whole species of animal; they were not idiosyncratic expressions.

Lamarck's evolutionism found some allies in his native country – e.g., Etienne Geoffroy Saint-Hilaire (1772–1844) – and several early adherents in Germany, such as Friedrich Tiedemann (1781–1861) and Gottfried Reinhold Treviranus (1776–1837). In Britain, Charles Darwin's early tutor Robert Grant (1793–1874) thought his own study of sponges supported Lamarck's transmutation hypothesis. But Lamarck's theory met crushing opposition from the doyen of French Naturalists, Baron Georges Cuvier (1769–1832). In the introductory volume of his *Recherches sur les ossements fossiles* (1812), Cuvier mounted three objections that would be reiterated against Darwin's theory: (1) no transitional species are found in fossil deposits; (2) experience shows that species only vary in nonessential traits; and (3) mummified animals from ancient Egypt are recognizably the same as those found in modern Egypt (Cuvier *1834*, vol. 1, pp. 198–218). In his *éloge* for Lamarck, his recently deceased colleague, after citing a few respectable achievements, Cuvier came to the infamous theory and reduced it to rubble. In his caricature: "It is the power of the desire to swim that produces the membranes between the toes of aquatic birds; it is by reason of going in the water but wishing not to get wet that river birds have their legs lengthened; it is the power of desiring to fly that has changed their arms into wings and has developed their hair and scales into feathers" (Cuvier *1835*, p. xix). Lamarck's theory later fell on ears more receptive, those of the young Charles Darwin.

Darwin's Evolutionary Construction of Animal Instinct

Though fully aware of his grandfather's views and Lamarck's theory, Charles Darwin remained orthodox in his biology while on the Beagle Voyage (1831–1836). It was only when he returned to England and started cataloguing his materials that he began to speculate on species change. He had sent back to the British Museum large samplings of organisms, among which were three varieties of mocking bird, taken from different islands of the Galapagos. Since the islands were volcanic and relatively young, Darwin assumed the birds had gotten blown over from the mainland and that their morphological alterations were merely varietal, induced by the different environments of the islands. When John Gould (1804–1881), the chief ornithologist at the Museum, contended that the birds represented three different species, he tripped a mind at the ready (Sulloway *1982*). Darwin began immediately speculating on species change in spring 1837, and in various early notebooks (March 1837–June 1838), he considered what might be the causal factors that produced species change. He immediately considered Lamarck's imponderable fluids but quickly concluded: "all structures either direct effect of habit, or hereditary effect of habit" (Darwin *1987*, p. 175). He argued to himself that new habits, if practiced by a population over long periods of time, would turn into instincts and that these latter would eventually modify anatomical structures and so would alter species. From Darwin's perspective, the intermediary of instinct would preclude any conscious, intentional activity on the part of animals, and so his nascent theory would not be subjected to the common charge brought against his predecessor that animals supposedly willed themselves new parts. Darwin, undoubtedly, was engaged in a bit of self-defensive scholarship. His own device of species change in this early period hardly differed from that of Lamarck; his modification of the essentially Lamarckian device could shield only a naïve researcher. Darwin's confidence grew after he formulated his chief principle of natural selection. Yet, Darwin never abandoned the idea that the environment could directly induce heritable changes and that habit could ultimately give rise to instincts and alterations of species. These assumptions are feathered throughout the *Origin of Species*, but they became secondary causes to his new discovery of natural selection in fall of 1838 (Richards 1987).

In early fall of that year, Darwin, as he recalled in his *Autobiography*, picked up “for amusement” Thomas Malthus’s *An Essay on the Principle of Population* (Darwin 1969, pp. 119–120). With the reading of Malthus’s *Essay*, he had the beginnings of the idea that would blossom into natural selection. Malthus provided him the idea of population pressure under scarce resources, which might produce a struggle for existence. All of this “wedging,” as he called it, had the “final cause” of filtering out all but the most fit organisms and thus adapting them (actually, leaving them preadapted) to their circumstance. Thus, the more fit organisms would live to reproduce and pass their advantages on to their progeny and consequently slowly alter the species (Darwin 1987, pp. 374–375). Through the next several years, Darwin would develop his principle of natural selection; he found it exquisitely useful in accounting for highly complex anatomical adaptations, especially ones that would not easily yield to Lamarck’s device of use and disuse. However, instincts still seemed more easily explicable by inherited habit.

Problems arose for the habit-instinct conception. Several natural theologians, in the late 1830s and 1840s, insisted that animals exhibited instincts without any knowledge of the purpose of their actions. The caterpillar spun its web without foreknowledge that the purpose was to provide shelter for metamorphosis. Examples such as the caterpillar’s production of a cocoon precluded any intentionally developed habit as source for the instinct. As a result of considering such examples, Darwin began to apply natural selection theory to account for those instincts that habit could not explain. But when he read William Kirby and William Spence’s theologically driven *Introduction to Entomology* in 1843, he was stumped (Kirby and Spence 1818). They described the “wonderful instincts” of different species of social insect. Soldier bees, for instance, instinctively guarded the nest and sacrificed themselves to protect it; worker bees had the instinct of constructing perfect hexagonal cells to store honey. These kinds of instinct, the authors maintained, could be explained only by divine providence. When Darwin attempted to account for these “wonderful instincts,” he quickly ran into trouble. Natural selection operates to preserve individuals who manifest advantageous traits. But self-sacrifice seems to offer the individual soldier bee no advantage – quite the contrary. Moreover, as Darwin came to appreciate, worker bees and ants were sterile; they did not breed in the first place. In June 1848, after he considered these difficulties, he lamented: “I must get up this subject – it is the greatest *special* difficulty I have met with” (Darwin 1848). In chapter 7 of the *Origin*, Darwin reiterated: the difficulty “at first appeared to me insuperable, and actually fatal to my whole theory” (Darwin 1859, p. 236). In working on that chapter, he hit upon the solution in the nick of time, one that we now more or less have adopted: natural selection works on the whole hive or nest. Those hives that had, by chance, more aggressive individuals were selected over those with fewer. And so the instinct of defensive action by bees, even at the cost of their lives, would gradually evolve over time. Darwin not only had a resolution to the almost “insuperable” difficulty, he offered it also as potent objection to his rival Lamarck (Richards 1987).

Darwin’s solution to the problem of instincts in the social insects had another dividend, a very large one. In the *Descent of Man* (1871), he considered what was distinctive about the human animal. It wasn’t reason, since even his hunting dogs exhibited a modicum of reason. It was moral conscience. If he could not give an account of morality, a wedge would be opened for the return of the deity.

Darwin began a construction of a theory of moral behavior, and here his work on the social insects proved crucial. He argued that if advanced animals developed reason sufficient to become reflective, language to communicate needs, and habits to solidify social relationships, then if such proto-human groups also instinctively engaged in cooperation, self-sacrifice, and mutual care, they would have the advantage over groups that had fewer such altruists. As he wrote in the *Descent of Man*:

It must not be forgotten that although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe, yet that an advancement in the standard of morality and an increase in the number of well-endowed men will certainly give an immense advantage to one tribe over another. There can be no doubt that a tribe including many members who, from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection. (Darwin *1871*, vol. 1, p. 166)

Darwinian morality is frequently caricatured as selfish and individually self-aggrandizing. Only the unaware and blinkered critic would so regard it. Darwin himself thought his theory removed "the reproach of laying the foundation of the most noble part of our nature in the base principles of selfishness" (p. 98). The essential grounds for his theory of morality were the social instincts of cooperation, mutual care, and altruism (Richards *1987*).

Instincts After Darwin

As a youth, William James (1842–1910) was enamored of Herbert Spencer's (1820–1903) evolutionary ideas. He became wary of Spencer, however, through the animadversions of his friend Charles Sanders Peirce (1893–1914). Peirce skewered Spencer's vagueness and lack of evidentiary foundations for his particular evolutionary considerations, especially in contrast to those of Darwin. James had been introduced to Darwinian theory in medical school through the courses offered by Jeffries Wyman (1814–1874), an early champion of the new theory. That introduction would be reinforced by Peirce and another friend Chauncey Wright (1830–1875). When James himself became a lecturer in the Anatomy Department at Harvard in 1873, he gradually deployed Darwinian theory in his courses. And during this early period in his career, he formulated an evolutionary argument for the independence of human mind; he debuted the argument in a series of lectures given at Johns Hopkins in 1878.

James's point of departure in his argument was Thomas Henry Huxley's (1825–1895) essay "On the Hypothesis that Animals are Automata" (Huxley *1874*). Huxley held that mental events were purely epiphenomenal. That is, the brain might be stimulated by sensory impulses that had two effects: (1) a causal train confined to the brain that would produce motor activity and (2) a conscious awareness of phenomena caused by that brain activity. The phenomenal experience might simply be that of, for instance, a black cat and the action to avoid it. But the motor activity of avoiding the cat would be the immediate result only of that causal sequence of brain activity, yielding the motor movement. Consciousness would merely be the passive observer, produced by brain activity but impotent on its own to effect anything. To this epiphenomenal theory of mind, James made a potent objection, which he more carefully spun out in his article "Are We Automata?" (James *1879*). James maintained that if consciousness were an evolved trait, then over the course of our gradual descent from ape-like ancestors, that consciousness would become more sophisticated and more finely articulated through natural selection. But natural selection only operates on traits that make a difference to the organism that give it an advantage. If consciousness was naturally selected, it would have to have a use. But if it had a use, then it had to be causally effective in the environment. If the brain were doing all the work, consciousness would be superfluous, and certainly not an evolved trait. Thus, on the premise of the evolution of consciousness, mind had to be effective and had to be independent of the brain (James *1890*).

James's psychology was thoroughly Darwinian, most especially in his theory of emotion, a theory that deployed as a fundamental ground the assumption of human instincts. James proposed a definition of instinct conformable to Darwin's: "the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance." Though it was usually assumed that human beings had fewer instincts than brutes, James argued that they were, on the contrary, "more richly endowed in this respect than any other mammal" (James *1887*, p. 666). He counted over 30 classes of human instinct (a list large enough to choke the behaviorist John Watson). James wove his conception of instinct into his theory of the emotions. That theory, independently arrived at by the Danish physiologist Carl Lange (hence, the James-Lange theory of emotion), asserted that cognition did not cause emotion, rather that emotion was a direct response to the instinctive wisdom of the body. The bear comes charging after you, instinctively your eyes widen, your body trembles, your heart races, and you start to run. These behaviors, in James's view, were protective instincts that resulted from millennia of natural selection. Our feeling of this bodily reaction was the emotion. In James's conception, then, we don't feel fear and then run, rather we run and as a result become afraid.

The Behaviorist Reaction to Theories of Instinct

L. L. Bernard (1881–1951), a social psychologist who trained at University of Chicago, surveyed the writings on instinct of over 300 authors publishing between 1900 and 1924. With some amazement, he cataloged 1594 different classes of instinct that had been attributed to men and animals. His study appeared in 1924, the same year as John B. Watson (1878–1958) published a declaration of war against such vague and experimentally recalcitrant subjects as instinct. In his book *Behaviorism*, Watson exclaimed: "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors" (Watson *1930*, p. 104).

Watson's attack on innate traits represented an about-face. In his first book, *Behavior: An Introduction to Comparative Psychology* (1914), he framed his study of sensation, instincts, and learning in terms of Darwinian evolutionary theory. His own earlier field research had been on the instincts of the noddy and sooty terns in the Tortugas (Watson *1908*). A scant 10 years later, the only inborn responses Watson recognized were three emotional reactions: love, rage, and fear. Out of these elements, very complex edifices of character and behavior could be constructed without recourse to instinct or even conscious mind. Watsonian behaviorism and its reincarnation in Skinnerian conditioning procedures swamped all lingering concerns with instinct in psychology departments in anglophone countries during the first half of the twentieth century. The coffin was nailed shut with the reaction to the eugenic movements in America and Europe, especially the version cultivated by the Nazis in the 1930s and 1940s.

The Rebirth of Instinct Theory in Ethology

Behaviorists assumed animal and human mind to be void of any preprinted messages, blank slates to be inscribed only by modes of conditioning. This was a doctrine that seemed well-tuned to the American ethos of frontier possibilities, where any little boy might grow up to be president if he had enough gumption and opportunity. In a more hierarchical society, the same presumption would not likely obtain (Richards *2008*). In Germany and Austria, evolutionary theory took rather firm root, especially as the result of the impact of Darwinian champions like Ernst Haeckel (1834–1919) and August Weismann (1834–1914). The individual who did the most, however, to adopt and further develop the Darwinian conception of instinct was the Austrian Konrad Lorenz (1903–1989), who, along with the Dutchman Nikolaas Tinbergen (1907–1988), established the discipline of ethology. Lorenz followed the path of his father to medical school, yet became more occupied by studies of the geese, ducks, and jackdaws that populated his father's estate just outside of Vienna. His friend and mentor Oskar Heinroth (1871–1945), a fellow ornithologist, encouraged him to cast his interests within a Darwinian framework. In a paper published in 1932, Lorenz began to refine Heinroth's theory of "drive activities" (*Triebhandlungen*) or what he later would call "instinctive activities" (*Instinkthandlungen*) – using the older, Latinate name to distinguish his conception from psychoanalytic and behaviorist views of drive. In his 1937 paper, "The Establishment of the Instinct Concept," Lorenz discriminated five criteria that would stabilize the concept: (1) fixed behavior would characterize most members of a species; (2) such behavior would be exhibited even by animals raised in isolation from learning; (3) the behavior would usually be more complex than the learning ability of the animal; (4) the actions would sometimes be performed incompletely (*Intentionsbewegungen)* or in inappropriate circumstances (*Leerlaufreaktionen*) – e.g., a kitten stalking a ball of yarn; and (5) the behavior would be rigid and exhibited as fixed reflex chains, not idiosyncratic and flexible actions (Lorenz *1971*).

Though Lorenz originally conceived instincts as a chain of reflexes wrought by natural selection, he began to suspect that instinct was more than reflex, rather a drive that sought release, often in inappropriate circumstances. Erich von Holst (1908–1962), a Baltic German and neurophysiologist, in conversations with Lorenz, suggested just the mechanism to explain the behavioral phenomena that his friend observed. Von Holst had discovered endogenous neural centers of rhythmic discharge and coordination, which led Lorenz to hypothesize that animals had reservoirs of response-specific energy gradually accumulating and motivating animals to seek release (Lorenz *1937*). It was a theory not unlike that of Freud's notion of libidinal energy that also builds up and seeks release, even in relation to inappropriate objects.

Before the Second World War, Lorenz had begun a collaboration with the comparative psychologist Nikolaas Tinbergen, with whom he would share the Nobel Prize for physiology in 1973, along with Karl von Frisch (1886–1982), for their collective work in the founding of the discipline of ethology. Both spent part of the war-years in concentration camps, Tinbergen under the Nazis (1942–1944) and Lorenz under the Russians (1944–1948). After the war, they renewed their joint efforts, though they had to work through their political differences first, since, like many German physicians, Lorenz had formally joined the NSDAP (*Nationalsozialistische Demokratische Arbeiter Partei*) (Burkhardt *2005*). Typical of the kind of experiments done on animal instinct were those demonstrating what they took to be an "innate releasing mechanism." The three-spine stickleback fish, when confronted with another male with a red belly, or even a crude model with a red underside, would assume the stereotypical threat posture; but when confronting a female with a non-red, swollen belly, it would dance the fixed steps of the mating ritual. A red belly released one kind of instinctive pattern in the male stickleback, while a swollen belly released a very different pattern of behavior (Tinbergen *1951*, *1952*).

Lorenz's theory of instinct met a hostile reaction from several prominent American psychologists in the 1950s, during the period when behaviorism dominated the profession. Undoubtedly Lorenz's membership in the NSDAP partly accounts for the animus, but the objections caused Lorenz to rethink his conception of instinct. Daniel Lehrman (1919–1972) complained that Lorenz's dichotomous categorization of behavior into learned and innate ignored the genetics of the situation, namely, that any genetic disposition requires internal and external environmental conditions for expression (Lehrman *1953*). To make his objection explicit, Lehrman cited the studies of Z. Y. Kuo (1898–1970), who argued against the notion of the perfect isolation experiment. The chick that emerged from the egg and immediately pecked at grain with coordinated movement might well have undergone a kind of conditioning while still sealed in the egg: the head of the embryonic chick, which would be bent over the thorax, would bob up and down with its heartbeat, so the chick might "learn" while still isolated in the egg (Kuo *1929*).

In a later monograph, Lorenz met Lehrman's objection in a twofold way. First, he maintained that the concepts of the innate and the learned were not necessarily antithetical; from an evolutionary point of view, the ability to learn was itself an adaptation naturally selected for, thus part of the phylogenetic program of the species. Second, in the specific case of the chick being condition in the egg to peck at grain, several other species of bird – pigeons, for example – though their heads may have undergone the same bobbing movement in the egg, yet when hatched they didn't peck at grain but shoved their beaks into their parents' mouths. The instincts to peck at grain or to act on the parent were adaptations specific to the kind of animal and thus naturally selected as opposed to having been learned. Lorenz yet conceded that the final shape of behavior was also a function of environmental circumstances but that only the genes carried the specifying information (Lorenz *1965*, p. 1).

The Contemporary Resolution

Three basic positions have been taken on animal instinct. From Descartes through the early work of Lorenz, instincts were understood to be constituted by chains of reflexes that respond to certain environmental releasers. James Watson, B. F. Skinner, Z. Y. Kuo, and other behaviorists in the first part of the twentieth century rather attempted to account for apparently fixed patterns of behavior by appeals to subtle modes of conditioning. The later Lorenz and evolutionary biologists like Ernst Mayr (1904–2005) established the third and most recent conception of instinct, one that recognized the role of genetically determined, species-specific information as well as the environmental conditions required for the implementation of the information. Mayr epitomized this recognition in his proposal that two kinds of programs governed animal behavior, a more closed program and a more open program (Mayr *1974*). Closed programs were those in which the releasing mechanisms were controlled by the genome of the species, such as mate recognition and display in many animals. For instance, fertile female Drosophila of one species, if reared in isolation and placed among males of several species that displayed to her, would unerringly receive only the male of her own species. However, freshly hatched graylag goose chicks would follow any object of the right size, if exposed to the moving object (e.g., Lorenz's head while swimming) during a critical period in the young gosling's life. The chicks rapidly learned the stimulus that released the fixed behavior of following. In some species of bird, a chick raised with chicks of a different species would imprint on the foster species and attempt to mate with its members. These cases of imprinting represent a more open program. The mechanisms of instinct, therefore, differ depending on the species of animal and the relative open or closed character of the program. Most behavior biologists today recognize these different instances of instinctual modes of behavior and have thus revitalized the instinct concept.

Cross-References

Behaviorism
Charles Darwin
Fixed Action Patterns
Jean Baptiste Lamarck
John B. Watson
Konrad Lorenz
Nikolaas Tinbergen

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