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Contemporary psychologists such as Herbert Spencer were influenced by the evolutionary movement, and the idea of an instinctive basis for human psychology became popular. William James, in Volume II of his Principles, insisted that man has more instincts than any other mammal. McDougall's widely read Social Psychology listed human instincts of flight, repulsion, parental feeling, reproduction, self-abasement, etc. Woodworth, Thorndike, and other leaders agreed that much of human behavior is best understood as an expression of instinctive drives or needs.

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For example, Erasmus Darwin's Zoonomia expressed the theory that all behavior is a product of experience, but this point of view was subsequently disavowed by the grandson of its sponsor. Charles Darwin made the concept of instinct one cornerstone of his theory of evolution by means of natural selection.

To bridge the gap of the Cartesian man-brute dichotomy, and thus to establish the evolution of mind as well as structure, Darwin and his disciples amassed two types of evidence. One type purported to prove the existence of human instincts; the other pertained to rational behavior in subhuman species. The idea of discontinuity in mental evolution was vigorously attacked, but the dichotomy between instinct and reason was never challenged.

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Dunlap's 1919 article, "Are there any instincts?"¹ was one opening gun in the battle, but the extreme protests came from the most radical Behaviorists as represented by Z.Y. Kuo, who wrote on the subject, "A psychology without heredity"². For a while the word "instinct" was anathema, but the revolt was abortive, and there were three principal reasons for its failure.

First, Kuo denied instinct but admitted the existence of unlearned "units of reaction." By this phrase he meant simple reflexes, but in using it he set up a dichotomy of learned and unlearned behavior which was fatal to his basic thesis. It merely shifted the debate to arguments as to the degree of complexity permissible in an unlearned response, or the proportion of a complex pattern that was instinctive. The second error consisted essentially of a return to the position taken by Erasmus Darwin

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at the close of the eighteenth century. Having averred that the only unlearned reactions consist of a few simple reflexes, the opponents of the instinct doctrine invoked learning to explain all other behavior. This forced them into untenable positions such as that of maintaining that pecking behavior of the newly-hatched chick is a product of head movements made by the embryo in the shell, or that the neonatal infant's grasp reflex depends upon prenatal exercise of this response. The third loophole in the anti-instinct argument derived from a dualistic concept of the hereditary process. Admitting that genes can affect morphological characters, and simultaneously denying that heredity influences behavior, opponents of instinct were hoist by their own petard. If the physical machinery for behavior develops under genetic control, then the behavior it mediates can scarcely be regarded as independent of inheritance.

1. Dunlap, W. Are there any instincts? J. abnorm. Psychol. 1919-20, 14, 35-50
2. Kuo, Y.Z. A psychology without heredity. Psychol. Rev. 1924, 31, 427-451

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Although there are militant opponents of the instinct doctrine among present-day psychologists, it is undoubtedly correct to say that the concept of instincts as complex, unlearned patterns of behavior is generally accepted in clinical, social, and experimental psychology. Among experimentalists, Lashley suggested that instinctive behavior is unlearned and differs from reflexes in that instincts depend on "the pattern or organization of the stimulus," whereas reflexes are elicited by stimulation of localized groups of sensory endings.

Carmichael² expressed agreement with G.H. Parker's statement that human beings are "about nine-tenths inborn, and one-tenth acquired." Morgan³ studied food-hoarding behavior in rats, and concluded, "since it comes out spontaneously without training, it is plainly instinctive." The following quotation reveals that some modern psychologists not only embrace the concept of instinctive behavior, but consider it a useful explanatory device.

"Of the theories of hoarding which have been advanced, the most reasonable one in terms of recent data is that the behavior is instinctive. . ."

At least three serious criticisms can be leveled against current treatment of the problem of instinctive behavior. The first is that psychologists in general actually know very little about most of the behavior patterns which they confidently classify as instinctive.

1. Lashley, K.S. Experimental analysis of instinctive behavior. Psychol. Rev., 1938, 45, 445-471.
2. Carmichael, L. The growth of sensory control of behavior before birth. Psychol. Rev., 1947, 54, 316-324.
3. Morgan, C.T. The hoarding instinct. Psychol. Rev., 1947 54, 335-341.
4. Waddell, D. Hoarding behavior in the Golden Hamster. J. Comp. psychol. Psychol., 1951, 44, 383-388

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It is a safe guess that most American psychologists have never observed any of these patterns of behavior. At a conservative estimate, less than half of the reactions listed have been subjected to even preliminary study by psychologically trained investigators. The significance of this criticism lies partly in the fact that those psychologists who have worked in the area of "instinctive" behavior tend to be more critical of the instinct concept than are those who lack first-hand knowledge of the behavioral evidence.

Relevant to the criticism of unfamiliarity is the fact that the degree of assurance with which instincts are attributed to a given species is inversely related to the extent to which that species has been studied, particularly from the developmental point of view. Before the development of complex behavior in human infants had been carefully

analyzed, it was, as we have seen, a common practice to describe many human instincts. Longitudinal studies of behavior have reduced the "unlearned" components to three or four simple responses not much more complex than reflexes.¹

1. Dennis, W. Infant development under conditions of restricted practice. Genet. psychol. Monogr. 1941, 23, 143-189.

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Perhaps a more serious weakness in the present psychological handling of instinct lies in the assumption that a two-class system is adequate for the classification of complex behavior. The implication that all behavior must be determined by learning or by heredity, neither of which is more than partially understood, is entirely unjustified. The final form of any response is affected by a multiplicity of variables, only two of which are genetical and experiential factors. It is to the identification and analysis of all these factors that psychology should address itself. When this task is properly conceived and executed there will be no need nor reason for ambiguous concepts of instinctive behavior.

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Inbreeding of domestic chickens for high egg production has produced behavioral deficiencies of various kinds. Although hens of some lines are excellent layers, they have almost totally lost the normal tendency to brood the eggs once they have been laid. The maternal behavior of sows of different inbred lines of swine is strikingly different. Females of one line are so aggressively protective of their young that they cannot be approached during the lactation period. Sows of a second genetical line possess such weak maternal interest that they frequently kill their litters by stepping or lying on the young.

1. Hurst, C.C. Experiments in genetics. Cambridge: Cambridge Univer. Press, 1925
2. Hodgson, R.E. An eight generation experiment in inbreeding swine. J. Hered., 1935, 26, 209-217.

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It is known that, selective breeding can alter the level of general activity¹, maze behavior², emotionality³, and aggressiveness⁴ in the laboratory rat. Inbred strains⁵ of mice differ from one another in temperature preference⁵, aggressiveness⁶, and strength of "exploratory drive"⁷.

1. Rundquist, E.A. The inheritance of spontaneous activity in rats. J. comp. Psychol., 1933, 16, 415-438.
2. Heron, W.T. The inheritance of maze learning ability in rats. J. comp. Psychol., 1935, 19, 77-89.
3. Hall, C.S. The inheritance of emotionality. Sigma Xi Quart., 1938, 26, 17-27.
4. Keeler, C.E., and King, H.D. Multiple effects of coat color genes in the Norway rat, with special reference to temperament and domestication. J. comp. Psychol., 1942, 34, 241-250
5. Hertler, K. Die Beziehungen zwischen Vorzugstemperatur und Hautbeschaffenheit bei Mäusen. Zool. Anz. Suppl., 1938, 11, 48-55.



6. Scott J.P. Genetic differences in the social behavior of inbred strains of mice. J. Hered., 1942, 33, 11-15.
7. Thompson, W.R. The inheritance of behaviour* behavioural differences in fifteen mouse strains. Canad. J. Psychol., 1953, 7, 145-155.

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Study of the effects of controlled breeding cast doubt upon the validity of any classificatory system which describes one type of behavior as genetically determined and another as experientially determined. For example, by manipulating the genotype it is possible to alter certain types of learning ability. As far as present evidence can show, the influence of genes on learning is as important as any genetical effect upon other behavior patterns commonly considered instinctive. There is no reason to assume that so-called instinctive reactions are more dependent upon heredity than noninstinctive responses; hence genetical determination is not a differentiating criterion.

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Behavior which is known to vary with the genotype is often incorrectly defined as "genetically determined" behavior. Although we can show a correlation between certain genes and particular behavior patterns, this is of course no proof of a causal relationship. Many other genes and non-genetic factors are always involved in such correlations. This point is nicely illustrated by a series of experiments on audiogenic seizures in mice.

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Susceptibility to fatal seizures is high in some inbred strains and low in others.¹ When a high-incidence and low-incidence strain are crossed, the susceptibility of the F₁ generation is intermediate between those of the parental strains. So far the evidence strongly supports the conclusion that seizure incidence is genetically determined. However, the incidence of seizures can be altered without changing the genetic constitution.

1. Hall, C.S. Genetic differences in fatal audiogenic seizures between two inbred strains of house mice. J. Hered., 1947, 38, 2-6.

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This is accomplished by modifying the prenatal environment. Fertilized eggs recovered from the tubes or uterus of a female of one strain and introduced into the uterus of a female of a different strain will sometimes implant normally and produce viable young. This has been done using seizure-susceptible females as donors and seizure-resistant females as hosts. Under such conditions the genetical characteristics of the young are unaltered, but their susceptibility to fatal seizures is lower than that of their own genetic strain and higher than that of the "foster" mothers in whose uteri they developed.¹

1. Ginsburg, B.E., and Hovda, R.B. On the physiology of gene controlled audiogenic seizures in mice. Anat. Rec., 1947, 99, 65-66

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Another fundamental principle illustrated by the results of transplanting fertilized ova is that the uniformity of behavior which characterizes highly inbred strains of animals cannot be ascribed solely to homozygosity, but depends as well upon minimal variability of the prenatal environment. More broadly conceived, this principle implies that behavioral similarities and differences observable at birth are in part a product of intrauterine effects.

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No bit of behavior can ever be fully understood until its ontogenesis has been described. Had psychologists always recognized this fact, much of the fruitless debate about unlearned behavior could have been avoided.

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Gravid female moths, Hyponomenta padella, lay their eggs on the leaves of the hackberry plant and die shortly thereafter. The eggs hatch, the larvae eat the leaves and eventually become mature. Females of this new generation in turn select hackberry leaves on which to deposit their eggs. Another race of moths prefers apple leaves as an oviposition site. The difference between the two races has been perpetuated, generation after generation, for many centuries. It would appear to be the example par excellence of a genetically controlled behavior trait. But such an explanation is insufficient.

When eggs of the apple-preferring type are transferred to hackberry leaves, the larvae thrive on the new diet. Thirty per cent of the females developing from these larvae show a preference for hackberry leaves when it comes time for them to deposit their eggs.¹

The evidence is of course incomplete. Why only 30 per



cent of the insects show a reversal of preference is not clear. It would be illuminating if the same experimental treatment could be repeated on several successive generations. Nevertheless it appears likely that the adult moth's choice of an oviposition site is influenced by the chemical composition of the food consumed during the larval period.² If this interpretation is correct, the data illustrate the fact that a complex behavior pattern may be "unlearned" and still depend upon the individual's previous history.

1. Imms, A.D. Recent advances in entomology. Philadelphia: Blakiston's Sons, 1931.
2. Emerson, A.E. Ecology, evolution and society. Amer. Nat., 1943, 77, 97-118.

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Comparable examples can be found in the behavior of vertebrates. Stereotyped patterns of behavior appear with great regularity in successive generations under conditions in which practice plays no obvious role. Nonetheless such "species-specific" responses may be dependent upon previous experience of the organism.

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There are undoubtedly many adaptive responses which appear de novo at the biologically appropriate time in the absence of preceding practice, but the possibility remains that component parts of a complex pattern have in fact been perfected in different contexts. Whether or not this is the case can only be determined by exhaustive analysis of the ontogeny of the behavior under examination. Nonetheless, to define behavior as "unlearned" in the absence of such analysis is meaningless and misleading.

When these methods have been applied to the various types of behavior which today are called "instinctive," the concept of instinct will disappear, to be replaced by scientifically valid and useful explanations.

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No such classification can ever be satisfactory. It rests upon exclusively negative definitions of one side of the dichotomy. It obscures the basic problems involved. It reflects an unnaturally narrow and naive conception of factors shaping behavior.

To remedy the present confused situation it is necessary first to refrain from premature classification of those kinds of behavior that are currently defined as unlearned. Until they have been systematically analyzed it will remain impossible to decide whether these numerous response patterns belong in one or a dozen different categories.

The analysis that is needed involves two types of approach. One rests upon determination of the relationships existing between genes and behavior. The other consists of studying the development of various behavior patterns in the individual, and determining the number and kinds of factors that normally control the final form of the response.

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