Book Reviews

On Uniqueness in Behavior

Mind. An Essay on Human Feeling. Vol. 2. SUSANNE K. LANGER. Johns Hopkins University Press, Baltimore, 1973. xii, 400 pp., illus. $12.50.

The first volume of Langer's imposing *Mind: An Essay on Human Feeling* was reviewed in *Science* by Robert MacLeod (*1*), who underscored the major theme, resumed in volume 2:

> The key concept . . . is the "act." Most of us in our everyday thinking are thing-minded; we accept the world about us as an array of essentially inert structures which may be pushed and pulled about in space in a multitude of ways, even to the point at which they seem to be generating power, but in the last analysis it is the structure (the atom, the molecule, the bone, the nerve) which is accepted as real; an event is merely what happens to things in time and is essentially secondary. When we found our philosophy on "things" we have the various forms of classical materialism, in which physics becomes the queen of sciences and the machine (the spring clock, the combustion engine, the electronic computer) becomes the prototype of mind.

Langer rejects this thing-mindedness. But the dethronement of substance by action, while still a startling view to some, is not so radical as to upset most biologists. Indeed, it but states the obvious. It has, after all, been nearly 20 years since Garrett Hardin, a biologist, referred to an organism as a point in space at which reactions were occurring at slower rates than in the surround (*2*).

In this second volume the nature of acts is further explicated and extended to the nature of man's mind. Langer begins by arguing that acts are extensions of somatic functions, and hence as instinctive or inevitable as mitosis and cellular respiration. Acts are selected and steered by particular situations, but organisms perform all the acts of which they are capable at any given time. In behavior, there are no unoccupied niches!

Instincts, as seen by Langer, are clearly not to be confused with the goal-directed, internally charged, hierarchically ordered *Erbkoordinationen* of the European ethologists. The now outworn models, proposed by Lorenz and Tinbergen in the 1930's and 1940's, are once again dissected and decisively rejected. One wonders why she bothers. These models have long since been abandoned by their own authors.

More significant to current ethology is Langer's insistence on a reemphasis on the study of perception. Acts must be guided by perceptions, and the perceptions of other animals we can never know. Von Uexküll's fanciful renderings of scenes as seen through the eyes of a fly may call attention to interspecific differences in sensory capacities, but they hardly do justice to the wide range of perceptual possibilities actually afforded. Perception, in fact, is probably dependent upon context, with different aspects of the environment becoming salient at different instances. But this is a view neither alien to ethology nor even as bravely speculative as Langer implies. Nor need one search far for the empirical support for such a view, though, ironically, it comes in large part from the literature on learning. Over 20 years ago Tinbergen wrote, "An animal may learn some things much more readily than others . . . . there seem to be more or less strictly localized dispositions to learn. Different species are predisposed to learn different parts of the pattern" (*3*).

The quotation from Tinbergen refers to interspecific differences. However, it has been found applicable to intraindividual variability. We say, "An animal may on certain occasions do certain things (in certain ways) much more readily than on other occasions." "Imprinting" and the "critical period" phenomenon, for instance, are well-known examples of learning that can occur only at a particular developmental state. Even within the relatively brief period when imprinting may occur, domestic chicks undergo systematic changes in their ability to discriminate changes (*4*). At first, familiar objects, a few hours later unfamiliar objects, are more readily learned and discriminated.

What must raise eyebrows is Langer's suggestion that definition of the context of an act must be so narrow as to preclude useful generalizations. What are the elements that define context?

The major contextual boundary is that provided by the uniqueness of each species' perceptual world. Von Uexküll (*5*) coined the term *Umwelt* to underscore that each species of animal perceives the world uniquely. Two white flowers, indistinguishable to us, may differ radically to the bee that is not blind to ultraviolet reflection; the world of scents and sounds certainly is different for us than for shrews or bats. These obvious (if neglected) differences in the perceptual worlds and perceptual acuity of organisms constitute one limitation, albeit a relatively minor one, to the understanding of what is perceived by others. Related to such interspecific differences are seasonal variations that are intraspecific in their effects. Some migrant songbirds respond to an artificial sky as indicating the time for northward or southward migration according to whether they have been experiencing long or short days. Even the discriminability of star patterns may depend on the prior photoperiod (*6*).

A second boundary is less obvious. It is the intimate relationship between perception and life-style. For some animals, for example, a response is learned as readily with food as the end product or "reward" as with water. For rats, this is not the case. A maze alternation habit can be established with a food "reward," but not with water. In the usual rodent way-of-life, of course, the location of food does often vary, and this is less often true for water. The rat's perceptual system allows the former to clue alternation behavior, and not the latter. Here, then, is an example of "context-bound" learning that is not merely the result of a unique sensory acuity. Similar paradigms have been extensively reviewed (*7*). Some of these examples do accord with an intuitive sense of what is reasonable, as in the maze-alternation situation, or the development of bait-shyness when gastric distress (but not foot shock) is the aversive signal. Others are less apparent, and must make us cautious about a priori suppositions as to what an animal can or cannot perceive. For instance, in the context of an imprinting situation newly hatched ducklings may treat members of a pair

of models as indistinguishable, even though the same ducklings (at the same age) do distinguish the models in a maze (*8*). We have as yet no clues as to the significance of these curious differences in what is learned. "The Skinnerian assumption that all discriminable stimuli can become discriminative stimuli . . . is unfounded" (*9*).

Another aspect of the context of behavior is its neural substrate. Neurophysiologists tend to believe that there are a limited and specific series of changes occurring within the central nervous system when an act is performed or learned, although they differ as to the nature of those changes. Growth or multiplication of synaptic end-bulbs, changes in synaptic cleft width, and quantity of neurotransmitter are but some of the mechanisms that have been proposed to underlie learning, for instance. Yet, is it not entirely reasonable that any response, an act entailing a color discrimination, for instance, may involve two different mechanisms in two different individuals, or even in the same individual at two different times? Resistance to extinction, ease of recall, generalizability, and other parameters of learning might then be expected to vary (*10*).

In short, the contexts of behavior range from the molecular to the ecological. Depending upon the graininess of the investigator's perceptual field, the degree of detail with which he is concerned, a given contextual element may become more or less important for him to consider, but this bears little on its significance to his subject. This implies that acts cannot be understood independently of the animal and the context in which they occur. Especially important, it implies that similarities in acts cannot be the basis for assuming the acts to be homologies (*11*). New actions, as Langer claims, rarely arise from older processes that serve the same ends.

Langer does not dispute that the normal procedures of scientific inquiry necessarily entail simplification. The fewer the variables assumed to be important to a given phenomenon, the more readily one can devise and test "explanations" for the phenomenon. It is a method at once elegant and powerful. Yet there often remains a residuum of unpredictable variance which implies either that the explanatory model is incomplete or that there is an imperfection in the system being explained. The next step is generally to consider an additional parameter and to see if thereby the residual variations disappear. Sometimes they do, often they do not. If the various factors that "explain" or "cause" or "influence" some phenomenon do not act in an additive fashion, if their interactions have a Gestalt character (which then becomes the context of the phenomenon), an approach that entails the accretion of variables is not profitable. Another mode of analysis is required. A similar point is, I believe, entailed in the fact that a sequence of seemingly trivial and identical movements (for example, of the gill covers of two Siamese fighting fish, *Betta* species) will suddenly take on a signal function. The point after which the movements have ceased to be trivial is clearly recognizable; the point of transition itself may well prove as elusive as the position of atomic particles whose velocities are being measured, unless a holistic mode of analysis is devised (*12*). Though this is not the consensual view, neither is it a radical one. Hence it is puzzling that Langer argues it with such aggressive zeal.

Toward the end of her lengthily annotated argument, Langer presents her answer to the query, "How did speech and human mentation arise?" The order is not insignificant—speech first, then mentation. If we accept the conclusions she has drawn, we are no longer bound to assume that behavioral convergences are indicators of more basic similarities. Then, we need not regard speech as having evolved as a communicatory mechanism. Indeed, Langer questions the very existence of communication among nonlinguistic forms, but this is a secondary (though important) issue. The motive for human vocalizations, she argues, was most likely communion, a vicarious form of tactile contact. Only subsequently did meanings attach to sound and a communicatory function evolve.

This last is, indeed, an original (though she acknowledges older sources) and interesting conception. It would be a pity if it were overlooked because of the superfluity of the other arguments.

One minor complaint must be registered. Creative writers may be permitted eclecticism in the sources they cite, but in a work of systematic philosophy some rationale for the selection of sources may be expected. For all of Langer's many pages on problems of convergence, no reference appears to G. Bateson; and how can one discuss the relation between language and concept formation and ignore Whorf? or animal communication and language and forget Sebeok? The problems of stimulus salience have attracted several prominent psychologists, yet none of them are named. The omission of references to most of the youngest generation of ethologists is curious, too, in the face of the copious footnotes adorning most pages.

PETER H. KLOPFER
Zoology Department,
Duke University,
Durham, North Carolina

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Geoscience of Islands

Island Arcs. Japan and Its Environs. A. SUGIMURA and S. UYEDA. Elsevier, New York, 1973. viii, 248 pp., illus. $23.50. Developments in Geotectonics 3.

This book is a review and a synthesis; the primary subject is the Japanese island arc, but some space is devoted to problems of island arcs in general.

The task of writing it must have been a large and difficult one because of the wide variety of subject matter—virtually all aspects of geology, geophysics, and geochemistry—that bears on island arcs. Some 600 references are cited, and the authors perform an important service for those who do not read Japanese by including results from important papers written in Japanese. The book is clearly, concisely, and authoritatively written and reads well.

There are but three chapters. The first brings together information on geophysical and geological features of modern arcs and includes topics ranging from hot springs and surface faulting to crustal and upper mantle struc-