people, as closed circles pierced by a line. The evidence for a concept is incontrovertible: the probability of obtaining by chance a set of ranks with such a degree of separation between positives and negatives is exceedingly small. The performances of the two pigeons not shown here were equally convincing.

Although the pigeons were undoubtedly responding to something closely associated with people in the pictures, it remains to be shown that it was the visual array that we would ourselves call a person. It could be that the results arose from some trivial and unsuspected visual clue in the slides, or from some nonvisual property of the procedure. To check the possibility of some correlation between the presence of a human being and color distribution in the slides, a set of slides was reproduced in black and white. Figure 2 shows the results obtained for two pigeons with black and white slides. Despite a slight deterioration in discrimination, the behavior was still unmistakably selective. To test the possibility that the pigeons were reacting to some nonvisual aspect of the procedure, a session was conducted in which half the positive slides were treated as if they were negative and half the negative slides as if they were positive. That is to say, the apparatus had a 50:50 chance of producing the wrong consequence when the pigeon pecked. Even under these contingencies, the pigeons reacted to the presence or absence of people. Numerous other simple tests have been performed, all suggesting that the pigeons were, in fact, looking for, and reacting to, images of people.

Additional evidence for the existence of the concept "person" lies in the nature of the errors made by the pigeons. For example, the pigeons sometimes failed to peck when the human being was severely obscured, and they occasionally pecked when the picture contained objects frequently associated with people, such as automobiles, boats, and houses. Both types of errors diminished greatly as training progressed. There were also, of course, a few errors that defied simple explanation.

The most plausible conclusion to be drawn from these results is not that the pigeons were taught the general concept "person" but that they were taught the particular features of the procedure, such as learning to eat from the feeder, learning how and when to peck at the disk, and, perhaps, learning to look at two-dimensional arrays. The speed with which their performances improved, coupled with the complexity and variety of even the first slides used, strongly suggests that they entered the experiment with the concept already formed. Whether the pigeons had learned the concept before they were subjected to the experiments, or whether they are in some way innately endowed with it, the present experiment does not reveal.

It has been the practice of most psychologists to use human beings to study conceptualization. The use of categories, which is the mark of a concept, is not only most evident in human behavior, but most easily explored in a creature that can talk. But no one would question the idea that animals can learn rules for sorting, and that they can generalize the rules to some extent, so that new objects are also sorted more or less correctly. Even in the study of instinctive behavior with animals low in the phyletic scale, there is abundant evidence for sorting and generalizing.

There has been reluctance to assume that the sorting done by human beings is of the same nature as that done by animals. Given the large difference in degree between the concepts of man and animals, a difference in kind has long seemed plausible. Man obviously sorts with pinpoint accuracy over classes involving indefinitely large membership and bewildering complexity ("even numbers," "elm trees," "grammatical sentences") and picks out new instances with ease and rapidity. Animals, on the other hand, have seemed to form concepts built on only limited critical properties ("red spot on the beak," "left turn in the maze") and have seemed hard-put to pick out new instances. The technical vocabulary itself suggests a basic difference: a human being is said to "conceptualize" or "abstract" when he sorts; an animal, to "discriminate." But, unless there is something extraordinary about the conceptual capacities of pigeons, our findings show that an animal readily forms a broad and complex concept when placed in a situation that demands one.

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Circadian Leaf Movements in Bean Plants: Earlier Reports

Hoshizaki and Hamner (*1*), in presenting evidence for a circadian leaf movement which continues for 4 weeks in *Phaseolus* under constant conditions, say, "Nowhere in the literature is there a report of a persistent circadian leaf rhythm in higher plants." However, there are many such reports. The conditions which allow leaf movements to persist for several weeks in continuous light have been applied at Tübingen for many years, with several species of plants.

Pfeffer (*2*), who published nearly 700 pages on diurnal leaf movements between 1875 and 1915, described the persistence of leaf movements in *Phaseolus* for more than 4 weeks. Because of his special methods, elaborated over a 40-year period, he got even much clearer records. One of his figures has been reproduced more recently (*3*). Pfeffer's figures also clearly demonstrate the deviations from the exact 24-hour period, that is, the circadian nature of these persistent rhythms. Persistence of leaf movements in *Canavalia* in continuous light for several weeks was described in 1929 (*4*). Hoshizaki and Hamner measured a circadian period of about 26 hours; a period of 25.4 hours (*Phaseolus multiflorus*, continuous darkness) was measured in 1930 (*5*).

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