

ference therefrom, can be compared makes this an extremely useful book to have at hand for this kind of study and discussion.

There are, of course, wide discrepancies between the observations of Dr. Dearborn and those who have made similar observations (the writer has himself observed four, in a more or less similar manner, though with much less technical knowledge), but on the whole there is a remarkable correspondence between what our author found and what the careful and more or less trained observer finds in such study. Dr. Dearborn's volume is one of those which must be kept in mind by all who wish to do anything in this field, and is so clear, so precise in its indication of the view of the author of the particular phenomena which he had to interpret, and withal, so satisfying in the conclusions at which he has arrived, as to make it a notable contribution to the science.

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THE DELAYED REACTION IN ANIMALS AND CHILDREN.
Walter S. Hunter. Behavior Monographs. Volume 2, Number 1. Pp. v + 86.

"The experiments in this monograph aim at an analysis of typical mammalian behavior under conditions where the determining stimulus is absent at the moment of response." This opening sentence indicates the nature of the investigation. The aims of the investigator were to determine how long after the disappearance of the stimulus an animal can react correctly; and to ascertain, if possible, the nature of the cues used by the animal in the solution of the problem.

Following the brief introduction, nineteen pages are devoted to a critical review of the main types of behavior which have been used as evidences of the existence of images or ideas in animals. Fourteen types are discussed under the following headings: Imitation, Use of Tools, Dreams, Learning Curve, Memory, Thorndike's Test, Learning by Being "Put Through," Recognition, Rate of Forgetting, Association by Similarity, Reluctancy and Expectancy, Varying Means to the Same End, Reactions to a Temporal Series of Colors, and Washburn's Cat on the Stairway. In each of the above cases the author of this monograph considers the arguments for the presence of imagery in animals to be inconclusive, and emphasizes the fact "that if comparative psychology is to postulate a representative factor, it is necessary that the stimulus represented be absent at the moment of response."

The subjects used in the investigation were twenty-two white rats, two dogs, four raccoons, and five children from two and a half to eight years of age.

The general method of experimentation was the same for all. The animals, for instance, were placed in a release box from which could be seen three equidistant and qualitatively similar "light-boxes." These were so wired that any one of them could be illuminated. The animals were taught to go straight to the lighted box when released. When this habit had been formed, "the light was turned off" (1) just before the animal had reached the light-box, (2) when it was half way to the light-box, (3) just as the experimenter started to raise the release-box, and (4) at intervals before the release-box was raised. These intervals were gradually increased in length until the animal failed, then they were decreased until the choices were again correct.

Bread and milk were used as rewards for the animals, and candy for the children. With eight of the rats an electric shock was also used as punishment for incorrect choices.

Some of the rats failed to react in the third stage of delay, while others could react correctly after a delay of ten seconds. The minimum delay for the dogs was two seconds; the maximum, five minutes. For the raccoons, the minimum was three seconds; the maximum, twenty-five seconds; and for the children the minimum was fifty seconds and the maximum twenty-five minutes. The intervals of delay were not affected when the backgrounds surrounding the entrances to the light-boxes were of differing degrees of brightness. When the problem was made less complex by the use of two light-boxes instead of three, the maximum delay recorded was greater in each case.

The interval of delay was not affected by the number of trials per day or by the use of punishment.

With the rats and dogs the orientation maintained during the delay was essential to correct reaction. Such motor attitudes seemed also to influence the raccoons. It is the author's opinion that to explain a great number of the correct responses of the raccoons, and all of the successful reactions of the children, there must be assumed a "representative factor" which fulfills an ideational function. This factor is sensory rather than imaginal in all the subjects except, possibly, the older children.

Subjects may be classed on this basis; (a) absence of learning, (b) trial and error, (c) sensory thought, and (d) imaginal thought.

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