

selection at all. This period may vary greatly in duration. Later the attractiveness of the blue end increases with the result described. The table in the original shows also that, while at the beginning of the preference for blue the reverse order of the spectrum is followed closely, with advancing age this order changes gradually and approaches the order of preference found in adults. Thus the young infant reacts in a physiological way to the more exciting colors of the red end of the spectrum. The older, mentally advanced child rejects the exciting reds and oranges and prefers the more restful colors of the blue end of the spectrum. These results may lead to further investigations. The described changes of preference in a child of about three years must certainly be parallel to alterations in the mental make-up. If we consider that at this age the reflective stage has begun to take the place of the earlier impulsive stage, the results should yield valuable data as to the character of some of the mental changes in the child. It is likely that an investigation into the development of the other senses would give results analogous to these.

K. K. BOSSE.

MEMORY.

Experimentelle Beiträge zur Lehre vom ökonomischen Lernen.

LOTTIE STEFFENS. Zeitschrift für Psychologie und Physiologie der Sinnesorgane. Band 22, Heft 5. Pp. 321-382.

This paper is chiefly devoted to a report of a series of experiments dealing with the methods by which various persons memorize verse. Having discovered a number of such methods, the author undertakes to determine which form of procedure requires the least expenditure of time in order to learn by heart any given selection of poetry. Throughout the article the term economy applies to the amount of time, and not to the amount of effort, involved in any of the various undertakings. The larger part of the experiments were made upon seven subjects. This is relatively a small number, but the results are sufficiently uniform to warrant considerable confidence that they represent typical tendencies at least. At a number of points the evidence was supplemented and confirmed by experiments with nonsense syllables.

Apparently the natural disposition of most persons, when attempting to memorize verse, is to split the selection up into a number of sections, which are learned more or less independently, and then put together. This general method shows many individual modifications, both as regards the length of such sections, and as regards the relative

number of repetitions accorded the several parts after they have been once learned. Very rarely is there any tendency manifested to learn an extended piece of verse as a whole, *i. e.*, to read it entirely through without the repetition of words, lines or sections. Unusual as this procedure seems to be under ordinary conditions, the experiments show uniformly better results when this method is adopted.

The author advances a number of plausible explanations for the common prejudices in favor of the piecemeal mode of memorizing and then attempts to prove in what particulars the other method is superior, calling to her assistance for this purpose nonsense syllables. The method of learning the selection as a whole has the obvious advantage of emphasizing the really helpful links of connection between the various parts, instead of the fictitious and misleading ones, which often arise when the material is learned in sections. Involved in this is the helpful influence of associations due to the absolute position of given elements in the whole. The importance of this factor will be readily understood by those who have experimented at all extensively with the memory processes. On the other hand, it is to be said that when the material to be memorized is not reasonably homogeneous, the segmental method may be more advantageous. The reason for this is obvious. A peculiarly baffling group of words may render many repetitions necessary, and where the whole selection is read through consecutively, the loss of time is inevitable. With homogeneous material, however, the advantage of this method is roughly proportional to the length of the selection. There is seemingly little tendency, when this method is employed, to rely upon purely mechanical motor processes, by means of which children often commit quantities of poetry to memory without the slightest suspicion of the meaning. Clearly the value of logical significance is at a maximum with the method. It promises, with material of uniform difficulty, the least amount of unnecessary and superfluous repetition of any portion.

Incidentally, in the course of the paper, a number of interesting points are touched upon, such as the relation of rapidity of reading to rapidity of learning; the dominance of sensory or motor elements in the different modes of memorizing, etc.

A final section discusses a series of experiments dealing with the question of the most advantageous method of distributing any given number of repetitions throughout a constant time. Here again nonsense syllables furnish the material. The general results indicate that the distribution of repetitions which affords the best results is that which secures the maximum number of *groups* of repetitions, with

intervals of time between the groups, and the minimum number of repetitions in each group. This means doing a little at a time and doing it very often. Like the conclusions of the first part of the paper, this runs counter to common prejudice and practice.

The author makes no attempt to discuss the question of permanence of retention, as connected with her problem of expeditiousness in learning, nor is there any notice of the modifications in her results, possibly due to the metrical nature of her material. This is not to be interpreted as a criticism of the work, which seems to have been intelligently planned and carefully executed, but simply as an indication of its limitations.

JAMES ROWLAND ANGELL.

UNIVERSITY OF CHICAGO.

PERCEPTION AND RETENTION.

Zur Untersuchung der Auffassungsfähigkeit und Merkfähigkeit.

JACOPO FINZI. *Psychologische Arbeiten* (Kraepelin). Bd. III., 2 Heft, 1900. Pp. 289-384.

Finzi's investigation is a methodological inquiry in which he undertakes a more exact examination than has heretofore been made of the disturbances of memory in the normal individual, for the purpose of applying the method in the diagnosis of mental diseases. It is impossible to determine the quantity of impressions which his past life has furnished to the patient, but it may be useful for the alienist to ascertain his capacity for receiving and retaining impressions at present.

The writer seeks to measure two things: the clearness of the impression and its fixity. In connection with the latter aspect we must separate the effects of fixation through voluntary repetition, and the involuntary retention of impressions which follow directly from their presentation. For his material the writer turns to visual impressions, and adopts the customary letters, syllables and pictures. The mechanical conditions of experimentation seem to have been carefully looked after and the apparatus for control of the exposure is fully described and pictured. To secure constancy a Welsbach lamp was used as the source of illumination and the figures were seen by transmitted light. The time of exposure for each point of the surface was approximately the threshold for the perception of letters, viz., 16.7σ. The action of the apparatus was under control of the observer himself. Five sets of experiments were carried out. In the first the interval between presentation and recall varied, the periods being 2, 4, 8, 15 and 30 secs. In the second a constant interval was filled by such distracting media