

a moment only; and show not that particular peripheral sensations must be present, but that strong peripheral sensations of another kind may inhibit for a moment the desired verbal image.

In addition to the reproductions of motor sensations, there must be other elements in the verbal image. For articulatory movements alone, unpreceded by the idea of expressing a word, do not necessarily awaken a verbal idea. The latter possesses a filling, a fullness which can be given only by a sort of unlocalized, faded-out auditory imagery, which never attains an independent, clear and recognizable reproduction. No trace of visual elements can be detected in any recognizable characteristic of the word-image. It is shown, however, that they must be aroused to a certain extent, unconsciously influencing and controlling the conscious imagery. Images derived from writing movements cannot be detected or inferred, unless when a word is spelled. In short, motor images are prominent, and are recognizable as such; auditory images are not recognizable as such, but furnish a recognizable portion of the content; visual images cannot be detected in any conscious feature of the content, but their presence is evidenced by their control.

Similar thorough analyses, with inferences as to the brain-paths used, are given of the verbal elements present, prominently or vaguely, in speaking aloud, in hearing, in reading and in writing. Whichever one of the four kinds of word elements is most prominently aroused, its firm association with the others arouses them also, though not all with equal distinctness. Where they are not consciously distinguishable, yet their unconsciously aroused traces influence the conscious content. The motor images are always of demonstrably greatest importance, in motor speech for determining it, in sensory for understanding it. Auditory, visual and motor types of individuals do not exist in the sense that one or the other element is present exclusively in any of their verbal images; they consist only in the prominence of one element over the others, all of which must be present.

E. B. DELABARRE.

BROWN UNIVERSITY.

*Ueber das Gedächtniss für Sinneswahrnehmungen.* W. von TSCHISCH. Dritter Internat. Congress f. Psychologie. (Munich, J. F. Lehmann, 1897.) Pp. 95-109.

This paper, read at the Psychological Congress, is a report of several investigations upon memory carried on at the Dorpat Labora-

tory. The questions taken up were the space sense (*Raumsinn*), position sense (*Ortssinn*), active and passive muscle sense, active movement, sight, sound intensity and tones. These were studied by different investigators, under the direction of Professor von Tschisch, who took personal charge of the one on sound intensity.

The method pursued, with two exceptions, was that of Right and Wrong Cases. For the sense of space, distances on the skin were used as stimuli; for the muscle sense, weights; for sight, light impressions of different intensities; for sound intensity, sounds of the same pitch but different intensities; and for tones, sounds of the same intensity and different pitches. The stimuli were given in pairs; the subject was required to designate the louder, higher, brighter, etc., as the case might be. The proportion of right answers to wrong was noted, judgment of equality being ruled out.

Having determined a pair of stimuli which could be distinguished correctly by the subject in about 70 cases out of 100 when given in close succession, this pair was adopted for subsequent tests, in which an interval of time was made to elapse between the two stimulations. The interval, at first short, was increased by empirical steps (which varied in the different investigations) until some marked diminution of the percentage of right answers, usually below 50%, was obtained. When necessary to prevent the memory from lingering over from one trial to the next, different pairs of stimuli were used alternatively in the same series. The interval of time at which a marked falling off in the percentage of right answers occurred was taken as measure of the strength of memory in each case.

In two investigations in which the method of Mean Errors was used, the same general procedure was employed; the interval of time at which a marked increase in value of the mean error occurred was made the measure of the strength of memory.

The space sense was investigated by means of a pair of compasses, the place chosen being the right forearm. 70 mm. was taken as normal distance, but tests were made for greater and lesser distances as well. For the sense of position, the left forearm was chosen; a point was touched by the experimenter with a pencil, and the subject endeavored to touch the same spot with another pencil held in his right hand; a screen prevented the arm from being seen by the subject, who was allowed to 'feel around' for the spot after touching. In this investigation the method of Mean Errors was used. The muscle sense was investigated by means of copper cylinders, of uniform size and varying weight. For the passive muscle sense these were laid upon

the palm of the subject's hand for the space of three seconds and then removed; for the active muscle sense they were placed by the investigator between the subject's thumb and fore-finger, and raised by him. Active movement was investigated by requiring the subject to move his hand slowly to the right or left. A thin stick attached to the hand, with a pointer extending upward to a scale, served to mark the angle of flexion; in the first of each pair of experiments the length of movement was regulated by a knob which the hand encountered; this obstruction was then removed, and the subject required to repeat the movement. The method of Mean Errors was employed here also. The investigations in sight made use of the shadow cast by a steel bar upon a white surface, with varying distances of the light-source. For sound intensity, steel balls were dropped from varying heights on a wood surface. The last study was one on tone differences; five tuning-forks were employed, which differed by four vibrations, from 436 up. For musical subjects differences of four vibrations were used; for unmusical subjects differences of eight vibrations were chosen, as this was nearer their perception threshold.

Comparing the results of the several investigations, Professor von Tschisch finds the memory for space to be weakest; it falls off in exactness the soonest. Memory for position and the muscle sense is somewhat better developed. Memory for active movement and the higher senses is decidedly stronger. The memory for sight and sound, and in the latter sense for intensity and quality, appears to be about the same; in these three the percentage of right answers falls from 70 to about 50 in 15 minutes, for normal individuals.

H. C. WARREN.

PRINCETON.

*Experimentelle Studien über Associationen.* I. Theil. Die Associationen im normalen Zustande. GUSTAV ASCHAFFENBURG. Leipzig, Engelmann. 1895. Pp. 95.

Dr. Aschaffenburg's aim in his experimental study of association is the establishment of a method of diagnosis in cases of nervous disease. The published part of his work deals with normal associations as basis for the later study of neurasthenic cases. The methods employed are the simple ones of older experimental tests. A word is pronounced to the subject who responds by writing down or by pronouncing the first suggested word; or (in one form of the experiment) by writing down, as quickly as possible, the first hundred words occurring to him. There are 4,400 single cases of association, with