

the other conditions of the test we are left in ignorance. The tests of what the writer calls general sensibility were, we infer, determinations of the threshold of electrical sensations, the stimulus being measured in volts. The most sensitive on the average were students and university graduates of 19 to 40 years; the least sensitive were the oldest group tested, men of 65 to 75. There seemed to be a decrease of sensibility with increasing age after middle life.

Similar results were found for pain sensibility, the percentage of subjects having the highest of 4 grades of sensibility (90 + volts), being as follows: School children (9 to 14), 6 per cent.; older school children (14 to 18), 31 per cent.; students (19 to 24), 17 per cent.; graduates (24 to 40), 7 per cent.; workingmen (20 to 40), 5 per cent.; older workingmen (40 to 65), 65 per cent.; very old workingmen (65 to 75), 45 per cent.

Ottolenghi concludes that the sensibility increases from childhood to manhood, and then decreases. His observations were not sufficient to justify such an induction. He tested but 18 school children of 9 to 14, and but 16 of 14 to 18. Then the men of 18 to 40 were of a different class from his other adult observers. The only conclusion that the figures warrant, that sensibility decreases in old men, is therefore not entirely acceptable. The writer fails to state the results for very young children, since, as he says, they objected to the completion of the test. It is not evident why the stimulus at which the children objected to its continuation cannot be taken as a pain threshold.

HAROLD GRIFFING.

Beiträge zur Psychologie des Zeitbewusstseins. ERNST MEUMANN.

Philosophische Studien, Bd. XII., Heft 2, 1896.

The author interrupts the systematic course of his announced investigations in the psychology of time-consciousness, to publish a cyclis of experiments concerning the illusions of the same. Two cases of time-estimation are distinguished: first, where the interval of time is simply limited by comparatively sudden sensations (judgment of the rapidity of succession of the limiting sensations); second, where the problem is the comparative lengths of continuous stimuli. The apparatus used is the well known 'time-sense apparatus' of the Leipzig Institute. A few details are added by the author to the elaborate description of the apparatus in an earlier article.¹ The method is essentially the same as in the earlier article on the Influence of the Intensity of Stimuli on the Estimation of Small Time-intervals; the inter-

¹*Philos. Studien.* Bd. IX., p. 270 ff.

vals, whether 'filled' or 'empty,' are produced by the electric current, the subject being in a dark room separated from the apparatus, and the length of the comparison-interval being gradually varied from shorter to equal and longer than the constant or normal interval, and reversed. The subject adds, as he did not in the author's earlier experiments, the degree of sureness of the judgment, as, *e. g.*, clearly, very clearly, doubtful, or very doubtful. In the comparison of 'filled' with 'empty' intervals it proved advantageous to let the latter precede the former and to retain the 'filled' interval constant or normal. The point is made clear that the 'empty' interval is, however, not empty, but filled with such sensations as the pressure of the clothing, of the chair on which the subject sits, the rising and fall of the breast from breathing, etc. Both the 'filled' and the 'empty' intervals are produced by sensations of sight, hearing and touch. The number of sensations entering the filled interval is also varied. Further, the author gives a number of experiments to show the effect of artificial 'aids' in estimating intervals, *e. g.*, tapping the finger, breathing, nodding the head, etc.; and another series in which the one interval is 'filled' with mental work, such as reading.

In the first group of experiments the stimuli are sounds; first with the filled interval, and then with the empty interval preceding. The first two tables present experiments where the 'filled' interval includes, beside the limiting sparks, only one sensation. The scheme is 'filled' interval, 1 2 3. In Table I. the filled interval precedes. 'empty' interval, 1—2. The result may be stated as follows: Where both are very short the 'filled' interval is much over-estimated; as the intervals are increased in length the deception disappears in an 'indifference-zone;' if the intervals are still lengthened, the 'empty' one becomes much over-estimated. The experiments show that these transformations of the illusion occur with all subjects used, but that they occur at different lengths of the constant interval with different subjects. "The length of the interval by which indifference enters is by no means constant." In the next following experiments the 'filled' interval follows, instead of preceding, the empty one, and remains constant. The result is the same, excepting that the indifference-zone lies higher, *i. e.*, by a much longer constant interval than in the former series. In the immediately following experiments the number of sensations increases to 5, 6 and 9, the arrangement of the two intervals being varied the same as before. As a result the over-estimate of the 'filled' interval becomes more marked than before, the indifference-

zone being again raised; but the transformation of the deception from over to under-estimate of the 'filled' interval, with the lengthening of the constant interval, remains obvious.

In the second group of experiments the influence of artificial 'aids' in estimating time-intervals is investigated. First, the beginning and ending sensations of the filled time are more strongly marked than the intervening ones. It is comparatively indifferent whether the former are objectively strengthened or merely rhythmically emphasized by the subject; in either case, the deception, although still manifest, is very much reduced. The indifference-zone appears by a much shorter interval than before. In the next experiments the subject was practiced before each hour in accompanying the six impressions of the 'filled' interval with six tapplings of his finger, the tapping being continued to the close of the empty interval; the latter is, in this case, compared with the former by means of the number of taps. As a result the deception became greater than in normal experiments, *i. e.*, without the tapping. It was sought to investigate the effect of periodic breathing; but only a disturbing influence appeared, in consequence of which the difference-threshold (U E) was very much raised. Finally, the 'filled' time was made to follow the 'empty' one, the motor 'aid' continuing through both. The deception of the normal arrangement continued unreduced. Experiments in the rhythmical execution of 'filled' intervals were conducted as follows: The subject made in one case, two, and in another, three hammer-strokes within a given interval; the rhythmical execution adopted in the former case is $\dot{1} \ 2$ and in the latter $\dot{1} \ 2 \ 3$. The strokes are registered on a kymographian cylinder. The two subjects execute the middle stroke of the triple interval somewhat quicker than either of the other two, indicating, among other things, that the triple interval is shortened to make its length *seem* (in compliance with the deception of filled intervals) to the executor the same as that of the double one.

In the third group of experiments the illusions of filled intervals in the different senses are compared, *viz.*, sight, hearing and touch. The experiments already conducted in the domain of hearing are here repeated in sight and touch, with the same general results as before.

The fourth group deals with the illusion resulting from filling the one interval with a continuous sound, the instruments being the Wagnerian hammer and the tuning-fork. The sound produced by the former, after being telephoned to the subject in the dark room, is a peculiar whirring noise. Where the 'filled' time follows the 'empty' one, the result is in general the same as before; but in this arrange-

ment the difficulty involved in letting the filled interval be varied and placed before the 'empty' one is not present. Where the sound is discontinuous, and the interval inconstant, there arises a momentary uncertainty as to the last hammer-stroke or other stimulus, which disturbs the judgment. The result of varying an interval filled with continuous sounds, while the 'empty' one is constant or normal, is, in general, the same as before; but the quantity of the illusion is much less than before, showing that the two cases are in fact very different.

In the fifth group the effect of filling the same interval differently is investigated. The stimuli are the already mentioned varieties of light and sound sensations. The first interval chosen is short, viz. 0, 4 s, and the result is in every case an over-estimation of the filled interval. When the stimulus of the 'filled' interval is continuous, the over-estimate is less; the application of the tuning-fork showing the least illusion. The second interval chosen is of medium length, viz. 1, 0 s. Here the over-estimation of the 'filled' interval is confined to the cases of discontinuous stimuli, the continuous stimuli producing here an over-estimation of the 'empty' interval. When the stimulus of the 'filled' interval is rhythmical, the deception is reduced but not eliminated. The third interval chosen is comparatively long, viz. 8, 0 s. Here the empty interval is clearly over-estimated.

In the sixth and last group the one interval is filled with mental work, such as reading a series of letters on the revolving cylinder of the kymograph and combining the same into a word, the apparatus being so arranged that only one letter at a time was visible; and again, the counting of a number of lines which appear in successive groups simultaneously on the cylinder. In this case the 'filled' interval is more or less under-estimated and the 'empty' one over-estimated.

Merely the general tendency of the author's explanation of the different illusions of time-judgment can be mentioned here, viz., the direction of the attention either to the time-relations themselves, or to the content of the intervals. In the last group of experiments, *e. g.*, in reading letters and combining them into a word, the attention is at first absorbed with the letters themselves (*i. e.*, with the content of the interval) and the interval is estimated too short. As the letters become better known, the attention is directed more to the time relations of the two intervals which are as a result more correctly estimated; finally, the letters become familiar, the 'work' is pleasant, and the 'filled' interval seems shorter, owing to the feeling of pleasure which accompanies it. At the close of the article the author gives about 15 or 20 short statements of results of the experiments which cannot be repro-

duced here. The article is rich in detail which we have not touched upon and which the student will do well to read in the original.

GUY TAWNEY.

NEW BOOKS.

- Grundriss der Geschichte der Philosophie zum Selbststudium und für Vorlesungen.* DR. JOHANNES REHMKE. Berlin, Carl Duncker. 1896. Pp. 308. \$1.35.
- Yoga Philosophy.* SWÂMI VIVE-KÂNANDA. London, New York and Bombay. 1896. Pp. xi+224.
- Infallible Logic. A Visible and Automatic System of Reasoning.* THOMAS D. HAWLEY. Lansing Smith Printing Co., Lansing, Mich. 1896. Pp. xxviii+659.
- Sense of Beauty, being the Outlines of Æsthetic Theory.* GEORGE SANTAYANA. New York, Charles Scribner's Sons. Pp. ix+275. \$1.50.
- Leibnitz's New Essays concerning Human Understanding.* Translated, with notes, by A. G. LANGLEY. New York and London, The Macmillan Co. 1896. Pp. xix+861. \$2.25.
- Education of the Central Nervous System.* REUBEN POST HALLECK. New York, The Macmillan Co. 1896. Pp. xii+258. \$1.00.
- The Power of Thought.* JOHN DOUGLAS STERRETT. With an introduction by J. MARK BALDWIN. New York, Charles Scribner's Sons. 1896. Pp. xiv+320.
- Elements of Psychology.* GEORGE CROOM ROBERTSON. Edited from notes of lectures by C. A. FOLEY RHYS DAVIDS. New York, Charles Scribner's Sons. 1896. Pp. xiii+268.
- The Life of James McCosh.* Ed. by W. M. SLOANE. New York, Charles Scribner's Sons. 1896. Pp. vi+287. \$2.50.
- Grundriss der Psychiatrie.* C. WERNICKE. Th. II. *Die paranoischen Zustände.* Leipzig, Thieme. 1896. Pp. 178. M. 1.30.
- Gustav Theodor Fechner.* K. LASSWITZ. Edited by R. FALCKENBERG. Frommann's Klassiker der Philosophie, I. Stuttgart, Frommann's Verlag. 1896. Pp. viii+204. M. 1.75.
- Hobbes' Leben und Lehre.* F. TÖNNIES. Frommann's Klassiker, II. Stuttgart, Frommann's Verlag. 1896. Pp. xiii+232. M. 2.
- S. Kierkegaard.* H. HÖFFDING. Frommann's Klassiker, III. Stuttgart, Frommann's Verlag. 1896. Pp. x+170. M. 1.50.