

which was therefore the sole variable condition. M. Binet promises more extended statistics on the subject at a later date, however. His method is an interesting one, and his results are of importance if they are sustained by further investigations.

The analytic portion of the *Année* contains fewer articles than usual, but greater care has been exercised in their selection, and they are fairly representative in the departments of Sensation and Pedagogy; the chief works on Hearing are summarized in a single review. The general bibliography, forming the third section, is identical with the PSYCHOLOGICAL INDEX issued by this REVIEW.

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VISUAL PERCEPTION.

Die optische Localisation der Medianebene. M. SACHS und R. WLASSAK. *Zeitsch. f. Psych. u. Phys.*, XXII., I., pp. 23-46.

This paper reports a series of experiments in which a subject seated in a dark room was shown a narrow vertical slit uniformly illuminated from behind, and was required to judge, from various positions of the head and eyes, whether the slit was straight ahead or on the right or left side. In presenting the results the authors draw a distinction which is of cardinal importance for their theoretical interpretations. It is the distinction between correctness (*Richtigkeit*) and certainty (*Bestimmtheit*) of judgment. Correctness means the degree of correspondence between the objective median plane of the body and the average judgments of the subject. Certainty means the narrowness of the area in which the judgments right and left may overlap, since the narrower this area the more closely defined is the judgment, 'straight ahead.'

Correctness is greatest when the head is in its normal position, *i. e.*, with its median plane coincident with that of the trunk, and when the eyes are left free to fixate where they will. When one eye is covered, the correctness is reduced and varies according to the eye used. When the head is turned, the median plane of the head becomes the determining plane for judgment, the correctness is accordingly small. From this it is argued that the sensations of movement from the neck muscles are of small importance in these judgments.

Certainty of judgment is regarded by the writers as of much greater significance than correctness. The highest degree of certainty found in any of these experiments was obtained by fixating the eyes steadily on

some bright point placed at the right of the median plane, the head being in such cases held in the normal position and the eyes being turned to the fixation point. These were the only conditions in the series of experiments under which the eyes had a definite point of fixation. In all other cases the eyes were left to wander until the slit appeared and then they fixated the slit. The argument of the authors from these results is that the most favorable conditions for judgment are not obtained from free movements of fixation.

Further evidence against the movement hypothesis is found in the fact that when the slit is moved through the field judgment is not so certain as when the slit is shown successively in a number of stationary positions. Also when movement from the lateral point of fixation to the slit is allowed, judgment is less certain than when the eyes are kept fixated on the point.

On these grounds the general conclusion of the whole paper is that sensations of movement do not play any important part in two-dimensional visual localization. Such localization depends rather on the relation of the image to the median axis of the retina. In short, the interpretation is in favor of Hering's theory of visual space perception.

The basis for such a general conclusion does not seem to be at all adequate. The number of results given is very small. The authors offer those presented, 'as examples,' but generally the examples are limited to one set of figures. In a judgment of such complexity certainly one or two cases will not serve as sufficient basis for general inductions. Again, it is not clear what the authors mean by the judgment 'straight ahead.' The position of the head does not, in the ordinary circumstances of life, or in any other experiment with which the reviewer is acquainted, determine our perceptions of the median plane of the trunk in any such way that we are illuded into the belief that the trunk has moved with the head. It is not easy to see, therefore, on what grounds it is argued that the influence of sensation from the neck muscles is unimportant. Finally, the high degree of certainty resulting from fixation of a lateral point is probably not due so much to the positions of the images on the retinas as it is to the fact that under these circumstances, and under these circumstances only, the subject had a definite point of comparison given in the field of vision, whereas in the other cases the localization depends on a much less direct and simple judgment. That such an explanation as this, rather than the one given by the authors, is the true one, would seem to appear also in the fact—which is altogether too easily disposed of in the paper—that correctness and certainty do not follow the same laws. This

being true, it would seem to be obvious that the degree of correctness is the more important datum for generalization in regard to the mode of localization. Certainty merely gives us an indication of the directness or indirectness of such judgments of localization. Any vagueness to be found in any of the cases just described is as likely to result from vagueness of bodily sensations of touch as from uncertainty in movement sensations.

The Perception of Horizontal and of Vertical Lines. Prof. B. O. PEIRCE. Science, Sept. 29, 1899.

Prof. Peirce reports in this article a large number of observations on the accuracy with which horizontal and vertical visual directions can be judged when all objective lines of reference are removed. The paper is unique in that it confines itself to a statement of the methods employed and the results obtained, no attempt being made to interpret the facts discovered or to establish any general principles of space perception.

The first method of these experiments was to allow the subject to turn the eyepiece of a horizontal telescope containing a single cross hair until the cross hair seemed either horizontal or vertical. A piece of ground glass placed in front of the object glass excluded all disturbing images. The second method used was the following. The observer looked at a surface crossed by a single line, through a tube which was two meters long and 35 centimeters in diameter, was blackened inside and was supplied with several diaphragms to prevent reflection. The line was now placed by the subject in what seemed to be a horizontal or a vertical position and the degree of deviation from the objective horizontal or vertical was recorded.

The results show that children and others who are without training in judgment of direction tend to set the line carelessly, but, after all, average fairly near to the objective standard. Training reduces the amount of variation. Astigmatism, even of a pronounced form, does not affect the judgment. When monocular vision is tested it is found that the line which seems horizontal to the right eye must be rotated slightly counter-clockwise in order to appear horizontal to the left eye. Tipping the chair or platform on which the subject sits or stands seems to confuse the subject somewhat and results in a lower degree of accuracy of the judgment. No constant relation was found between the direction of the tipping and the direction of error in the judgments. Deviations are also greater when the head is turned so as to

look over the shoulder, or when the body is bent so that the subject looks between his legs. When the body is erect and the head is much inclined to the left deviations are constantly counter-clockwise. When the inclination of the head is to the right the deviations are clockwise. The same holds for readings taken when the observer lay on a horizontal shelf on the left or right side. The deviations in such cases sometimes reach as high as 20 and 22 degrees.

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La phonétique expérimentale appliquée à l'enseignement des langues vivantes. Par ADOLPHE ZUND BURGUET. P. 35. Paris. 1898.

Applications pratiques de la phonétique expérimentale. By the same author. P. 24. Paris. 1899.

While these two pamphlets aim to discuss the practical side of experimental phonetics, they give a brief exposition of the present state of this method of research and a concise illustrated description of the appliances peculiar to it. The phonetic elements of a language are regarded as differing in duration, intensity, pitch and quality according to the relations of the various organs of speech to each other.

It was the recognized inability of ordinary observation to discover the exact relations necessary to the production of different sounds that finally led to the invention of the following appliances: (1) an artificial palate by which the relation of the tongue to the hard palate can be determined, (2) *les ampoules exploratrices*, rubber capsules of different sizes, for recording lip and tongue pressure, (3) *les olives nasales*, small bulbs for registering the amount of air discharged from the nose, (4) *l'embouchure*, a receiver for the air discharged through the mouth, (5) *le signal du larynx*, a complicated instrument for detecting the movements of the larynx, (6) *le cadran-indicateur*, an appliance for indicating to the eye and ear the amount of air expelled to produce a given sound. In use, a kymograph and recording tambour are necessary to 2, 3 and 4.

Though these instruments were primarily intended for research, the author proceeds to discuss them as a means of teaching foreign languages to youths and adults or of correcting faulty pronunciation in their native tongue. It is shown by specific cases how a child (who learns his mother tongue by ear) may acquire a faulty pronunciation and his ear habitually ignore the difference between his own speech and the normal. In such cases some other sense must be appealed to and here experimental phonetics steps in. This same habit

of the ear makes it difficult for an adult to learn a new language. In all such cases apparatus may be brought in to give by eye an indirect perception of the required movements.

The author calls attention to some facts of psychological interest.

He illustrates how futile it is to tell a person with a defective pronunciation that his palate must be so, tongue thus, etc., and how easy it is to teach him the correct pronunciation by apparatus where his eye can see by a line upon the drum of a kymograph or by the dial of the cadran-indicateur when he has made the correct movements.

So far as the reviewer is aware very little attention has been given to the relations existing between hearing and the imitative movements of speech. Our principal manner of imitating movements is by eye—there are obvious reasons why this is true for animals as well as men—and not by ear; but a sound is imitated from what appears to be very meager data. It is well known that in a movement the kinæsthetic 'copy' is the complex experience of the correct movement, but here we usually have an ever-present objective test, as in striking a certain key on a piano.

In the case of an articulation we have only a remembered sound as the test. It is with some reason, then, that our author says the acquisition of a correct pronunciation is somewhat a matter of chance, for we see that with such an indirect test the wrong kinæsthetic 'copy' may become fixed. Now, the use of the afore-mentioned apparatus in correcting such an erroneous copy is to provide a visible test so that the correct movement may be noted among the random ones and repeated until it becomes fixed in place of the other. In teaching a new articulation it gives a familiar sign of the correctness of a movement whose copy may thus become fixed. The reviewer suggests that these methods may be valuable in teaching the deaf to speak.

The author passes hastily over variations in articulation because he has other points in view, but it seems especially important to know something of the exactness with which words are pronounced. If experimental phonetics is to maintain its claim to an exact method of perpetuating a language, the variations of the individual and of the individual from his fellows must be known. In any case this would be an important research from a psychological point of view.

As a whole, experimental phonetics is a laudable achievement and is one of the more recent triumphs of the exact method, but it is too early to decide upon its value as a method of instruction, when it can at best have only a limited application.

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The Memory Image and its Qualitative Fidelity. I. MADISON BENTLEY, PH.D. American Journal of Psychology, XI., 1, October, 1899, pp. 1-48.

The author tries 'to determine the exact place of the image in the memory consciousness' and 'to discover the changes which the image undergoes in the course of time'; to which are prefixed an examination of the place given to the image in the memory literature, and a discussion of the nature, function and genetic significance of the image. His experiments, conducted by the comparison method, consisted in presenting successively two shades of gray, made by a Marbe adjustable color mixer. A norm and two variations were used, one having 5° of arc more white, and the other 5° less than the norm, a difference considered to be about liminal. The subject judged whether the second shade, 5 seconds later, was the same as, or lighter or darker than, the norm. The experiments were carried out under two conditions of illumination. One set was done by diffused daylight and another in the dark room where the rotating disc was the only object affecting the retina. It was found that in the daylight the subjects judged the second stimulus to be darker, when it was the same, or lighter, more often than they did in the dark room. This Dr. Bentley conceives to mean that the memory grows lighter in the daylight and darker in the dark (p. 47), thus showing that the stimulated or unstimulated state of the rest of the retina plays an important part in the quality of the memory image. He finds that 'the tendency of the memory to lighten increases with the length of the interval between stimuli.' Other results are that from 2 to 6 seconds may elapse between stimuli without uniformly affecting the brightness of the memory image; that the infidelity (sic) of the memory image increases from 1 to 5 minutes, but the memory image itself is 'more readily producible after 5 minutes than after 1 minute.' The two methods above mentioned were supplemented by a third, a series of experiments having been performed in which the second stimulus was gradually altered until the subject thought it equal to the first; and three 'subsidiary methods' were tried and found unsatisfactory, viz.: recall and selection (different colored papers twice exposed); aqueous solution of pigment formed by burette droppings, which was found defective as an objective standard; and direct reproduction (the subject mixing and applying a color wash to paper).

It seems curious at first sight that a research nominally upon the qualitative fidelity of the memory image should yet be conducted in such a way that the actual presence of the memory image itself as a

part of consciousness during the period of time occupied by the experiment is not essential. But the fact remains that a record of images was kept showing that in one-sixth of the experiments the subjects had no visual image at all. Their introspection showed, instead, verbal mental content. They helped their memory for brightnesses by saying 'dark gray,' 'light gray,' etc., mentally. One with feminine *Apperceptionsmasse* interpreted the shades into likes and dislikes of gray cloth dress goods. From a comparison of the hundred imageless experiments, and the five hundred experiments that had images, with the accuracy of recall Dr. Bentley infers that an 'imageful recall' is better after a lapse of five minutes than after a lapse of one minute.

In connection with the interpretation and application of the foregoing experiments, two questions present themselves. (1) Does the comparison of two objective stimuli tell anything about the 'qualitative fidelity' of images, particularly when those images are of such a nature that they may or may not be a part of consciousness during the experiment? Is not the research, then, rather a quantitative estimate of retentiveness, especially that part of it concerning the effect of time upon the memory? (2) Why should experiments upon imagery, whether visual or otherwise, be concerned with memory work? To be sure, all images, as representations, are memory images; even the images which are the groundwork of the productions of creative imagination are memory images to the extent of being composed of elements belonging to the subject's past. But though all images may be regarded as memory images, and though by introspection much clearer insight may be gained into the processes of memory, much more will be gained by leaving the memory aspect of images out of account and paying stricter attention to the description of the images themselves and their relations one to another.

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COMPARATIVE PSYCHOLOGY.

On the Instincts and Habits of the Solitary Wasps. G. W. and ELIZABETH G. PECKHAM. Wisconsin Geological and Natural History Survey, Bulletin, No. 2, Madison, Wis., 1898. 245 pp. With plates.

Dürfen wir den Ameisen und Bienen psychische Qualitäten zuschreiben. ALBRECHT BETHE. Pflüger's Archiv, LXX., 1898. 85 pp.