THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS

VISUAL SPACE

BY GEORGE M. STRATTON

University of California

Degenkolb (4, 5) treats of the personal differences which appear in attempting to bisect a line—personal differences which promise, he believes, to have value for the diagnosis of cerebral disturbances. The line to be bisected is set at various angles upon a wall, or the top of a table and a fresh determination is made for each of the 18 or 36 positions which it occupies as it boxes the compass. And the results he thus obtains for each person are expressed in the form of an interesting graph, made by plotting in all directions around a central point the amount and direction of the error for each of the angles used in the original experiments. A line connecting these points gives a surface of various sizes and shapes, and with various directions of elongation and of nicking,—a surface which he calls the "*Raumumgangsfeld*."

He has experimented upon a number of patients with symptoms of disturbance of the aural labyrinth, and upon normal persons whose labyrinths have been artificially stimulated by rotation or by the galvanic current, and finds certain characteristic developments of the graph according to the nature and severity of the disturbance. The form of this graph or "field" differs for the same person under various conditions, and yet maintains a notable constancy of form—although not of size or of direction of elongation—for the same person. Persons are grouped by him according to the types of field which they display. The form of the "field" is modified not merely by the disturbances already noted, but ac-

cording as the bisection is made by the subject's right hand or by his left hand, or by the experimenter's hand guided by the word of the subject; it is modified also by the position of the head in relation to the neck and trunk as well as by the position of these other parts of the body. Indeed Degenkolb claims for his method a remarkable nicety and sensitiveness. These and various other normal and pathological observations point, so Degenkolb believes, to the existence of a special centripetal tract assumed by Sachs, passing to the parietal lobe,—a tract not concerned with light or color but only with sensations from the ocular muscles, the spinal joints, and the vestibular nerve. This hypothetical center in the parietal lobe, in which are represented (he supposes) the "goals" of all our ocular movements, Degenkolb proposes to call the "parietal retina."

Osborn, an expert on the identification of handwriting and of legal documents generally, sets forth in a brief and popular way, (13) the differences which observers show in the recognition and discrimination of such forms as are found in handwriting and typing. Material is described and illustrated for testing persons on their ability rapidly to select specimens that are from an identical source and to discriminate them from specimens from other sources. With different persons the number of the errors made and the length of time required varies greatly.

Mayfield (12) applies to the visual field the statistical method used by Urban with lifted weights. Experimenting upon the visual comparison of lines, he finds that some persons underestimate, while others overestimate; and therefore he can find no constant direction of error. The discriminative threshold for such lines has a mean amount of about 1.25 to 2.0 per cent. of the standard line he used.

Hoppeler (10) sought to determine the elevation at which one would judge a point of light in a dark room to be horizontal to the eye. With twenty observers of various ages and degrees of education, he found this elevation to be in general actually below the horizontal, the limits of the subjective horizon for all his observers being 2° above and 5° below the reality. The author would explain this result by the fact that the ocular muscles find their state of rest when the line of sight is slightly lowered,—that is, when the eye is in "the primary position" of the eye; and also because there is so little practical need of estimating by eye alone the precise horizontal direction.

Angell and Root (2) have ingeniously measured the distance to

which the after-image is projected in the field of the closed eyes. With the different persons on whom they experimented, this distance varies from about 6 cm. to 17 cm. Angell (1) discusses the discrepancy between these findings and those of Meyerhausen, whose measure of the distance was 2 meters. Angell, even when using Meyerhausen's method, is unable to arrive at any such result, nor is he able to explain the discrepancy. He lays some stress on the fact, however, that in Meyerhausen's case convergence seemed to have played a far more important part than it did with any of Angell's own observers.

A number of experiments of the year are as usual concerned with binocular depth. Dufour who annually reports facts, many of which are well known, this year emphasizes (6, 8) the amount of "play" which there is in what we call the "identity" of retinal points; he finds that impressions upon the two retinae may fall upon points that are without geometrical or anatomical correspondence, and yet be binocularly fused. Such fusion sometimes occurs after the surgical removal of the lens from one eye and when there has been a correction by common glasses; although now the images in the two eyes differ in size. He also takes stereoscopic cards and rotates one of the views in its own plane to find the limit beyond which the two views can no longer be combined. The eye, he finds, will tolerate a rotation of about 10° in either direction, a total of 20° ; and this he adduces to show how little of anatomic or geometrical precision there is in the "identity" of retinal points. He seems quite to overlook how much of this angle is compensated by actual torsion of the eye-ball, and cannot therefore represent the retinal disparity which binocular fusion must overcome. He finds, however, that this angular limit beyond which the stereoscopic views cease to combine varies from day to day, is markedly increased by practice, and is diminished by fatigue. The rôle played by fatigue in producing diplopia in his own case when there is latent heterophoria is also reported by Dufour (7).

Binocular fusion with no retinal disparity whatever,—the converse of that with which Dufour was mainly concerned—is the theme of Werner's report (14). Presenting to the two eyes patterns that are geometrically identical, he rediscovers the well-known fact that the apparent distance and size of the resultant object is affected by changes of convergence. When the patterns are such as to permit binocular fusion of certain parts only, so that these appear sharp and the rest is blurred, these sharper lines obtain what he

calls a "purely optical," as distinguished from an "oculomotor" stereoscopy.

Blumenfeld's investigation (3) is a development, in several new ways, of Hillebrand's "*Allee*" experiment, which has for years been a mild storm-center. The reader will recollect that when an observer looks between two rows of objects going off into the distance from his eye, and attempts to arrange these so that they shall seem to form two exactly parallel rows, certain remarkable errors occur, which for Hillebrand indicate how important is convergence for the estimation of the distance-apart of the successive pairs of objects that form the "*Allee*." Blumenfeld, after a historical survey, sets forth his own experiments which bring out afresh the fact that the two rows of objects must actually diverge as they go into the distance if they are to seem parallel; and moreover must be not straight lines, but curved; Blumenfeld finds that the direction of the curvature, however, differs with the mode of judging the relation of the receding objects, being mutually *inward* at the center when the subject attends to the general direction of the rows and tries to make these directions the same; but the curvature is *outward* if he tries to compare, one by one, the distance between the successive pairs of objects forming the two rows, and to make these distances equal. Since the form of the resultant "*Allee*" is thus so dependent upon the character of the attentive act, Blumenfeld contends (and, it would seem, justly) that it is idle to make convergence the sole determiner. Less important, although adduced by Blumenfeld to support his position, are his farther findings that the form of the "*Allee*" is influenced by the position of the eyes,—whether they are in the plane of the objects to be compared or are above them; and moreover shows the same general kind of variation when the observer uses but one eye as when he uses both. Blumenfeld is on the whole therefore opposed to Hillebrand's inferences, and looks sympathetically at the general method of explanation that makes much of the attention, as in the paper by Jaensch reported a year ago. Blumenfeld points out the interesting mathematical incongruity in his observer's judgments, inasmuch as an arrangement of points giving apparently parallel lines is nevertheless not seen to the observer to be equidistant; that is, the judgment of the *direction* of the rows does not exactly harmonize with the judgment of the lateral *distance* of their members.

Katz (11) found that in looking at paintings with a certain friend the depth-interpretation of the two observers was markedly

different. This led Katz to careful experiment upon his companion, using various drawings that in different degrees suggest a third dimension. The outcome is, that this subject is far readier than are most observers to accept such figures as "flat." And yet by willing it he can give them an exceptionally vivid plastic character. There is in his case an absence of the spontaneous interpretation of the signs of depth, possibly connected with the fact that he is a visualizer of a high order, but perhaps rather due to his special mode of attention. Katz points out the similarity of these findings to those of Karpinska, reported a year ago, who, working now with identical, now with disparate stereoscopic cards, found some individuals far more prone than others to give to these pictures a plastic form. Katz believes that his results tend to reduce the importance of lateral disparity for the perception of depth.

Dunan's long contribution (9) deals more with the psychology and even the metaphysics of space in general, and more especially with the long-standing conflict between Nativism and Empiricism. Defining Empiricism as the assumption that a given extension is perceived successively and by putting together the parts, while Nativism is the view that in our representation the whole exists before the parts, he surveys the discussion of space in modern philosophy. Expressing finally his own belief, he finds that in every attempt to define position—the position, say, where the *Titanic* went down—we push outward step by step toward a purely ideal system of positions which do not "exist" at all and yet are by no means mere nonentities. This ideal non-existent absolute space is therefore logically presupposed by us in all existent and empirical spaces. Thus he arrives at and defends anew a form of "Nativism."

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TACTUAL AND KINÆSTHETIC SPACE

BY HELEN D. COOK

Montclair (N. J.) State Normal School

Ponzo is continuing his work on cutaneous localization. He presents a study (4, 8) of the localization of sensations of warmth and cold. Selected cold and warmth spots on the finger, forearm, and upper arm were localized by the Weber method, and the results compared with similar tests in the localization of pressure and of pain sensations. The results show that (contrary to the usual view) pain is the most accurately localized, next pressure, then cold, and lastly warmth. For all four sensation qualities, the errors of localization are both more numerous and larger in the longitudinal than in the transverse direction. The author calls attention to the fact that this agrees in general with his earlier findings on the error of localization in the intercostal spaces,¹ since in the arm the largest nerve-trunks run in the longitudinal direction. Nervous innervation in the forearm is, however, much more complex than that of the intercostal spaces. Ponzo's study (7) of the effects of practice on the accuracy of localization merely repeats material already reported in another place.²

The same author (5, 6) attacks the problem as to whether or not a tactile sensation comes into consciousness with its "local sign" already given, i. e., whether the consciousness of the localization of a touch sensation is simultaneous with the consciousness of the quality

¹ *Arch. ital. de biol.*, 1911, 56, 193-201; reviewed in this BULLETIN, 1913, 10, 259-261.

² *Riv. di. psicol.*, 1912, 8, 390-407, reviewed in this BULLETIN, 1913, 10, 260.