

dispassionate "War Book of the German General Staff" (4), recently translated. The object of warfare is the complete destruction of the enemy's material and mental (*geistig*) resources; the suffering inflicted should be mitigated, however, in so far as this is compatible with the primary purpose.

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VOLUNTARY PHENOMENA

BY R. S. WOODWORTH

Columbia University

Hammer's experiment (3) is of considerable interest. His subject, watching the movement of an artificial star carried by a pendulum, was to react with the finger synchronously with the passage of the star behind a vertical hair (the "transit" observation). Sometimes, however, the star was extinguished shortly before transit, and the subject was then to omit his reaction. When the star was extinguished as much as 300 σ before transit, the reaction could always be inhibited; less than 200 σ , never. Between these limits, more or less frequently. Feelings of tension were observed as the star approached the line, and feelings of release as it moved away, in the preliminary swings that were allowed before the swing during which the reaction was required. The hand seemed to be rehearsing its reaction in these preliminary swings. It was clear that the reaction began, internally, some time before the actual movement, developing gradually and agreeably, and at first outside the field of attention; unless the subject's "disposition" was unfavorable, when a disagreeable moment of sudden decision occurred, with a delayed reaction. If, now, the star was extinguished very early in its swing, before the impulse to reaction had begun to develop, there was no counter inhibitory impulse, but

simply a "standing pat." When the disappearance of the star came later, there were conflicting impulses toward reaction and inhibition; and the later it came, the stronger was the reaction-impulse, and the more difficult of inhibition. If the disappearance came too late, the inhibitory impulse failed altogether to develop, the subject accepting the situation without struggle or unpleasant feeling. When the struggle was close, the feeling was very unpleasant; when the inhibitory impulse had an easy victory, the feeling was one of satisfaction.

As a voluntary act for introspective analysis, with objective registration also of reaction time and of breathing and pulse, Kramers (4) chose the recognition of four-place numbers, previously shown, with reaction by finger movement—the instructions sometimes calling for reaction with recognition and non-reaction with non-recognition, sometimes for the reverse, sometimes for reactions with different fingers to recognized and unrecognized stimuli. The purpose in thus varying the instructions was to facilitate introspective study of the process of reaction. It was found much easier to connect reaction with recognition than with non-recognition, the latter requirement often leading to false reactions. This fact is interpreted in terms of the Wundtian feelings; in recognition the feeling is one of release, in non-recognition one of tension; and the reaction-feeling, being itself one of release, fuses more readily with the recognition feeling than with that of non-recognition into a total-feeling from which the voluntary act can develop. There are other similar observations, similarly interpreted; but the author himself prefers not to insist on his results, believing that his contribution consists mostly in opening up the problem and suggesting methods. He suggests that retrospection may be either immediate ("reaperceptive") or delayed ("reproductive"), the former being suited to bringing out what is peculiar to a single experience, and the latter, carried out after a long series of similar experiences, being suited to the discovery of what is common to all of them. This reproductive retrospection is apparently identical with the old "reflexion," which psychologists have been trying to banish from the science. The author gives no clear-cut instances of results gained by this method.

Bauch (1) follows up the work of Marbe and others on "uniformity of reactions," the best-known expression of which is found in the "frequency tables" for free association, by allowing his subject a choice of several arm movements, with instructions, however,

to execute the movement as rapidly as possible. On a horizontal table, seven points were placed at distances of 160 mm., forming a regular hexagon with its center, and, the finger being placed on any one of the points, was moved at a signal to any other point, while the reaction time in starting and the duration of the movement were recorded by Marbe's smoke method. From each starting point, some one terminal point was more frequently, and usually much more frequently, chosen than any other. The frequent movement was more rapid than the less frequent, was more often flexion than extension, and, as shown by supplementary observations, was apt to be judged the easiest or most convenient movement from the given starting point. The result, then, comes apparently to this, that the easiest and quickest movements are commonly selected when rapidity of movement is desired, and that they are either known from past experience or quickly discovered in the course of a series of trials.

Bleuler (2) attempts to show how the concept of "*Schalten*," or switching in the nerve centers, affords a basis for accepting psychic causality and the reality of will. The path and outcome of a reaction are not determined wholly by the stimulus, but partly by central influences which shunt it in or out, hither or thither, and thus inhibit, release or direct it. The whole personality is concerned in these switching operations, and the act of will consists in the influence thus brought to bear by the personality on the outcome of any single reaction. Voluntary action differs only in degree from emotional and reflex action, which also are subject to switching; and, in fact, there is no difference in principle between physical and psychical causation.

Among other interesting observations by Sano (5) on the behavior of the inhabitants of Antwerp during the bombardment, is the following which bears on the study of will: without much sign of fear, introspective or objective, there was so great an absorption in the condition of affairs that serious work on any other subject was impossible, while there was an overflow of energy into such channels as talking and letter-writing. Those who fled to Holland showed extraordinary resistance to fatigue, a fact which leads the author to conjecture that, in spite of the absence of violent emotion, the adrenals may have been stimulated as in fear or rage.

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LOCOMOTOR FUNCTIONS

BY H. C. STEVENS

University of Chicago

The articles summarized in this review fall rather definitely under three headings: the energy relations of functioning muscles, physiological experiments on the locomotor reflexes and pathological observations on disturbed locomotion. Benedikt (1), in addition to describing a case of paralysis of the muscles supplied by the peroneus and the tibialis nerves, applies Watt's formula to the performance of any muscle. According to this formula, the efficiency of a muscle is represented by mht , the product of the muscle force, m , into the distance, h , through which the muscle acts, and t , the duration of the action. The energy transformations of man upon a horizontal path are calculated by Brezina and Reichel (2), from experimental data determined by Brezina and Kalmer in 1911. The problem of the relation of the size of the animal body to the velocity of locomotion is attacked by DuBois Reymond (4) on the basis of experimental observations made by O. Fischer. DuBois Reymond questions the conclusions of Fischer that the law of corresponding velocities applies to human beings as well as to inanimate self-propelling objects such as ships. The law is stated as follows: if the resistance of the water to a ship of the size, l , with a velocity, v , is equal to r , then the resistance of a ship of the size, nl , with a velocity $v\sqrt{n}$ is equal to n^3r^2 , *i. e.*, is proportional to the cubic contents. It has been supposed that the same law holds for human locomotion. Therefore with equal muscular effort, the velocity of larger and smaller men would be proportional to the square root of the length of the body, *i. e.*,

$$\frac{v_1}{v_2} = \frac{\sqrt{l_1}}{\sqrt{l_2}}$$