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MENTAL SCIENCE.

The Rivalry of Mental Impressions.

WHENEVER two or more impressions are presented to the mind at the same time, there results a rivalry between them in attracting the attention and getting into the focus of consciousness. Usually the attention is divided between them, though this flitting of the attention is at times so rapid and so unconscious that we hesitate to believe that it has really taken place. If the one process is automatic in character, or nearly so, the interference is reduced to a minimum. When both processes are voluntary, mutual interference is inevitable; and its extent will depend upon the complexity and other characteristics of the task, and will doubtless vary, too, with each individual. Some simple experiments in this field by M. Binet, though they hardly do more than open out the possibilities of research in this direction, may be here recounted for their general interest and suggestiveness. The subject of the experiment is asked to take hold of a rubber bulb connected by means of a tube with a recording apparatus consisting of a point raised and lowered by the air-pressure within the tube, and writing upon a smoked surface fastened to a rotating drum. He is required to press this bulb once a second, and the result is a tracing on the smoked surface showing very regular curves. With this is compared the tracing produced when at the same time he is required to perform some simple mental exercise, such as reading aloud, adding or multiplying numbers, and the like. The most usual result is that the intervals between the pressures are lengthened, with some persons only slightly, with others more noticeably; and in some cases the pressures even cease altogether for a brief period. Very frequently, too, the movements are less forcible, so that the curves are not as high as normally. Again, let the subject be told to make a series of five pressures, then allow a second's interval and begin another series of five; and so on. This is done very constantly and regularly; but, if the subject performs another task at the same time, we have, in addition to the other irregularities, an irregularity in the number of pressures in a series, sometimes only four, and sometimes six. Sometimes the interval is neglected or two pressures overlap, and in every way the mental friction and inco-ordination is shown. The pressure upon the rubber tube, in turn, interferes with the mental task, although this cannot be so accurately noted. The addition of simple numbers takes considerably longer than normally, and the result is often wrong. M. Binet notices, too, that the pressures soon get to be done subconsciously, the subject not knowing at the end of the experiment whether he has made an error, or has written irregular curves or not. The pressures thus become more or less unconscious while still remaining voluntary. It is interesting to note, that, if the pressure be done by both hands, the errors and irregularities are the same. If, for example, the one hand presses four times instead of five, while its owner is engaged in some mental task, the left, pressing at the same time, will also write four instead of five curves, thus indicating that one volition brings about both actions. The degree of interference depends upon the nature of the two tasks; and if we keep the one task the same, and vary the other, we have a kind of test of the power of an individual to do two things at once. It was found that some subjects could perform simple additions and keep up a series of two pressures in a second, but not with more than two; others could keep up as many as five in a series. But all these actions are extremely fatiguing, and some individuals refused to go on with them on account of the headaches they are apt to produce.

A different aspect of this interference is revealed when the two hands attempt to make two different movements at the same time. In all such cases there is great mutual interference, not alone because the two tasks are closely similar, and so employ allied brain-centres, but especially because the movements of the two hands are subject to a special co-ordination, and their disassociation is proportionately difficult. If one hand attempts to draw curves and the other straight lines, the curves will be somewhat straightened out, and the straight lines somewhat curved. If the one hand is to beat two beats to every five of the other, this may be done correctly for a time, but soon the two tend to beat the same number of times. If one hand attempts to write a sentence while the other draws circles, the writing and the circles will both materially suffer. All this when the two tasks are different: if the two hands make the same movement, they seem to aid each other, and especially does the preferred hand (right or left handedness) help the other.

M. Binet has studied another phase of the subject, introducing us to a quite different order of mental phenomena. If the attention, instead of being divided between the operations, is sharply concentrated upon one, we approach the case in which a person abstractedly does one thing while his attention is devoted to another, — an artificial absent-mindedness, which, as usual, implies an extreme "present-mindedness" in another direction. The subject is given something to read, and his one hand he is told not to consider at all. If the attention be sufficiently engrossed (and this can be done with only a few subjects), the hand will reproduce slight movements imparted to it by the operator in total unconsciousness of their origin. Such movements are spoken of as automatic movements. These are of a quite different character from the foregoing; for while there the two acts interfered with each other, and the more so the less intense the effort to produce them both, here the two acts do not interfere with each other, and are best performed when no conscious effort at all is made. This difference M. Binet

regards as important enough to warrant the reference of the latter to a different stratum of the personality, a different *ego*. The reason of this is, that in the case of the voluntary movements we have a mental representation of the act about to be done, and we unite its elements into a single idea. As this becomes difficult by reason of the disparity of the various acts, the evidences of mental conflict become prominent. On the other hand, in the automatic acts no mental representation is present to the mind, and therefore no conflict arises. In brief, we can do two things at a time with advantage in two quite different ways. The first is when they contribute to the same end, such as the different movements of the two hands of the pianist or the violinist, and so on; the second, when the one is done automatically and unconsciously; and both of these capabilities will vary very considerably in different persons.

M. Binet has reduced to experiment a further class of automatic reproductions. We all appreciate the tendency to beat time when listening to a lively musical production, or the unconscious adaptation of our gait to the selection of a band on the street. The same fact is shown in the case of an hysterical subject in whose hands is placed a recording dynamometer while a metronome is beating in the room. The result is an unconscious series of pressures to the time of the metronome beats.

THOUGHT AND RESPIRATION. — The experiments of Professor Leumann indicating the adaptation of the rate of reading, and possibly of other mental work, to such physiological rhythms as the respiration (v. *Science*, Nov. 22, 1889), have called forth some interesting comments upon his thesis. Attention has been directed to the analogy between this and the methods adopted by the Yogi to reach the condition of abstract contemplation and rapt ecstasy. Professor Max Müller contributes some extracts from the Sanscrit *Yoga-sûtras* describing this *prânâyâma*, or expulsion and retention of the breath for the purpose of steadying the mind. The Yogi must assume a firm and easy position, and then begin to regulate his breath. He draws it in through one nostril, pressing his finger on the other, and then, after retaining it some time, emits it through the other nostril. "All the functions of the organs being preceded by that of the breath,—there being always a correlation between breath and mind in their respective functions, — the breath, when overcome by stopping all the functions of the organs, effects the concentration of the thinking principle to one object." The time devoted to each of the three factors is regulated by so many repetitions of the syllable *om* or other mystic formula, or by turning the left hand round the left knee a given number of times. The time devoted to inspiration is the shortest, and that to the retention of the breath the longest. The operation is performed as a preparation for an abnormal mental state in which incredible powers are exemplified. The theory of the process is thus given in a commentary. "By the motion of the breath the thinking principle moves; when that motion is stopped, it becomes motionless, and the Yogi become firm as the trunk of a tree: therefore the wind should be stopped. As long as the breath remains in the body, so long it is called living. Death is the exit of that breath: therefore it should be stopped." Another writer, Mr. Ley, notices the use of deep and rapid respiration as an anæsthetic. Some dentists ask their patients to breathe quickly and fully some four or six minutes, at the end of which the patient becomes giddy, to some extent loses consciousness, and a short operation may be painlessly performed. While in this condition, the patient has no power to move his arms, but will open his mouth at the bidding of the dentist (v. *Nature*, Feb. 6, 1890).

HEALTH MATTERS.

THE ORIGIN OF FEVER.—M. Roussy, in a paper read before the French Academy of Medicine by M. Schutzemberger, states that fever is often the result of soluble non-organic principles, but of microbian origin, being introduced into the animal economy. He has ascertained, according to the *British Medical Journal*, that injecting into the blood or under the skin water in which different organic matter has been macerated also determines a febrile condition. M. Roussy has isolated the pyrexogenic element, and concludes from the results of his experiments that certain diastasis or zymosis (soluble ferments) have a febrile influence: the water in which the yeast of beer has been macerated is an instance. M. Roussy used the same method as M. Berthelot for obtaining "invertine," and it is possible that the body discovered by M. Roussy is identical with the invertine.

EUROPEAN INFANTILE MORTALITY.—We learn from the *Medical Record* that a comparative study of infant mortality in different European countries has been made by Dr. Fodar, with the following results: of 1,000 children born alive, 106.3 die during the first year in Norway, 137.1 in Sweden, 154 in England, 169.1 in France, 217.7 in Prussia, 220.1 in Italy, 254 in Hungary, 258.2 in Austria, 317.1 in Bavaria, and 329.5 in Wurtemburg. With regard to Bavaria, there is considerable difference in the infant death-rate in different districts. Thus in Suabia it reaches the enormous figure of 409 (nearly four times as great as that of Norway), and in Upper Bavaria it is 406, while in the Bavarian palatinate it is only 187. From these statistics it would appear that the hygiene of infancy is better understood in Norway than elsewhere, and that German nurslings are either particularly delicate or particularly unfortunate in the mode of their bringing up.

THE FATE OF CADAVERIC MICROBES.—It is a comfort to learn, on the authority of M. Esmarch, that most pathogenic microbes succumb sooner or later after their victims have died. Experiments were carried out with nine different micro-organisms, says the *Medical Press*, and the bodies of the animals on which they had wreaked their wicked will were either buried or kept under water, or exposed to the air. The bacillus of septicæmia survived ninety days, while that of anthrax disappeared within a week. The bacillus of fowl cholera was seldom found after three weeks, but the tubercular microbe did not lose its virulence until 204 and 252 days had elapsed. All trace of the other organisms was lost in from three days to a week, including those of typhoid-fever, Asiatic cholera, and tetanus. As a general rule, the more active the decomposition, the sooner did they perish, and this is another argument in favor of "earth-to-earth" burial, pending the universal adoption of cremation.

RECENT SAVING OF LIFE IN MICHIGAN. — In a carefully prepared paper read before the Sanitary Convention at Vicksburg, the proceedings of which are just published, Dr. Baker gave official statistics and evidence which he summarized as follows: "The record of the great saving of human life and health in Michigan in recent years is one to which, it seems to me, the State and local boards of health in Michigan can justly 'point with pride.' It is a record of the saving of over one hundred lives per year from small-pox, four hundred lives per year saved from death by scarlet-fever, and nearly six hundred lives per year saved from death by diphtheria, — an aggregate of eleven hundred lives per year, or three lives per day, saved from these three diseases. This is a record which we ask to have examined, and which we are willing to have compared with that of the man who 'made two blades of grass grow where only one grew before.'"

GASTRIC JUICE AS A GERMICIDE.—Drs. Straus and Wurtz have conducted a series of experiments in order to ascertain the action of the gastric juice on the bacilli of tubercle, charbon, typhoid, and cholera-morbus. The gastric juice from man, dogs, and sheep was selected for the experiments. It was found, as stated in the *British Medical Journal*, that digestion for a few hours at a temperature of 100° F. destroyed all the germs. The bacillus anthracis was killed in half an hour, the bacillus of typhoid and cholera in under three hours, while the bacillus of tubercle bore digestion for six hours, under which time it was still capable of provoking general tubercular infection. Even when digested for from eight to twelve hours, the