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ALL THE STATES OF SOUTH AND MIDDLE AMERICA have of late years shown great solicitude about the condition of the national education, but none more so than the Argentine Republic. Dr. J. B. Zubiar has just published a little pamphlet entitled "Quelques mots sur l'Instruction dans la République Argentine" (Paris). He is inspector of the national schools and training-colleges, and was his country's delegate at the last Paris exhibition and at the pedagogical congress held on that occasion. The object of his pamphlet is to show to the civilized world what progress the Argentine Republic has made since it succeeded in shaking off the clerical government of Spain, which had for three centuries held it down. The following facts need no comment. In 1810 the only places where teaching went on were a theological college and a few schools kept by priests, who taught the young idea how to shoot chiefly by means of the cane. In 1888, after fifty years of independence, there are for the forty million inhabitants two universities with three faculties each, 15 colleges, 34 training-colleges with 758 professors and 11,365 pupils, 2,263 elementary schools with 4,744 teachers and 175,239 pupils (which gives an average of 34 to each class only), and, besides, 831 private elementary schools with 1,094 teachers and 33,723 pupils,—altogether 3,227 schools with 254,608 pupils. In commenting on this report, the *Journal of Education*, London, states that the great impulse to education was given by the law of 1789, and ever since the work has rapidly extended. In one year, 1887–88, there was an increase of 109 schools, with 1,000 teachers and 27,158 pupils.

MENTAL SCIENCE.

A Study of Movements in Young Children.

MODERN science attaches great importance to the study of beginnings, and such study is quite as promising and interesting in the field of mental as of physical facts. The origin and growth of human faculty as exemplified in the development of the child claims an especial importance on account of its very general and educational interest. Quite a number of child biographies have been written from this point of view, and the period has now come when special studies of particular lines of development and acquisition of faculty are made. A recent study by M. Binet (*Revue Philosophique*, March, 1890) deals with the following four points: the co-ordination of movements in walking, the bilateral character of movements, automatism in movements, and re-action times.

The study of how children learn to walk has been confined mainly to determining the age at which independent locomotion begins: this in the average of a number of infants was found to be at about eighteen months. It varies considerably with the health and growth of the child, and also with the degree of attention the child gives to the learning of it. M. Binet tells of two sisters, the elder of whom learned to walk at twelve months by carefully and persistently leaning on one chair, feeling the way to the next, and so on; while the younger, who was stronger and had every opportunity of learning quickly, made very intense but irregular efforts to walk, and did not succeed until her fifteenth month. This difference of character has been maintained, the elder being calm, serious, and not easily distracted, while the younger is exuberant, easily distracted, and volatile. The origin of the tentative movements resulting in walking, Preyer regards as instinctively inherited, and in this opinion M. Binet concurs. The latter observed in an infant only three weeks old alternate movements of the legs when the child was held with the legs free to move, and the soles of the feet were in contact with any substance. Repeated experiments showed that if the child were held with its feet above the ground, no such alternating movements of the legs occurred, but as soon as the feet touched the floor these movements were reflexly excited. This seems to indicate that the movements of walking are instinctive; it also indicates that the fact of walking being a power which the child acquires somewhat late does not interfere with its instinctive character.

If one observes the spontaneous, explosive movements of the arms and legs of infants a few weeks old, one will notice a great preponderance of bilateral movements; the two arms or the two legs moving together, or, if not quite together, alternating so rapidly as to amount to the same thing. The contrast in this respect between the infant and a child of two or three years is very marked. Of 57 movements made by an infant one week old, only 13 were unilateral, 25 were bilateral, and 23 of the rapidly alternating kind. This tendency towards bilateral movements can be observed in older children. Rubber tubes were placed in the hands of a three-and-a-half-year-old child with the request that at a given signal she should press only one of the tubes. The record showed very frequently that both were pressed, and other irregularities occurred. In connection with these movements, M. Binet's attention was called to the expression of fear in the child when not securely held. This was very evident by its crying, which ceased as soon as the child was securely held. This occurred before the child had had a fall, and so would suggest a sort of instinctive fear of falling,—a fear which does not exist with regard to fire, for instance.

Recent researches have attached great importance to the phenomena of automatism, or the subconscious reception of sensation, and execution of appropriate movements. In a single child such automatism was evident during the first six months of life. If the child's hand were open, a light pressure on the thumb sufficed to make it close, and when closed a stroking of the back of the hand opened it. This succeeded as well whether the child was awake or asleep, whether the child directed its attention to the hand or not. The same automatic faculty comes to the front in many ways. If a child's interest is held towards a certain point,

one may slip a key or other object into a child's hand and have it held until the hand opens and the key falls, evidently without the child's knowing it. The ease with which a child may be distracted is well known. A crying child is appeased by drawing its attention away from the source of trouble. The case is cited of a child much put out by being presented to strangers, but who at once stopped crying when a match was lit. As soon as the match went out, the crying recommenced, and so on, for several minutes. We here see an alternation of the mental view that would be regarded as abnormal in the adult. The contrast between this and the elaborate means necessary to gain mental diversion in adult life is certainly striking.

The time of mental acts can be studied in children old enough to understand what is asked of them. Ordinary observation shows that children are slow in responding to a stimulus. Actual measurements were taken by having children press upon a tube as soon as they heard a sound. The average adult time for this re-action is .14 of a second. Children from four to seven years old require over half a second to do the same thing. The times, too, are irregular, from a minimum of one-fifth of a second to a maximum of a second or more, indicating an irregularity in the power to fix the attention upon so artificial a task. When the time was measured, the curve of contraction was also written. This in the adult is a quick, sudden stroke, occupying about .34 of a second. In three of the children the movement occupied over half again as much time, and in one child was as long as two seconds. This suggested a test of the maximum number of pressures a child and an adult could make in a given time. The adult makes 18 (in an extreme case 27) in 4 seconds, while the children averaged only 9 pressures in the same time. We have thus indicated in a variety of ways the gradual development of human faculty, as well as the unconscious education we pass through in childhood, and the means of educationally utilizing it.

The Sensations of Movement

We are getting to appreciate more and more how much of mental life is founded upon the information obtained through the contraction of muscles. The exact determination of how this knowledge is obtained becomes correspondingly important. A recent study by M. Bloch sheds interesting light on some phases of this question (*Revue Scientifique*, March 8, 1890). It is to be observed at the outset that we have no direct knowledge of the muscular changes produced in the muscles themselves when they contract. When we close the hand, all the sensation is in the hand itself, while the muscles whose contraction brings on the movement are farther up in the fore-arm. It is, then, from the sensations of compression of the skin and the movement of joints that we obtain our notions of movement. There are indeed certain secondary associative contractions of muscles, coming a slight fraction of a second after the contraction of the muscle we innervate, that seem to tell us of the realization of the intended contraction. While thus ignorant of the means of muscular contraction, we can direct its extent and direction. We can set the vocal chords to sing a certain note, but in many cases these adjustments are simply a series of tentative attempts, and even then liable to some considerable errors. For the motions of the arms this was tested in the following way. The two leaves of a screen standing at about an angle of eighty degrees to each other had their sides covered with ruled paper, and the general problem was for the observer in a definite position in front of the screen to find with the two arms corresponding places upon the two leaves of the screen. The movements of the two hands were most nearly alike when the movements were nearest to the body and near the line of the eyes, although the eyes in these experiments were of course closed. The difference in position of the two hands is about 1 centimetre in this region; this when the two hands are moved together. If the one hand is placed, and the other is to find a corresponding position, then the task is much more uncertain, and the error larger; the error being 5 centimetres, where it was but 1 centimetre before. If this process depends upon the contraction of muscles, then the error should be larger if the one arm is moved passively by an assistant, while the other arm finds the position in which the first was placed. An actual test showed that under such conditions the process is quite as exact as before. This independence between the perception of the position of our limbs and the muscular contraction was further shown by placing the wrist of one hand through a ring suspended by a rubber band from the top of the screen. To find a place low down on the screen, the hand must pull against the rubber band, and this should make all the adjustments too high; but no such effect occurs. Again, if a weight of 2 kilograms be attached to either wrist, it does not change the accuracy of the adjustments. Another kind of muscular sensation was tested by taking a number of leaves of a book in between the thumb and forefinger of one hand, and finding with the other an equal number of leaves. This error for a small number of leaves was about one fifteenth the number of leaves, but for a larger number this ratio decreased. It makes some difference whether the right or the left hand is the judging hand; and for M. Bloch, who is left-handed, the left hand feels lengths as larger than equal lengths in the right hand.

We also have no definite knowledge of the precise time of a muscular contraction. If we attempt to beat time with a metronome by the rhythmical contraction of a muscle, we imagine that we begin the motion as the metronome beats; but in fact it is the end of the movement that coincides with the beat of the metronome, the real contraction preceding it by a considerable fraction of a second. More curiously still, if an impulse is sent out at the same time to a muscle near the brain (say, the muscles moving the jaws) and to muscles far away (say, those moving the foot), the impulse will reach the foot later. If, now, we keep time with a metronome by alternately contracting the jaw and the foot, then we really begin the movement of the foot earlier than that of the jaw, so that the close of the movements shall coincide with the sound.

The intensity of muscular sensations, M. Bloch subjected to only a very rough test. After many unsatisfactory modes of testing, he used a form of balance, on the short arm of which was suspended a constant weight, and along the long arm of which the finger moved, keeping the beam horizontal. The finger was placed in a certain position, and then moved as little one way or the other as was necessary to tell that the pressure had changed. From this the ratio of pressures at the two positions was calculated, and found to be about 1: 4.3. In this both the muscle sense and the pressure-sense are used. To rule out the former, a brace was placed above the beam, so that the weight pressed against the finger, but the latter need not support it. The ratio thus determined was 1:3. The pressure-sense was eliminated by wrapping thread around the finger, and then the sensibility was determined to be 1:2.5, so that both these senses contribute to the common result.

BOOK-REVIEWS.

A Primer of Phonetics. By HENRY SWEET, M.A. New York, Macmillan. 16°. 90 cents.

THIS work makes use of "Visible Speech" to teach the elements of phonetics, and to denote the analysis of English, French, and German sounds. All the details of "Visible Speech"—its organic and phonetic classifications, its terminology, and even its symbolic notation—are borrowed in wholesale, in a way that, however flattering to the author of the system, cannot be satisfactory to its students: for Mr. Sweet has made "a few modifications" of the symbols; and, notwithstanding that these have been repudiated by the author of "Visible Speech" as not in harmony with the fundamental principles of his system, they are here incorporated with it, without any indications to distinguish the innovations from the original parts of the scheme. The "Visible Speech" notations should at least have been shown in comparison with the substitutions, so that a student might use the one or the other, as his preference might dictate. Without the symbols themselves, the objectionable character of the "modifications" cannot be made clear; but the ground of the objections will be understood from the statement that the mutual relations of the