

value for each of the elements f of a set, can be transformed into a Stieltjes integral. By making use of the univocal correspondence, established by Peano, between the points interior to a rectangle and the points on a segment of a line, functionals depending upon two arbitrary functions can also be reduced to simple Stieltjes integrals.

The subject of the fifth lecture, which was given by Prof. Nörlund, of Copenhagen, was "Les équations aux différences finies." The lecturer gave a very complete discussion of the solutions of equations of the types

$$\frac{1}{2}\{\phi(x+\omega)+\phi(x)\}=f(x), \quad \frac{1}{2}\{\phi(x+\omega)-\phi(x)\}=g(x).$$

In an interesting communication Prof. W. H. Young proposed a new definition, which does not involve an approximation by means of tetrahedra, for the area of a curved surface. The proposal is, first, to define the "area of a curve" as the square root of the sum of the squares of three integrals of the form

$$\int y dz - z dy.$$

Then, the surface being determined by the equations

$$x=f_1(u, v), \quad y=f_2(u, v), \quad z=f_3(u, v),$$

suppose the domain of u, v to be divided up into elementary rectangles in the u, v plane. The area of the surface is the limit of the sum of the areas of the corresponding elementary curves.

Prof. Weiss, the director of the Strasbourg Institute of Physics, gave an account of the methods of sound-ranging in use in the French Army during the war. The method normally employed was the same as that in use in the British Army. A useful alternative was the method à courtes bases, in which six or more microphones were placed in pairs. The microphones

of each pair were about a hundred metres apart, so that the gun locus became a straight line (asymptote), and at once gave the direction of the hostile gun. The installation was very simple, and could be made in an hour, while single sets of observations could be reduced and reported in a minute. This method was used, not for the accurate location of gun emplacements, but for determining quickly which one of the known hostile batteries was in action. Guns were also successfully located by observations of the *onde de choque*. The normals to this wave-surface determine a caustic which is nearly constant in form for high-velocity shells. To locate the gun emplacement, a standard caustic drawn on tracing-paper was fitted by trial to the normals determined by the instruments. This method was used when atmospheric conditions made the spherical wave imperceptible, and, although less accurate, it gave very good results. A case was quoted where 80 per cent. of the hostile emplacements were correctly located solely by *ondes de choque*.

In the course of the congress receptions were held by the Committee of Organisation, the Société des Amis de l'Université de Strasbourg, the Mayor of Strasbourg, and the Commissaire Général (M. Alapetite).

At a concert organised by the Société des Sciences du Bas-Rhin, the delegates had the pleasure of hearing's *Elsasslied* sung by the mixed choir of the Concordia-Argentina Choral Society. The delegates were entertained at the conclusion of the proceedings at a banquet given by the Organising Committee.

The invitation conveyed by Prof. Leonard Dickson to hold the next congress in New York in 1924 was accepted, and a further invitation was received to hold the congress of 1928 in Belgium. H. B. H.

Disorders of Symbolic Thinking.

DISCUSSION AT THE CONGRESS OF PHILOSOPHY AT OXFORD.

SEVERAL subjects of direct scientific interest were discussed at the Congress of Philosophy held at Oxford on September 24-27. One of the greatest importance, because based on recent clinical and experimental research, was the discussion introduced by Dr. Henry Head in a paper entitled "Disorders of Symbolic Thinking due to Local Lesions of the Brain." It raised the whole problem of the relation of language to thought while concentrating attention on the significance of certain definite observations—cases of young men who had received cerebral injuries in the war—in which the injury to the brain had affected the power of articulation.

Dr. R. Mourgue, of l'Asile de Villejuif, also contributed a paper, and was announced to take part in the discussion. He was unable to be present, however, and his place was taken by Prof. Bergson.

Dr. Head said that his general conclusion from the cases he had studied experimentally, where gross destruction of brain-tissue had resulted in loss of speech, was that there always remained elements in thought which were not associated with words. Speech is a discriminative movement capable of fine degrees of adjustment, essentially an intellectual mechanism. Even in the gravest cases of aphasia the patient is evidently fully aware of his emotions, and can express them clearly in gesture and action. Under the influence of emotion he may even use words or phrases which he is quite impotent to evoke voluntarily. Speech can be disturbed, or even totally lost, without reducing the patient's intellectual capacity or of necessity producing grave intellectual defect. All the early work of investigation of aphasia

had been vitiated by the conception that speech was a well-defined intellectual function, strictly localised in some particular site in the brain. Attention was concentrated, therefore, on correlating the extent of anatomical destruction on this site with the character of the disorder of speech. The fundamental error at the root of all this work is its ignoring of the physiological changes which intervene between the anatomical lesion and the psychological states with which it is associated. Destruction of the substance of the brain disturbs the act of speech only because it interferes with the physiological processes necessary for its perfect execution.

Dr. Head then described the nature of his experiments and the means he had devised to discover the physiological processes with which the particular injuries had interfered. In the older theories auditory images were supposed to be responsible for "memories" of words, and these were said to be stored up in certain areas of the cortex. The hypothesis is entirely unable to explain the phenomena of aphasia. Patients who cannot name consecutively a series of objects in front of them can choose them correctly when the name is given either orally or in print. It is the name, not the auditory image, which is lacking. The loss of the power to use words is not due to a destruction of images.

What, then, Dr. Head asked, are the functions which are disturbed in aphasia? The true answer had been given so long ago as 1868 by Hughlings Jackson, though its significance was not then seen. The chief mental activity disturbed by unilateral lesions of the brain was declared to be the use of words in proposi-

tions. The loss of function in aphasia might therefore be indicated as that of "propositionising." But though this term suggests a conception which covers the larger number of facts, it does not comprise every aspect of the loss of function. Dr. Head suggested, therefore, that these functions should be spoken of as "symbolic thinking and expression," though even this phrase does not quite satisfactorily define the group of processes affected. It is not all symbolic representations, but symbols used in a particular manner which suffer in these disorders. There are four fairly well marked groups of functions into which he now proposed to divide "symbolic thinking and expression" on the ground that they are dissociated in different ways under the influence of organic injury. These are (1) verbal defects, (2) syntactical defects, (3) nominal defects, and (4) semantic defects.

Dr. Mourgue's contribution was in no sense opposed to Dr. Head's conclusions. It dealt with a rather different aspect of the case, and seemed indeed to supplement the general theory in a remarkable way. Dr. Mourgue had given particular attention to some characteristic cases of aphasia in which the sufferers were themselves skilled in the treatment of the disorder and able on recovery to record and analyse their experience. The particular cases cited were the autodiagnosis of Dr. Saloz and Prof. Forel, and also a case recorded by van Woerkem. In all these cases the speechlessness of the aphasic state was comparable with the kind of indistinctness of psychical elements often experienced in the dream state. There was complete preservation of intuitive thought, but absence of imagery, or at least of verbal imagery. The will is unaffected, and may even show exaltation, but there is an absence of discrimination and differentiation—characters which, from a somewhat different point of view, Prof. Bergson has described as essentially belonging to intelligence.

Prof. Bergson said that the communication which Dr. Head had presented constituted a complete rejection of the theory of aphasia which for a long time had been classic. It offered in its place the quite new theory that aphasia was the disorder of a special faculty of symbolising, which might be said to be a certain aspect of intelligence. The classical theory of aphasia might be described as a complete metaphysic. So long ago as the years 1892 and 1893 he had himself been led by a question of pure metaphysics to study the relation of mind and body. He found that philosophers had given us only very vague ideas on this subject, and he determined, therefore, to study the facts of the relation without any philosophical presuppositions. It was extraordinarily ambitious, for he had no technical scientific equipment. Gradually, however, the problem of the relation of mind and body transformed and narrowed itself into the problem of the relation of memory to the brain, then of the memory of words, and then of the meaning of words. Surprise followed surprise. The theory of Broca then held the field, complicated by the work of Kussmann and Lichtheim. Nerves converge on nervous centres, there are strange communications between the centres, the path from A to B is not the same as the path from B to A, and every theory called for some new theories to explain each particular case studied. He appealed to his neurologist and psychologist friends, but he was ill-received; and when some years later he attacked their theories in his book he was looked on with pity. He was not surprised, therefore, when Prof. Pierre Marie gave the results of his anatomical researches, based on Broca's work, and, indeed, on a restudy of the actual brain which Broca had dissected. Long before this, psychology had itself shown the old theory to be impossible. The theory

had, in fact, broken down before a psychology of common sense which called for scarcely any effort of introspection. A perception, in fact, is already memory, for a perception has duration. A part of the perception is memory, therefore, even while the perception still remains. Where does perception begin to be past? All the hypotheses were contradicted by simple self-observation. Prof. Pierre Marie proceeded to demonstrate a new theory of aphasia. He reduced it to two things: (1) A certain disorder of articulation which he named *anarthrie*, and (2) a certain enfeeblement of intelligence.

Prof. Bergson then referred to his own studies of aphasia. What had struck him most forcibly in the records of a great number of cases was a certain powerlessness in the patient to analyse or decompose his perception. Deafness to words was a concomitant symptom rather than a distinct factor. There were cases where persons after complete recovery and restoration had described their experience by saying that they heard perfectly well, but seemed to be listening to a continuous sonorous blur. One of Charcot's patients could hear the clock strike quite well, but could not distinguish the strokes. In verbal blindness, another form of aphasia, it is very remarkable to observe in some of the cases the difficulty the person has to decompose and analyse his perception. He will want, for example, to write a letter of the alphabet, and may succeed, but he will begin where he would not ordinarily begin; he is seen to lack the sense of the organisation of the letter, and when he produces it he has not synthetically constructed it. When we listen to persons speaking a foreign language we are in the condition of some of these aphasics. We hear perfectly, but we cannot repeat the whole of the sounds; they appear to us crushed, as it were, into a formless mass without bones or joints, a sonorous continuity. He had himself, following another line of investigation, been led to attribute capital importance to nascent movements, tendencies, and outlined actions—movements sketched, as it were, and not carried out. An idea is a grouping together of virtual actions. The continuity of thought is simply a continuity of attitudes and of virtual movements not executed, sometimes scarcely delineated. The brain, and in particular the cerebral cortex, indicates an enormous number of initiated actions. Instead of considering the spinal cord as a diminished brain, we ought to think of the brain as a completed spinal cord. Coming back to the special case of aphasia, he asked himself whether, in order to understand speech, we had not got to undertake a work of disintegration of the movements of articulation, neither completely voluntary nor completely automatic. There are certain beginnings of movements which are not carried out. They are partly automatic, partly voluntary, for our mind projects our actions in advance of their accomplishment.

Prof. Bergson concluded by expressing his profound admiration of Dr. Head's researches on the question of aphasia; they appeared to him of capital importance for psychology, and even for metaphysics.

University and Educational Intelligence.

BIRMINGHAM.—An appeal is being issued for 500,000. in aid of the funds of the University. The finances are in a critical condition; there is a debt of 130,000., which absorbs at present 8000. per annum, necessary extensions of building have had to be made, the staff is deplorably underpaid, and the entry of new students is a heavy one. In spite of the 25 per cent. increase in the fees of new students, these fees will still represent only about 30 per cent. of the cost of