motions of the individual parts is the only outlook we have into the possible causes of the modification principle of geneplasmic adaptation. We have not even a glimmer of a hypothesis as to the causes of the dual creative or aristogenetic principle in evolution.

Fortified with a complete knowledge of what may be actually observed and measured in anatomy and physiology, zoology and paleontology, the most hopeful line of escape from Bohr's agnostic position seems to be in biophysics, biochemistry and bioenergetics. The most hopeful outlook for the future of the Harvard Biological Laboratories, as I understand the wide scope of your personnel and the equally wide reach of your apparatus, is a collective creed that life and adaptation in all their aspects, past and present, present a single rather than a multiple problem which must be attacked by the combined synthetic research of all the adaptive phenomena of past as well as present time.

THE MEASUREMENT OF PERSONALITY

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THE measurement of personality is bound up with the question of psychological measurement in general. Hardly anything has so affected the aspect of experimental psychology during the last quarter century as the introduction and development of quantitative methods. Their influence on the whole has been good. The non-quantitative categories of descriptive psychology were frequently too ill-defined to be very meaningful or to offer fruitful points of departure for experimental work. More and more the descriptive approach is being abandoned in favor of procedures which are quantitative and often elaborately statistical.

It is well to remind ourselves, however, that the application of quantitative methods does not guarantee new psychological insights. Moreover, measurement enthusiasts too often lose sight of the inherent difficulties, even dangers, involved in the reduction of psychological data by the mathematical tools that are so indispensable in the physical sciences. Perhaps no saying of Thorndike's has been so often quoted as his statement that "whatever exists exists in some amount and can be measured." These words have been taken up by his followers and turned into a veritable battle-cry in their assaults upon every psychological stronghold, including even those mysterious characteristics that go to make up what is known as "personality."

Is it really possible to measure personality in the strict sense of the word "measure," as the physicist, for example, is accustomed to use the term? To measure in this sense implies that we have a measuring scale with a zero point and with equal units throughout; a scale on which the score 20 is exactly twice the score 10, or the score 100 exactly five times the score 20. Every one acquainted with the literature of the subject knows that no such scale is available for the measurement of personality. In fact, no one so far seems even to have essayed the task of deriving a personality test that would "measure" in this strict sense of the word. Is any such goal attainable, either now or ever?

Let us turn to the field of intelligence, where quantitative methods have been so much more extensively cultivated than in the study of personality, and note what progress has been made since the early adventures of Galton in what he called "psychometrics." Binet, after many years of explorative work with mental tests, gave us a "measuring scale of intelligence." However, Binet was careful to point out that his scale does not, strictly speaking, measure intelligence, since it has neither a zero point nor equality of units. He tells us that instead of measuring intelligence in any absolute sense, his tests merely bring to light the hierarchy of developing intelligence. This is the sense in which the word measurement has been used by the majority of Binet's followers; it is the connotation which the present writer had in mind in entitling one of his books "The Measurement of Intelligence." Thorndike, on the other hand, in a more recent book bearing the same title, attempts to demonstrate that it is possible to measure intelligence in the same sense as a physicist measures distance or mass or time. His CAVD intelligence scale has what purports to be a zero point and units which are equal. The scores of the scale range from 0 to 43. Zero intelligence is just less that which leads one to spit out a substance that has a very bitter taste or to retain in the mouth a substance that tastes sweet. We will pass by the seeming arbitrariness of this standard, as well as the questionable procedure by which it was derived, and consider the results of applying the CAVD scale in the measurement of absolute intellectual differences. Score 43 represents approximately the intelligence of a college professor or the exceptionally gifted student. By the verdict of the CAVD scale the average child of six years has almost exactly three fourths this amount of intelligence, and the half-way point between zero and moderate genius (score 20) is repre-

sented by a mental age level of about three years, which is just at the borderline between high-grade idiocy and low-grade imbecility of an adult defective! It hardly seems necessary to argue about the merits of a measuring scale that leads to results so patently absurd.

It seems to me that the absurdities derive not so much from the particular methods which Thorndike has used in making his scale as in the very undertaking itself. Before attempting to answer the question whether A has twice or three times or four times as much intelligence as B, it might be well to consider whether such a question is capable of being answered or even whether it makes psychological sense. We are so accustomed to use numbers to express the results of our investigations that we end by taking them too literally. It is very well that we should count the errors and the minutes in a maze performance, the number of books written by literary geniuses in each life decade, the number of items correctly answered in an intelligence test, or the number of lines of poetry memorized. Rough quantification of our findings is necessary and will be helpful so long as we remember that it is rough. The truth is we do not yet have and may possibly never have psychological measuring units which are straightforward and unambiguous. There is yet no rigid technique for comparison of gains in a practise experiment, losses in a forgetting experiment, the amount of fatigue in a continuous work experiment or the percentage loss of intelligence in senile decay.

If this is true in the older fields of psychological experimentation it is even more true in the "measurement" of personality. Surely it is no more than a figure of speech to say that A is twice as introverted as B, three times as submissive as C, half as fair-minded as D, 25 per cent. less masculine-minded than E, three times as witty as F and has twice as much inferiority feeling as G. Indeed, personality testing is in about the stage that intelligence testing was passing through in the nineties of the last century. We are not measuring personality, but exploring with improvised tests, too often haphazardly, to see how people respond. We are still groping, as Binet groped for nearly fifteen years before he was in position to put together an intelligence scale. And Binet's experience has much to teach us. He did not begin with a rigid concept of intelligence, but tried out a succession of tentative hypotheses. His favorite method was to apply his tests to contrasting groups—children and adults, normals and institutional defectives, "bright" and "dull" school children. Patiently he studied the responses of such groups to a great variety of tests—rote memory, logical memory, word knowledge, simple reaction, choice reaction, continuous association, finding likenesses and differences, detecting absurdities, defining abstract terms, copying designs, handwriting, physical measurements, etc. By noting how his contrasting groups responded to such tests he was able at last to eliminate those of least value and to find others better than he had previously hit upon.

This is the kind of work most profitable in the present status of personality testing. Many examples could be given of its effective use. When Woodworth set about devising a test of psychopathic tendency he ransacked the leading text-books in abnormal psychology and embodied in questions, for the testee to answer, those abnormal symptoms most commonly agreed upon by psychiatric authorities. Responses to these questions were then secured from such contrasting groups as unselected normals and patients known to be suffering from mild mental disorder. Much earlier the Kent-Rosanoff standardization of the free association test upon 1,000 unselected adults had been followed by studies of such contrasting groups as college students and psychopathics, young and old subjects, men and women, etc. Miles (Catharine) and Terman have used the method extensively in connection with a series of studies (not yet published) of mental masculinity-femininity. In this case some thousands of test items were assembled which, on the basis of the existing literature on sex differences, looked as though they might differentiate between the sexes. They were tried out on male and female groups and the non-discriminating items were eliminated. The remaining items, some 950 in all, were arranged in two "forms" of an M-F test. It is the method which E. K. Strong has followed in the development of his Occupational Interest Test, and with the result that he can now score his test so as to differentiate between all the leading types of occupational interest, between stages of interest maturity and between masculinity and femininity of interests. Numerous other examples of the use of this method could be given. It is the method *par excellence* of getting together, not a finished personality test, but a first approximation to such a test. By a series of approximations, each based upon tests of contrasting groups, with analysis of responses by the groups to every item, the instrument is gradually brought to the second, but by no means its final, stage.

The next step is to make more definite the meaning of scores yielded by the test. This requires a procedure which is the reverse of that just described. Whereas, to begin with, roughly contrasting groups were used as a means of improving the test, the test itself is now used to pick more purely contrasting groups for further psychological study. For example, once a test of introversion has been brought to this

stage, intensive study should be made of groups of subjects who have scored at the extremes on the test. Herrington has in fact investigated the physical correlates of introversion-extroversion by a comparative study of contrasting groups selected on the basis of scores on three tests of this trait. Oliver, using a similar method, investigated a number of the psychological correlates of the same trait. Always, when a test has been put through the first stages of validation, it should be administered to a large variety of populations, especially to contrasting groups, in order to make the scores yielded by the test more meaningful. Usually a huge amount of this kind of comparative work is necessary before the use of the test in clinical practise is warranted.

This intensive study should be both statistical and clinical. The clinical approach has been particularly neglected in this connection. Exhaustive analyses should be made of the behavior characteristics of individuals who test as extremely self-sufficient, fair-minded, introverted or extroverted, dominant or submissive, masculine or feminine, mature or immature in their interests, etc. Moreover, enough subjects at each extreme should be thus clinically studied to make generalizations possible, for case histories taken singly are notoriously futile. We want to know what is *generally* true of extreme cases, and not only this, but also what kinds of exceptions there are to the general rule. These clinical studies should sample the entire population, from the mentally defective to outstanding genius of every kind. Clinical biography should be cultivated, for we have here an almost untouched field, one that promises more for the understanding of the adult personality than any amount of alleged "measurement" by the method of tests, however valuable the latter may in time become. Laswell's studies of agitators and reformers are suggestive in this connection and should be extended and refined.

The clinical approach is absolutely necessary for the interpretation of personality as a whole, for a true picture of a personality can not be pieced together from any number of test scores. The total is an organismic, not an additive, total. Personality traits are not merely intercorrelated, but are functionally interactive in infinitely complex ways now little understood. This fact is familiar to us in the concept of compensation. The presence of inferiority feelings may give rise either to a chronic attitude of self-depreciation or, by over-compensation, to an attitude of boastfulness. Physical cowardice may give us either the typical coward or, by over-compensation, the foolhardy daredevil. The boy of naturally effeminate tastes and attitudes does not always develop into a sissy; he may cultivate the ways of the cave man and flaunt his masculinity. If one is naturally prone to form emotional prejudices, *and knows it,* one may succeed in becoming a Darwin of fairmindedness. One who is excessively introverted does not ordinarily become a good salesman or an effective leader, but by taking thought he may become either. It is one of the great weaknesses of personality tests that they can not discriminate between behavior attitudes that are the expression of the subject's natural personality characteristics and those that have been acquired by compensation or self-discipline. Moreover, the behavioral significance of a given amount of a particular trait is never unequivocal; it is always dependent upon the other trait complexes in which it is imbedded.

There appears to be a wide-spread opinion among psychologists that the methods of factor analysis, especially as developed by Thurstone, will prove a powerful tool in untangling the skeins that make the warp and the woof of human personality. That they can be very useful in analyzing the content of current personality tests has indeed been sufficiently demonstrated. They have shown that a large collection of personality tests which yield scores on a vast array of alleged personality "traits" may possess altogether not more than four or five distinguishable components. It is well to know this, but it is another thing to conclude that the total personality can be accounted for so simply. There must be, certainly are, many factors of personality that have not been and can never be embodied in our tests. These unknowns are always entering to upset our interpretations of test scores and to limit their usefulness when we apply them in our attempts at personality diagnosis and adjustment. There are no statistical short cuts to the understanding of human nature.

At present personality tests of children give a very slender basis for prognosis. In this they resemble the intelligence tests of a quarter century ago. At that time no one could predict from the best intelligence tests what the later course of intellectual development was likely to be. Since then follow-up studies and retests have made it possible, within reasonable limits, to predict from the intelligence score of an eight-year-old child what the subject's adult level of intelligence will be and what educational accomplishments can be expected. No one knows whether there is any such constancy in the field of personality. It may be that compensations and other cross currents are capable of altering the entire landscape of one's personality in a few years. No one knows how serious for later life a given personality fault of childhood may be. The only way to find out is to make minute studies of the personality characteristics of large groups of young children and follow their later development into adult life.

Until longitudinal studies of this kind have been made, the school counselor and mental hygiene "expert" will be working in the dark. At present they can only guess at the prognostic significance of the personality traits they discover, whether by the use of tests or by means of clinical observations. The psychologist stands aghast at the self-assurance with which the professional school counselors in America diagnose the personality faults of little children and at the boldness with which they undertake the delicate task of adjustment. That some counselors do much good, by the mere application of common sense, will of course be admitted; that others do real harm is hardly less certain. The student of genius who is familiar with the motivating influences that have their origin in quirks of childhood personality shudders to think what the result would have been if school counselors had had a chance to "adjust" the personalities of some of the budding geniuses of history. One can imagine them, freed of all their peculiarities and complexes, adjusting to the world as it was and becoming undistinguishable from the human herd.

Some day, it is to be hoped, the psychologist will know how and when to adjust personalities; at present he knows very little about it and the professional school counselor knows even less.

OBITUARY

SIR HORACE LAMB[1]

IN the death of Sir Horace Lamb, which occurred on December 3, at the age of 85, mathematical science loses one of its brightest ornaments and Cambridge society one of its most venerable figures. During his long life he systematized several branches of applied mathematics, in addition to making to them individual contributions of the highest importance. Hydrodynamics was the most vigorous offspring of his fertile brain, but tidal theory and seismology owe not a little to him, as also does aeronautics, to which his years of retirement were largely devoted. The primary aim of science in Lamb's view was to explore the facts of Nature, to ascertain their mutual relations, and to arrange them so far as possible in a consistent and intelligible whole. The material effects came later, if at all, and often by a very indirect path. The mathematician's task, to his mind, had an esthetic character. He took delight in the comparison of a well-ordered piece of algebraic analysis with a musical composition, and bemoaned the passing of the scientific memoir, which in the hands of a Lagrange or a Poisson had the completeness and austerity of a great work of art.

Lamb was born at Stockport on November 27, 1849. From Stockport Grammar School he passed on to Owens College, Manchester. The college was already gathering to itself a brilliant body of teachers. The professor of mathematics, Barker, had the singular habit of teaching quaternions before Cartesian geometry, but this was perhaps no disadvantage with his abler pupils, such as Lamb and J. J. Thomson. Like Thomson, his junior by seven years, Lamb went up to Trinity College, Cambridge, and there became second Wrangler and second Smith's prizeman. He was elected a fellow of his college and quickly began those hydrodynamical investigations on which his fame so securely rests.

[1] Abridged from an article in the London *Times* [December 4].

This particular line of research fitted in well with the general revision of the special sciences then being conducted under the stimulus of Thomson and Tait's "Natural Philosophy." But in 1875, on his marriage to Miss Elizabeth Foot, of Dublin, Lamb accepted an invitation to become professor of mathematics at Adelaide University. He took advantage of the change to set his ideas in order, and in 1878 his first book appeared under the title, "A Treatise on the Mathematical Theory of the Motion of Fluids." His treatment of vortex and cyclic motion, with their electromagnetic analogues, the discontinuous jets of Helmholtz and Kirchhoff, the motion of perforated solids through a liquid, and the effects of viscosity was bold and original. The skill with which he handled the complicated mathematics, his lucidity, and his powers of systematization won for him an immediate and complete success. From 1881 to 1884 he published a brilliant series of memoirs dealing with the application of harmonic analysis to vibrational problems.

Obviously his recall to England could not be long delayed. In 1884 he was elected a fellow of the Royal Society, and in the following year he returned to Manchester to succeed his old teacher as professor of mathematics. In 1889–90 he published a number of valuable papers on the elastic deformation of plates and shells. To his administrative abilities no less than to his teaching the young university—it had received its charter in 1880—owed more than can be expressed. He was president of the Manchester Literary and Philosophical Society, one of the most important of the provincial academies. He retired from his chair in 1920, though still displaying the vigor of many a man 20 years his junior, and went to live at Cambridge.

Lamb's teaching years were marked by a succession of books, of which his "Hydrodynamics," published in 1895, has become the standard treatise on the sub-