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PSYCHOLOGY IN AMERICA

ADDRESS OF THE PRESIDENT OF THE NINTH INTERNATIONAL CONGRESS OF PSYCHOLOGY[1]

By J. McKEEN CATTELL

FORMERLY PROFESSOR OF PSYCHOLOGY IN THE UNIVERSITY OF PENNSYLVANIA AND COLUMBIA UNIVERSITY

WE welcome to America the psychologists of the world. You have come from distant nations, but we are intellectual neighbors; your faces may be unfamiliar, but we are scientific friends. Biologically we of the North American continent are descended from every race and people; culturally we owe our civilization in the main to the older nations. We have received a great inheritance; may it be our part to return its fruits with usury. Eight times previously have these congresses of psychology met in six different countries. Americans have enjoyed their hospitality and have profited by their programs. Now the ninth congress has honored us by coming far from its origin and center. In its proceedings we are like Chaucer's clerk of Oxenford:

> And gladly wolde he lerne and gladly teche.

For ourselves and on behalf of our foreign members we have pleasure in expressing appreciation and obligations to the host of this congress, Yale University, long a leader in education and in psychology,

[1] Given at Yale University, New Haven, September 2, 1929. In place of lantern slides there was distributed a brochure of twenty-four pages including (1) portraits of six American and two foreign psychologists—James, Hall, Ladd, Royce, Münsterberg, Titchener, Wundt and Galton, (2) tables and curves showing the number, distribution, work and publications of American psychologists at four different periods and (3) curves showing the results of unpublished experiments made from 1889 to the present time on effort, fatigue, learning and variation in performance.

now forming large plans for the study of human relations.

I

A history of psychology in America prior to the last fifty years would be as short as a book on snakes in Ireland since the time of St. Patrick. In so far as psychologists are concerned, America was then like Heaven, for there was not a damned soul there. Jonathan Edwards, the theologian, and Benjamin Franklin, the practical man, were our most typical representatives. In our colleges mental and moral philosophy was indeed taught, mostly Scotch, the importation of which was not prohibited in those days. Noah Porter, president of Yale University from 1871 to 1886, gave us the most elaborate text-book; James McCosh, president at Princeton from 1866 to 1888, performed the greatest service by sheltering physiological psychology and organic evolution under the cloak of Presbyterian orthodoxy.

There was no science of psychology in America fifty years ago; it may be that there was no organized science of psychology in the world prior to 1879. In that year Wilhelm Wundt established at Leipzig the first laboratory, Th. Ribot published his "La Psychologie allemande contemporaine," Francis Galton his "Psychometric Experiments," William James the first chapter of a work on psychology. In so far as psychology dates from 1879, this congress celebrates the jubilee of our science. The first congress of psychology met in Paris in 1889; the present congress marks the fortieth anniversary of our international cooperation.

The pedigree of psychology, as of every science, can indeed be traced to Aristotle and the efflorescence of the Greek period, further back to the civilizations of Egypt and Asia Minor, dimly through the twilight and darkness hiding primitive men. If the making of fires and the use of tools, the cultivation of plants and the domestication of animals, were the beginnings of the physical and biological sciences, then psychology goes back to primitive speech, habits and customs. Perhaps the origins of psychology may be found in more remote pre-human, pre-mammalian and pre-vertebrate animals than those of any other science. The modern dog doubtless finds more differences between two individuals of its species than between a tree and a lamp-post that smell alike. Our early ancestors were mainly concerned with themselves, with their mates and their offspring, with the behavior of their fellows, of their prey and of their enemies. Satisfaction of desires, escape from danger and pain, efforts to foresee and to control the conduct of others, were the earliest and are the most fundamental of interests.

When such is so clearly the case, it may at first sight seem surprising that the sciences, both curious and useful, of matter and energy should have had an earlier origin and a more systematic development than the biological sciences, while psychology is only now taking its place among the descriptive sciences and has witnessed but its first beginnings as an applied science. The explanation is partly in the difference in stability and complexity of the objects of the different sciences. Matter is plastic to experiment and measurement; human behavior eludes experimental and quantitative methods. The motions of the solar system since its beginning are less complicated than the play of a child for a day. It is also the case that in the architectonics of science the mathematical and physical sciences are fundamental. Morphology and physiology are based on physics and chemistry; psychology on all these sciences. The foundations must be laid before we can build the upper stories, in which we may prefer to live and from which there may be the wider outlook.

A less obvious reason for the late development of psychology is the circumstance that it is easier to satisfy needs and to control behavior by altering the environment than by altering individuals. The savage could learn to shoot an arrow from a bow or to move a stone with a lever more readily than he could strengthen his own right arm. He could obtain food better by planting corn than by developing his skill as a hunter And so it is to-day. By increasing economic production we can do more for the welfare of people than by teaching them to be virtuous and wise. In America we have constructed a great civilization, not by trying to be civilized, but by applying invention and organization to the exploitation of natural resources.

Psychology had to await the development of the exact and the natural sciences, whose objects are more open to measurement, whose contents are more basic, and whose applications are more useful. And it should be remembered that all the sciences, as we now know them, are comparatively new. The doctrine of the conservation of energy is only about as old as Professor Stumpf, the theory of evolution by natural selection about as old as Professor Jastrow. Modern physics and modern genetics are no older than the younger members of this congress. When sciences of earlier origin have made such notable advances during the lifetime of those now living, we may look forward with hopefulness to a corresponding development of psychology within the lifetime of our children.

Fifty years ago William James, born in 1842, was assistant professor of comparative anatomy and physiology at Harvard; Stanley Hall, four years his

junior, was a student in Germany. As to other American psychologists there were—as Franklin said when asked if he had any children—"none to speak of." James was transferred to an assistant professorship of philosophy in 1880 and appointed to a professorship of psychology in 1889, resuming after eight years a chair of philosophy. He published in 1890 "The Principles of Psychology," a work of genius not often equaled in any science or in any language. Hall received the doctorate of philosophy from Harvard in 1878, one of the first awards of the degree, and was appointed lecturer there and at Williams College in 1880. In 1883 he became professor of psychology and pedagogy in the Johns Hopkins University, giving also the courses on philosophy. In that year he established the first American laboratory of psychology, unless we count as such the work by James at Harvard under physiological auspices, in which case it would antedate the Leipzig laboratory.

George Trumbull Ladd, eight days younger than William James, was called to a professorship of philosophy at Yale in 1881; he published in 1887 his "Outlines of Physiological Psychology," the first American book on the subject and, as revised by Professor Woodworth, one of the best. In that year there was established a lectureship and in 1888 a professorship of psychology at the University of Pennsylvania. This chair, held by me, was the first in any university here or abroad to be so named and in which the work of the professor was confined to psychology, the department being coordinate with philosophy and other university disciplines. In the laboratory were given the first experimental courses for students, the work at Leipzig and the Johns Hopkins having been limited to research.

In rapid succession there were then established chairs of psychology and laboratories at Wisconsin under Professor Jastrow, at Indiana under Professor Bryan, at Nebraska under Professor Wolfe, at Brown under Professor Delabarre, at Wellesley under Professor Calkins, at Stanford under Professor Frank Angell, at Clark under Professor Sanford, at the Catholic University under Professor Pace, at Illinois under Professor Krohn, at Toronto and at Princeton under Professor Mark Baldwin. In 1891 a professorship and a laboratory were initiated at Columbia, a year later at Yale, Harvard and Cornell, Professor Münsterberg having been called from Germany to Harvard and Professor Titchener from England to Cornell. In this group should be included, for his contributions to psychology and education, John Dewey, professor of philosophy at Michigan, Minnesota, Chicago and Columbia. Josiah Royce, born in California in 1855, appointed assistant professor of philosophy at Harvard in 1882, a psychologist of distinction, alone bridges the gap between James, Hall and Ladd, our pioneers, and the second generation of American psychologists here in part enumerated.

The academic advance of psychology in America in the course of the four-year period from 1888 to 1892 is notable. There were no foundations as in Germany, England, France and Italy, in which countries a scientific psychology had for a hundred years or more been emerging from philosophy, and in which physics, physiology, zoology, neurology, psychiatry and other sciences had for an equal period been assembling subject-matter and methods that could be taken over by psychology. From our Declaration of Independence in 1776 until the founding of the Johns Hopkins University, exactly one hundred years, but little scientific research was accomplished in the United States and that little remote from psychology. There were Franklin, Rumford, Bache and Henry in physics, the Sillimans in chemistry, Gould and Chauvenet in astronomy, Peirce in mathematics, Torrey, Gray and Engelmann in botany, Agassiz, coming from overseas, Baird and Leidy in zoology, Dana, Hall, Lesley, Le Conte, Hilgard and others in geology, a practical science. But few of them have an international standing; there was none who helped to make straight the way for psychology.

What we had in America prior to 1876 was a comparatively well developed common school system, the beginnings of state universities, many denominational colleges. The research degree of doctor of philosophy was first given in 1861 by Yale. In the course of fifteen years that university conferred 18 of these degrees, Harvard 4, Columbia and Cornell 2 each. After 1876 there was a rapid development of universities and at the same time a large increase in the number of Americans who worked in Germany. Of our leading scientific men in 1903, 487 held the degree of doctor of philosophy or its equivalent. The universities awarding 10 or more of these degrees are: The Johns Hopkins 102, Harvard 57, Columbia 38, Yale 28, Cornell 26, Chicago 25, Clark 12, Michigan 10; in Germany, Leipzig 39, Göttingen 33, Berlin 22, Heidelberg 15, Munich 13. One was from Paris, two master of arts degrees were from Cambridge.

The main condition favorable to the remarkable academic advance of psychology from 1883 to 1900 was the growth of our universities. Previously mental and moral philosophy had in most cases been taught by the president of the institution, qualified for both offices by being a clergyman, and when this situation changed it was natural to continue the teaching of psychology by special students of the subject. The enlargement of the universities and the adoption of the elective system permitted the introduction

of a new science. Our people had curiosity, acquisitiveness and energy, with ever-increasing wealth. We were able to take over what we wanted from abroad; we were not bound by precedents and traditions. Even after years in our environment Professor Münsterberg claimed that "the presuppositions with which a science starts decide for all time the possibilities of its outer extension," and Professor Titchener said that he did not object to work on the measurement of individual differences in behavior so long as it was not called psychology. The psychologist has some reason to thank God when he is born a happy and irresponsible American child.

In comparison with literature and art, science is international. The velocity of light is the same whether measured by Fizeau in France or by Michelson in the United States. The electrons discovered by Thomson and measured by Millikan have the same hypothetical properties in Cambridge and in Chicago. The equations written by Einstein in Berlin are equally correct and equally relevant or irrelevant to the real world in Germany and in Japan. None the less the lines of advance followed by science are directed by the national life. It is not a chance accident that laboratory research in psychology is of German origin, that pathological psychology has been cultivated in France, that psychoanalysis has spread from Vienna, that Darwin and Galton were English, that objective psychology and the measurement of individual differences have had their chief development in the United States. Germany may keep its *Gestalt* psychology, France its hysterics, Austria its libido, England its "g"; we shall continue to bear the burden of our meta-behaviorism.

America is part of the continuation of the cultural history of Europe. In psychology we owe to it everything up to the past fifty years, during which period there has been cooperation on terms that have now become equal. The two Europeans to whom our debt is the greatest are Wilhelm Wundt and Francis Galton. I had the privilege of working with both of them, as also with Herman Lotze and James Ward. Many Americans frequented the Leipzig laboratory, but perhaps only Titchener, who retained his British citizenship and outlook, continued its traditions. Stanley Hall and I were the first of Wundt's American students, but Hall worked in Ludwig's laboratory and I continued in my own rooms the work begun in America, in part because Wundt would not allow the testing in his laboratory of individuals who could not profit by introspection. Galton—the greatest man whom I have known—more nearly laid down the lines for the objective measurement of individual differences. But in his statistical methods of studying individuals he had been preceded by Quetelet and in America by Gould; in his study of imagery by Fechner, this work having been based on fallacious introspection. Wundt and Galton are the foreign psychologists whom we most honor, but it may be that if neither of them had lived psychology in America would be much what it is.

When Jefferson wrote in the Declaration of Independence that all men are created equal, he was referring to the unalienable rights to life, liberty and the pursuit of happiness. Where individual differences in rank and wealth are fixed by custom and law, they are taken as a matter of course. In a political and social democracy, such as has partly obtained in England and to a somewhat greater extent in the United States, attention is directed to the varying qualities of individuals. The wars of England are said to have been won on the playgrounds of its public schools. Competitive fellowships and scholarships, the mathematical tripos, arose in the English universities. The American college student wants to make his fraternity and the football team, sometimes also Phi Beta Kappa or Sigma Xi. Every boy may hope to become a Coolidge and get two dollars a word for his autobiography, or a Carnegie and try to make all university professors his pensioners. He learns that the race is to the swift and the battle to the strong. Those engaged at first in a conflict with nature, wild animals and savages, later in subduing the wilderness, now in the construction of a vast and complicated industrial civilization, are more likely to be interested in their own performance and in the conduct of others than to indulge in the refinements and the vagaries of introspection. It may be that there is American science and American psychology.

Of 84 Nobel prizes in science only five have been awarded in the United States, two of the recipients having been born abroad. No more were deserved. We have not excelled in broad generalizations based on abstract considerations; but we have done more than our share in invention and in the applications of science. It is scarcely necessary to name a few from the long list of advances on which modern life is based which have had their origin or chief development here. Omitting the steamboat, the railway and other applications of steam, these include the cotton gin, the reaper and other agricultural machinery; the sewing machine, the refrigerator, the vacuum cleaner and other household machinery; the typewriter, the manifolder and other office machinery; all sorts of factory, foundry and mining machinery and methods; steel and cement construction; central heating; electric light and electric power; the telegraph, the telephone and the radio; the phonograph and the motion picture; the automobile and the airplane. It may be

that trial and success methods, so important in learning by the individual, are equally fundamental in learning by the race and in the advancement of science. Who devised the Greek temple and the Gothic cathedral? The most magnificent architecture since these is here arising before our own eyes, but no one knows who is responsible for it. The proximate cause of the New York sky-scraper is an ordinance of a board of aldermen, prescribing that, in order to conserve light, high buildings must be recessed from the street.

The situation is the same in psychology. The advances in America are due to the work of uncounted individuals, many of them not known as psychologists. It appears that I was the first to publish psychological measurements of individual differences without regard to introspection and with special reference to their useful applications, but that is because I had the misfortune to be born a long time ago. So Columbia University and its Teachers College may have done the most—more than 150 members and associates of the American Psychological Association hold its doctorate—to advance objective, individual and group psychology, especially in its applications to education. In a sense this is due to Professor Thorndike, Professor Woodworth and other leaders who have worked with me, but it is in the main a manifestation of economic and other factors of our national life. Psychologists have been academic teachers and have naturally taken up problems concerned with children and schools. Other aspects of objective psychology to which these lead have been measurements of animal behavior. We are apparently somewhat behind Germany in the applications of psychology to industry, but we have a large development of industrial management and personnel work—the Taylor system is American—which will ultimately be taken over by official psychology. Even our swarms of cranks in the air above and our shoals of charlatans in the water beneath may be found to have contributed their bit, when natural selection and survival of the fit are given ample time.

It is not intended to discuss here the relative extent to which progress is due on the one side to great leaders, on the other to the activities of large numbers of individuals reacting to economic and other conditions. Neither is there any intention to undertake to define or delimit the field of psychology. Over a long period of years I have expressed opinions, incidentally or when an official address was required, some of which are quoted in the brochure that has been distributed; but such dicta—as also those that I am now perforce imposing upon you—are more analogous to a parlor game than to scientific research. The work at hand must be done; time will tell what part of it is useful and will survive. We can, as they say, "point with patriotic pride" to James, Hall, Royce, Dewey and Santayana as five writers on psychology, approaching it from the philosophical and literary side, but with full appreciation of scientific method, such as would be difficult to parallel in any other country. It seems, however, that the chief contribution of America to psychology has not been large philosophical generalizations, but the gradual accumulation from all sides of facts and methods that will ultimately create a science, both descriptive and applied, of human nature and human behavior. Each of us, as the English poet Clough says,

> must slave, a meager coral-worm,
> To build beneath the tide with excrement
> What one day will be island, or be reef,
> And will feed men, or wreck them.

II

The American Psychological Association was founded in 1892 on the initiative of Stanley Hall with 31 members; it now has 540 members and 353 associates; next year the total membership will be about 1,100. It is under the auspices of our association, which covers the whole of North America, that this congress is held. The officers and the national committee of the congress were elected by a plebiscite vote of the membership of the association, which has appropriated funds for the expenses and will publish the proceedings. It has merged its annual meeting with the congress and the address of its president will be one of our principal functions. It owns—thanks to the generosity of Professor Warren—and conducts six psychological publications; at the last annual meeting in New York the registration of attendance was over 500. The association may not be as useful as it should be and will be, but it is one of the most responsible American unions of scientific men and the world's greatest organization of psychologists. The growth of the association, which closely parallels the increase in the number of American psychologists, is recorded in the table and shown in the curve which are printed in the brochure that has been placed in your hands.

The 31 members of the American Psychological Association in 1892 exhibit the position of psychology in America 37 years ago. The majority were not primarily psychologists. It may be that only four or five of the number were then actively engaged in psychological research and so continued. Of the presidents of the association for the first sixteen years perhaps only Jastrow has remained faithful. During this period psychology was entangled with philosophy and parasitic on other sciences. Of the nineteen presidents of the association since 1910, all but two are

now actively engaged in psychological work, one of the two exceptions, Baird, having been so occupied at the time of his death.

In 1903 a census was taken of the psychologists of the United States. There were 313 who were judged to have contributed to the advancement of psychology, or, excluding those whose work was not primarily in psychology or in psychology combined with philosophy or education, there were 270. In that year the Psychological Association had 135 members. The number of psychologists had about quadrupled in eleven years. A study was at that time made of their origin, work and standing for the number of the *American Journal of Psychology* issued in honor of Stanley Hall.

In psychology and in each of eleven other sciences the workers were arranged by ten of their leading colleagues in the order of the value of their work and the average positions determined. This order of merit method is an American contribution that has found wide application in educational psychology and in other directions. Philosophers are still included among the fifty leading psychologists, and as many as seven were or became university presidents; but in eleven years there had been a remarkable increase in the number of those professionally engaged in psychological work.

When scientific men were arranged in 1903 in order of merit it was stated that the lists would not be published within 20 years. Twenty-six years having now elapsed it may be useful in a historical survey to name the psychologists. The order gives no information concerning their contemporary position, several near the bottom having risen to the top and some at the top having dropped. A comparison of the standing of each psychologist after a period of twenty years has been made. This gives in quantitative units (with a probable error attached) his gain or loss in the judgment of his colleagues. The efforts of a lifetime are condensed into a single informing and dramatic figure. On the list in the brochure there is given the rank, which is the average position obtained from ten judgments, followed by its probable error.

The 200 competent psychologists of 1903 received their college degrees from 76 different institutions. The students then gathered in a small number of universities for graduate work; of 115 American doctorates 23 were conferred by Columbia, 22 by Cornell, 18 by Clark, 15 by Harvard and 11 by Yale; of 31 German doctorates 17 were from Leipzig. Practically all our psychologists were at that time engaged in teaching. Their relative productivity was found by counting the articles printed in or reviewed by the *Zeitschrift für Psychologie* in its first 25 volumes. Germany was far in the lead, partly owing to the source of the data. The number of experimental contributions from Germany, France and America was about the same. In theoretical papers we were about equal to England and far behind Germany and France; in physiological and pathological papers we were exceeded tenfold by Germany, threefold by Italy, France and England.

A further study of the distribution of American psychologists was made at the end of the year 1916 for an address given on the occasion of the twenty-fifth anniversary of the American Psychological Association. The members then numbered 307; more than 90 per cent. of all psychologists of standing were found to be included. The psychologists of America had about doubled in number from 1903 to 1916, whereas they had about quadrupled from 1892 to 1903. Of the 307 members 272 were engaged in educational work in 121 different institutions. 16 were connected with boards of education, hospitals, charitable institutions, etc., and it was at the time remarked that "this group, now so small, may at our fiftieth anniversary surpass in numbers those engaged in teaching." 84 per cent. of the number held the degree of doctor of philosophy, making psychologists the most academic of scientific workers, mathematicians and zoologists coming next with about 60 per cent. The American universities which conferred more than two of the 258 degrees were: Columbia 46, Harvard and Chicago 31, Clark 25, Cornell 24, Johns Hopkins and Yale 15, Pennsylvania 11, Iowa 6 and Michigan 4. The foreign universities were: Leipzig 15, Würzburg, Berlin and Freiburg 3.

The papers presented at the first 25 meetings of the association were classified by five-year periods. The percentage of experimental papers fell from 1892 to 1902; afterwards it increased slightly. The significant features of the curves are the great decrease in historical, philosophical, analytical and introspective papers, and the great increase in papers concerned with the measurement of individual differences in behavior. The time that psychologists reported themselves able to devote to research was found. Only 16 of the 215 who supplied the information devoted more than half their time to research; 149 of them less than a quarter. They are placed in three groups, in accordance with the value of their work. The largest group, ominously large, consists of those doing little or no research and standing lowest. Otherwise, there is scarcely any correlation between ability in research and time devoted to it.

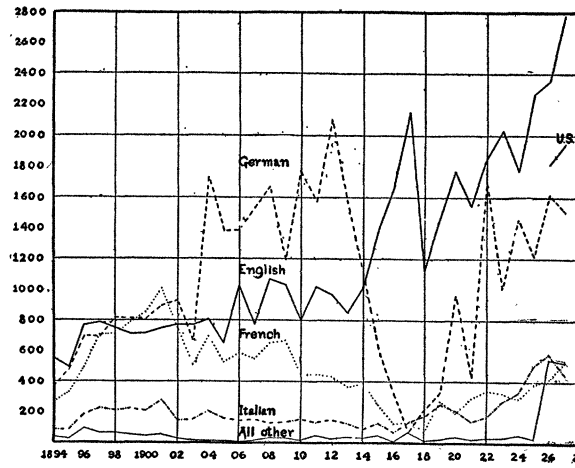
In the twelve years since the celebration of the twenty-fifth anniversary of our association, it has grown from 307 members to 540 members and 353 associates, all of whom are or have been engaged in psychological work. Of the members only 12 do not

have the degree of doctor of philosophy or its equivalent. The universities that have conferred the largest numbers of these degrees are Columbia 155, Chicago 91, Harvard 68, Clark 54, Iowa 42, Pennsylvania 41, Cornell 37, Johns Hopkins 34, Stanford and Yale 26, Washington and Minnesota 15. There are only four degrees from Leipzig, whereas there were 17 in 1903, with one fourth as many psychologists. The institutions from which the first degree was received are widely scattered and there seems to be no tendency for psychologists to be recruited from the institutions having strong graduate departments. I have found the center of productivity of scientific men to have moved westward from New England to the central states and onward to Iowa, Missouri and Nebraska. In the production of psychologists the universities of Indiana and Nebraska stand high.

The 893 psychologists hold positions in 339 different educational and other institutions. There are no fewer than 45 at Columbia, of whom 34 are members and 11 associates; Minnesota ranks next with 24, followed by Harvard, Pennsylvania, Yale, Chicago, Cornell, Stanford, Iowa, Ohio State, Michigan, New York and the Johns Hopkins, which are the institutions with which 10 or more psychologists are connected. In the two divisions of the University of California there are 17. The budgets of these universities show that, in spite of inadequate salaries, large sums are now spent on psychological teaching and research. Columbia appropriates nearly $200,000 annually for psychology, the budget of the university corporation being $69,200, of Teachers College $107,266, of Barnard College $18,800. Among the universities reporting, Ohio State stands next with costs of $114,771, followed by Stanford, Northwestern, Minnesota, Chicago, Michigan and Indiana, which are the universities having budgets in excess of $40,000. Seven institutions spend on psychology between $30,000 and $40,000, sixteen between $20,000 and $30,000, thirty-five between $10,000 and $20,000.

A table has been drawn up from the reports made by members of the association on the subjects that they are teaching and the subjects with which they are engaged in research. Two or more subjects are usually given and the relevant fraction of the total time is distributed to each subject. Apart from "general" which refers mainly to teaching, "experimental" stands first, occupying the full time of the equivalent of 116.5 psychologists. "Educational," representing the time of 109.5 individuals, comes next, followed by "tests" and "clinical," 77.5 and 73.5, respectively. There then follow in decreasing order pathological, social, genetic, applied, theoretical, vocational, comparative, physiological, statistical and historical. The classes overlap, but the times are distributed among them as well as may be in accordance with the reports of those concerned. It is evident that the time of American psychologists is mainly devoted to work on individual differences by objective methods, educational work predominating. Curiously only one half of a psychologist confesses to the pursuit of psychoanalysis.

Professor Fernberger has counted up the publications recorded in the *Psychological Index* from 1894 to 1925 in accordance with the language used. For 1926 and 1927 the count has been continued, contributions from the United States and from Great Britain being separated. The curves are truly dramatic. For the first nine years at the end of the last century and the beginning of this, English, German and French contributions were very nearly equal in number, rising for each language from about 400 to about 800. There is then a remarkable increase in the German publications up to over 2,000 just before the war. The French publications drop to an average of about 400. The English publications remain nearly constant with a small increase. The disaster of war practically eliminated German and French publications. Owing to America, contributions in English rise with a drop for 1918. Germany has now regained its pre-war level, but French publications are fewer than 30 years ago.



CONTRIBUTIONS TO PSYCHOLOGY RECORDED IN "THE PSYCHOLOGICAL INDEX"

The titles from 1894 to 1925 were compiled and published by Professor Samuel W. Fernberger. For 1926 and 1927 the contributions from the United States are given separately. The classification is based on the language of the publication rather than on the nationality of the author. In order to conserve space the size of the curves and lettering is here reduced further than otherwise would be desirable.

France, Italy and Russia are close together, each with about 500 publications. The number of Russian contributions is notable. It should be remembered that variations in the curves are due to methods of indexing as well as to actual variation in the number of publications in a given year.

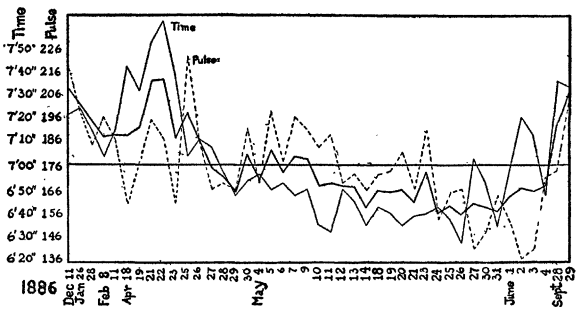
For publications in the year 1927 (including a few from the preceding year) I have made a subject as well as a language classification and have used also the German indices. In that year the distribution of titles according to the *Psychological Index* was: United States, 1,943, German, 1,509, British, 836, French, 553, Russian, 457, Italian, 449, all other, 71. The correspondence with the German indices is so close that I assume there is an exchange of titles such as I arranged when responsible for the American index. The distribution is as follows: United States, 1,966, German, 1,353, British, 775, French, 519, Russian, 480, Italian, 461, all other, 84. The total number of psychological publications recorded in our index is 5,798, in the German indices, 5,638.

In the subject-matter classification used in both the American and German publications what is called "mental development" stands first with 1,108 and 1,142 publications, respectively, recorded. Then follow "psychopathology" with 919 and 892, and "social functions" with 928 and 870. "Mental development" and "social functions" are not satisfactory terms; the publications refer largely to tests and educational psychology which are also included under other categories. There are recorded, respectively, 489 and 449 publications on sensation and perception, only 70 and 73 on feeling and emotion. The United States leads Germany in educational and comparative psychology; it is below Germany in psychopathology and "special (largely abnormal) conditions." We are also relatively below England and France in those subjects as in physiological psychology.

A table is also presented showing a classification of the contributions to psychology abstracted in *Psychological Abstracts* from its first issue in January, 1927, to the current issues for July, 1929. These number 9,383, approaching the number of titles recorded in the *Psychological Index*. The United States is in the lead with more publications abstracted than are listed by title in the index.

CONTRIBUTIONS TO PSYCHOLOGY ABSTRACTED IN "PSYCHOLOGICAL ABSTRACTS" FROM JANUARY, 1927, TO JULY, 1929

	U.S.	Ger.	Br.	Fr.	It.	Ru.	Oth.	Tot.
General	483	113	66	64	28	8	28	790
Sensation	329	162	55	68	22	2	35	673
Feeling, etc.	112	10	8	7	2	1	9	149
Attention, etc.	178	49	19	42	10	3	8	309
Nervous System	92	63	36	34	5	9	11	250
Motor	317	144	48	51	26	23	37	646
Comparative	317	67	30	64	1	4	12	495
Heredity	235	17	60	7	6	1	6	332
Special	286	258	147	95	20	9	31	846
Pathological	513	199	147	203	57	54	37	1,210
Individual	741	223	68	63	18	4	57	1,174
Industrial	274	85	56	27	6	11	18	474
Childhood	363	78	27	32	12	16	36	564
Educational	797	53	28	34	2	4	33	951
Statistics	107	5	11	2	1	0	2	128
Tests	308	23	30	18	2	0	11	392
Total	5,449	1,549	836	811	218	149	371	9,383



PRACTICE CURVES FOR RUNNING THREE MILES IN 1886 AND 1887

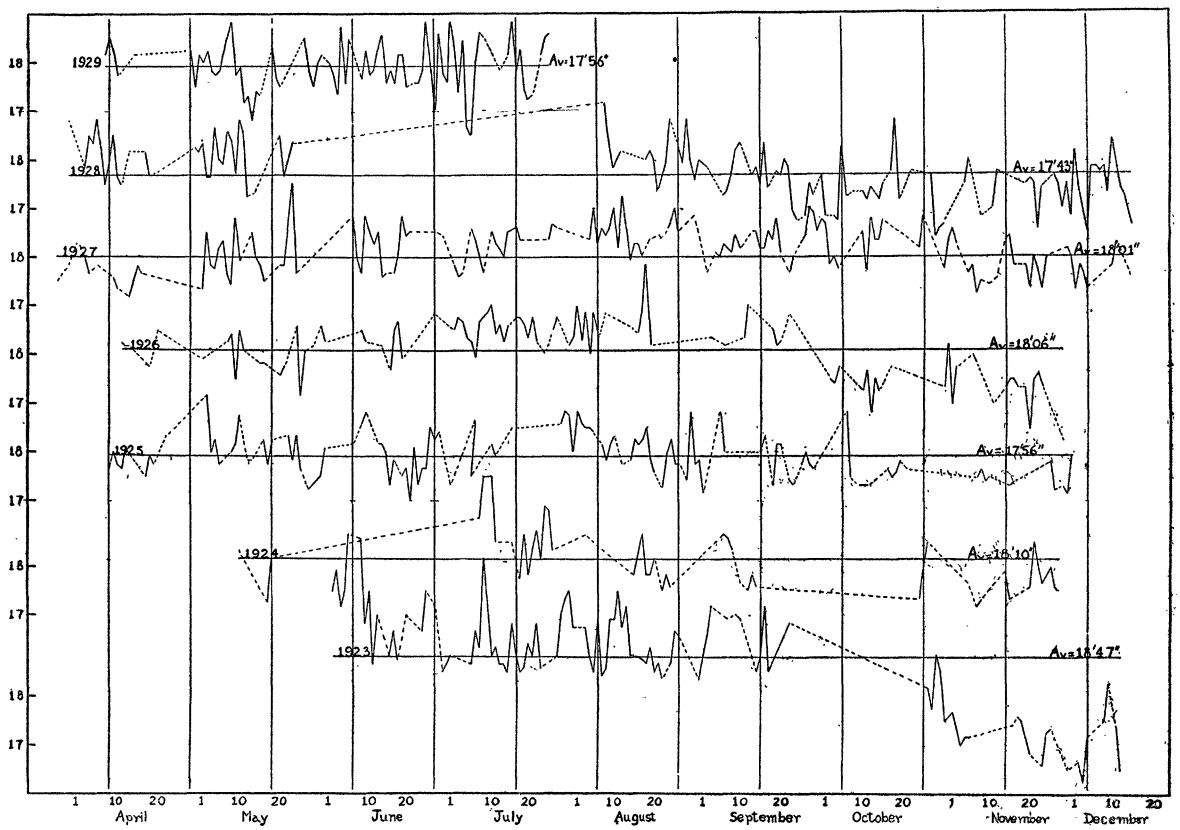
These curves, hitherto unpublished, appear to be the first practice curves and the first quantitative study of the relations between fatigue and effort on the one side and physical and psychological conditions on the other. The experiments were begun at Leipzig in the spring of 1886, the records here given having been obtained at Cambridge, England, at the end of 1886 and in 1887. There are other records for running a single mile. The figures give the average time for each of three miles and the average pulse rate at the end of each. As shown on the curves the variability in seconds and in pulse beats happened to be the same, so an average gives a significant practice curve and measure of performance, for if other things are equal the shorter the time the higher the pulse.

It may be noted that there was greater irregularity at first, especially in the relation of the time and pulse. Afterwards there is a definite improvement in each with the variations shown in the curves. The last two trials after an interruption of three months show both a longer time and a more rapid pulse.

Full records were kept of physical and emotional conditions, occupation during the day, hours slept the night before, coffee, tobacco and alcohol used, weather, etc. Correlations are not here given for, though it may be that no similar experiments have been made in the course of the past forty-three years, the curves are intended to be regarded mainly as museum specimens.

These number 5,449, followed by German 1,549, British 836, French 811, Italian 218, Russian 149, other 371. That more than half of the 9,383 publications are American is doubtless due to the place of publication of the abstracts, but this will probably soon be the actual situation. The classification of titles is more satisfactory than in the case of the indices. Of 951 publications in educational psychology we are responsible for 797, with nearly the same predominance in tests and statistics as also in comparative, genetic and industrial psychology. In physiological and pathological psychology we are relatively much below Germany, England and France. The publications for 1927 abstracted or reviewed in *l'Année psychologique* have also been collated. The 1,166 publications are distributed as follows: American 371, French 365, German 249, British 83, Italian 40, Russian 21, other 37.

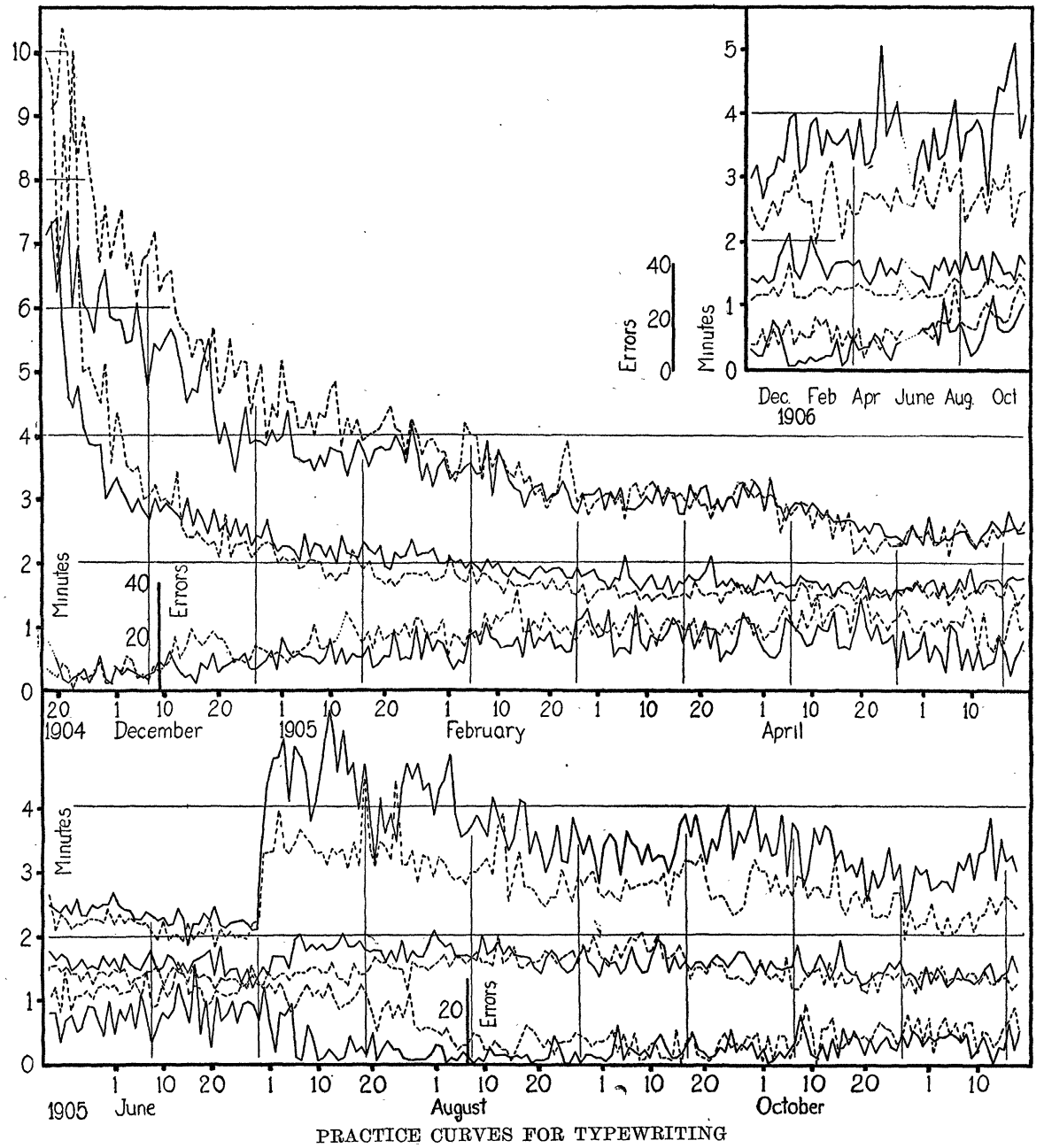
There were no women among the 31 original members of the American Psychological Association; two, Professor Calkins and Mrs. Ladd-Franklin, were elected at the second meeting. In 1917 there were 39 women, 13 per cent. of the number. This was a larger proportion than in any other science, zoology coming next with 7.5 per cent., the percentages then decreasing to 2.1 for chemistry and 1.3 for physics and



TIMES FOR WALKING A MILE

The times are shown in the curves for walking about a mile, including a descent and ascent of about 300 feet. The data are from the same individual who made the records for running forty years before. The pulse was also taken here and a record of physical and psychological condition, weather, etc., and there was made an estimate of time and pulse rate before the performance was known. All records, 729 in number, are given, though it appears that an error of a minute may have occurred in several cases, the time of starting not having been recorded. The times are regular, the average variation in 1929 being 23 seconds. Days for which there was no record are indicated by a broken line. These were in most instances due to absence from home, the subject, for example, having been in Europe in the summer of 1928.

It is not proposed to give here a scientific analysis of the data. Attention may, however, be called to the value to the individual of such records. They make a brisk walk before breakfast a matter of interest instead of a task. They have a considerable diagnostic value, especially when made with advancing years. In the curves shown the times are longer and more irregular the first two years than the last four. This is partly a practice effect, though the intervening winters would prevent improvement through better physical condition from the exercise. The physical and psychological age in later life deserves thorough investigation, for it is a problem of great practical importance.



PRACTICE CURVES FOR TYPEWRITING

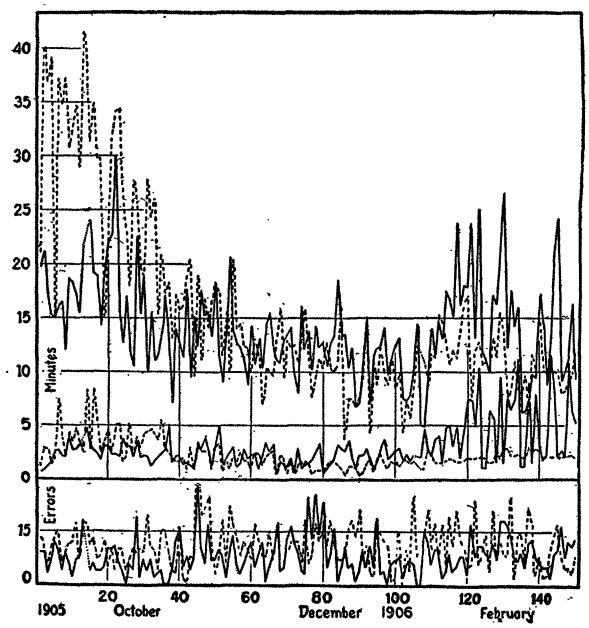
The curves are for practice in typewriting made on 365 consecutive days without an exception and continued once a week for a second year. The solid line is for a girl, the broken line for a boy, whose ages at the beginning were 13 and 11 years. The material used was the first stanza (74 words in archaic spelling) of Spenser's "Fairy Queen" repeated over and over and three new stanzas each day. To make the times for the repeated and the new material comparable the latter has been divided by three, though this reduces the relative variability. On June 29, where there is a rise in the curve, a page of George Eliot's "Mill on the Floss" was substituted for the three stanzas of the "Fairy Queen," the times being divided by four to correspond with the number of words. The ordinates showing the number of errors are for the repeated stanza.

These curves have not hitherto been printed though they have been used by Professor M. A. Rosanoff to study the relation of the practice curve to physical and biological formulas and by Professor Ellsworth Huntington to study the relation between performance and the weather. The curves are dramatic exhibits useful for obtaining a comprehensive view of the results; correlations must be calculated from the original figures.

In the course of these measurements there were made once a month tests of 10 different sensory-motor processes, ranging from tapping to cancelling A's, in order to investigate the transfer of practice.

geology. There are now 242 women who are members or associates of the association, 27 per cent. of the total membership. In but few fields of endeavor in which men were in complete control thirty-seven years ago have women made such large gains.

Contrary to the usage of most foreign academies, our National Academy of Sciences, though it does not at present have members in economics, history or philology, includes psychology among the natural and exact sciences and has a section of anthropology and psychology. The National Research Council, which is a committee of the National Academy, has likewise a division of anthropology and psychology. The American Association for the Advancement of Science has a section of psychology; its section of education is largely concerned with psychological measurements. Reference should be made in passing to the organization of psychologists during the war by a committee of the American Psychological Association, the National Research Council of the National Academy and

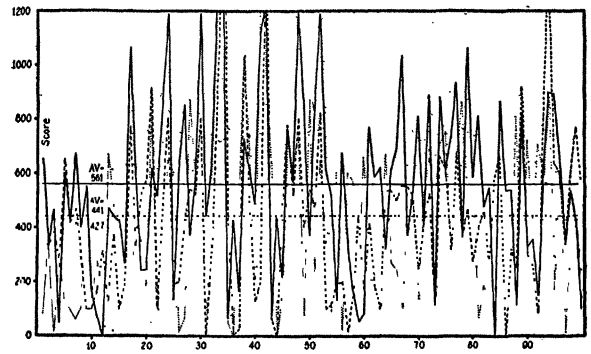


CURVES FOR LEARNING GERMAN WORDS

The upper curves show the time required by a girl of fifteen (the solid line) and a boy of thirteen for committing to memory ten German words and their English equivalents. The German words were the more commonly used words of one and two syllables not having similar forms in the two languages. It was difficult to find so many words; if they are known it is comparatively easy to read the language.

The middle pair of curves shows the time for relearning the same ten German words and their English equivalents on the following day. Records were kept of the time required to call to mind and write down the twenty words, but the data are not given here; it is mainly a matter of time consumed in writing. The numbers of errors for the first learning, mostly of spelling, are shown in the bottom pair of curves. There were later made experiments in which it was not required that the twenty words be committed to memory, but the German words being given the English equivalents were written after them and conversely.

Parallel with the measurements experiments were made on the transfer of learning. Once a month nine different kinds of material were used, French and Latin words, concrete and abstract prose and verse, etc.



SCORES AT BRIDGE

There are shown on the curves scores at bridge. Scores at chess, tennis and billiards made by the same individual are not here shown. The results at bridge are for 100 consecutive rubbers of three-handed bridge by the same players in the course of four years. The mean variation for the middle score of 441 is 236; the probable error for the 100 rubbers is 20. The larger score of the upper curve is consequently due to greater skill, whereas the smaller score of the lower curve is likely to be due to chance.

The curves for chess and tennis show with each ordinate the number of games won by an individual in a group of ten. The chess games were played with the same opponent over a period of five years to the present time, the tennis games in 1928 and 1929. The curve for billiards gives the number of points made in 100 shots. The records cover a period of four years to the present time.

None of the curves shows improvement with practice or deterioration, though it might be that in chess and tennis both players improved. The changes with age in sedentary games such as chess and cards, in games requiring motor coordination such as billiards, and in games requiring physical activity such as tennis, are of obvious interest.

It is curious that in spite of the millions of people who daily play these four games there does not appear to have been made any scientific investigation of the effects of practice or of variability in performance and its causes. No attempt at such a study will be made here, but attention may be called to the circumstance that continuous scores and curves add to the interest and pleasure of games. If a game is interesting in itself gambling is superfluous.

the American Association for the Advancement of Science under the leadership especially of Colonel Scott and Lieutenant-Colonel Yerkes. Most American psychologists became commissioned officers of the sanitary corps and took an active part in applying psychological methods. In a review of psychological organization mention should be made of the Psychological Corporation chartered in 1921 with 20 leading psychologists as directors and 170 members of the American Psychological Association as stockholders. The objects of the corporation are defined as the "advancement of psychology and the promotion of the useful applications of psychology." It aims to make the practice of psychology a profession and especially to conduct research of economic value on the lines of the industrial laboratories, which in America are rivaling the universities in their contribution to the advancement of science.

III

These remarks have been concerned with American psychologists, their distribution and organization, not with our contribution to the advancement of psychology, the briefest summary of which would require manyfold the time at my disposal. What we are doing in psychological research will be shown by the 360 papers and reports to be presented by American psychologists before this congress. In a formal address before a scientific congress it may, however, be expected that the speaker will give some account of his own work. Perhaps the data concerning American psychologists may be regarded as such, for one of the developments of psychology in America has been the statistical study of groups of individuals. The main contribution of America to psychology has been the objective measurement of response to the situation without introspection and with special reference to individual differences and practical usefulness. It happens that experiments on effort, fatigue, learning and variation in performance, begun in 1886 and continued to the present time, have not been published, so reference may be made to them here as an example of the kind of work that I have tried to do.

Limits of time allow only a few words in regard to the raw data exhibited by the curves in the booklet that you hold. Perhaps this is not unfortunate, for it is a practical demonstration of the scientific method that I have followed. Theories assumed to explain the way people learn may be more interesting than crude facts, but theories are likely to become beds of Procrustes into which observations are fitted. Certainly we want laws in psychology; it would be most convenient if every one learned everything in the same way and this could be stated in a simple equation. But we are concerned with the real world in which we live; it is not the scientific man but the philosopher who hopes to see from his armchair a vision of monism seated in the lap of the absolute.

Perhaps a useful classification of individuals would be into those who ask "why" and those who ask "how and what for." Why people learn in the way they do is one question; how people learn, how they differ in the way they learn and what are the best ways to learn are different questions: these are the ones with which I am concerned. Acquired reflexes, so fruitfully investigated by Professor Pavlov—to-day our distinguished guest—of which on the sensori-motor side reaction times, reading and typewriting are typical, may be used as a theory to explain behavior, or they may be measured in order to obtain the most correct and economical description and in order to use this knowledge in useful ways. Thus, for example, the practice curve may prove to be an educational method of value. The student obtains an actual measure of comparative performance and progress much more correct than the opinion of a teacher. But the main advantage is that the competition of the student is not so much with others as with himself. The effort is not primarily to excel others, but to do better to-day than yesterday. It may also be noted that intensive effort for a short time is a better method of learning than dawdling for a longer time, and that making the measurements, correcting the errors and drawing the curves are excellent training. The practice curve method can be used with every school subject. Some references to other problems are made in connection with the curves that are exhibited and it is necessary to stop at that.

IV

International congresses are significant factors in the advancement of scientific research; they also promote international cooperation and good-will. The objects of the sciences are more ideal than the objects of the churches; their practices are more Christian. When in the fulness of time there is a family of the nations, when each will give according to its ability and receive according to its needs, when war among them will be as absurd as it would now be for members of this congress to begin murdering one another, this will be due in no small measure to cooperation among scientific men of all nations in their common work. And it may be that psychology, the child among the sciences, and the United States, the child among the nations, shall lead them.

It is the object of psychology to describe, to understand and to control human conduct. The old philosophical distinctions between a positive and a normative science have faded in the light of increasing knowledge and common sense. If any one here holds that

war is a blessing, it is not a matter for argument, but a case for confinement in a hospital for the insane. Within limits we know what we want and can use the methods of science to get it. Psychology, not less than other sciences, perhaps more than any one of them, is concerned with problems of human welfare. The nation, the family, schools, churches, courts, prisons, armies, navies—these are all institutions which aim by emotional and rule of thumb methods to alter individuals and to control their behavior. When we have knowledge and understanding concerning institutions and individuals and learn how to apply knowledge and understanding for their betterment, it will be the product of a science of psychology.

There may be worse ills on earth than wars, a more desirable good than friendship among the peoples of the world; but an international gathering is particularly concerned with these things. The Seventh International Congress of Psychology held at Oxford in 1923 was the first scientific congress after the war to which all nationals were invited on equal terms; we welcome to the present congress with special pleasure psychologists from Soviet Russia. The United States has taken a Quaker engineer for its president; we have set up a symbol of peace and scientific progress in an industrial democracy. In the words given by our great poet to Columbus for his prayer to God, as "full of woe . . . a batter'd, wreck'd old man . . . he took his way along the island's edge":

Haply the swords I know may there indeed be turn'd to reaping tools,
Haply the lifeless cross I know, Europe's dead cross, may bud and blossom there.

OBITUARY

GEORGE RUSBY KAYE

1866–1929

GEORGE RUSBY KAYE, until recently a member of the Indian Education Department at Simla, India, and well known for his memoirs on early Hindu mathematics, died suddenly of heart failure at Tunbridge Wells, England, on July 1, 1929. He was born at Leicester on November 9, 1866, and most of his active life was spent in India. He was for a time vice-principal of the Allahabad Training College, and in 1904 became bureau assistant to the director-general of education. In 1910 he became registrar of the Education Department and in 1915 was appointed curator of the Bureau of Education. He also held the post of secretary to the Central Advisory Board on Education, and in recognition of his work in the educational field he was awarded the Kaisar-i-Hind gold medal in 1921. He retired from the Indian service in 1923, but was soon thereafter appointed to carry on the cataloguing of manuscripts in European languages in the India Office Library, London.

It was, however, for his work in the history of Hindu mathematics and astronomy that he will best be known. He was a careful student of the Sanskrit classics in this field, and among his memoirs were "Indian Mathematics," a historical sketch (1915), "The Astronomical Observatories of Jai Singh" (1918), "A Guide to the Old Observatories" (1920), "Astronomical Instruments in the Delhi Museum" (1921) and "The Bakhshālī Manuscript" (1927). He also wrote on the two Aryabhattas and numerous other topics relating to Hindu science.

Mr. Kaye aroused a great deal of opposition on the part of Hindu mathematicians because of his conclusions that the early writers were dependent solely upon the Greeks and showed little originality except in the framing of fancifully worded problems. In fact, he clearly belonged to that school which asserts that pure mathematics never flourished in the Far East except as it adapted the theories of the West. Nevertheless, India is indebted to him for this very opposition, for it encouraged her scholars to study sources more thoroughly than before and to seek to base their claims upon more substantial foundations than mere tradition.

The best known of Mr. Kaye's contributions is his study of the Bakhshālī Manuscript, published as volume 43 of the Archeological Survey of India. This appeared only two years before his death and represents a painstaking examination of the internal evidence leading to a closer approximation to the date of the work than had been theretofore possible. It is too early to know the reaction of Sanskrit scholars to his conclusions, but in any case he has set them forth in such a logical fashion as to present a clear issue. No doubt the evidence in rebuttal, in the argument for an earlier date, will be assembled with equal care.

Mr. Kaye left a widow, a son, who has recently entered the India army, and two daughters.

DAVID EUGENE SMITH

NAOMASA YAMASAKI

NAOMASA YAMASAKI died at his home in Tokyo on July 26 of this year after a long illness at fifty-nine years of age. He was professor of geography and head of the Geographic Institute in the Tokyo Imperial University, a member of the Imperial Academy of Sciences, the Imperial Earthquake Commission and the Japanese National Research Council and foreign