NATIONAL ACADEMY OF SCIENCES

ROBERT MEARNS YERKES

1876—1956

A Biographical Memoir by
ERNEST R. HILGARD

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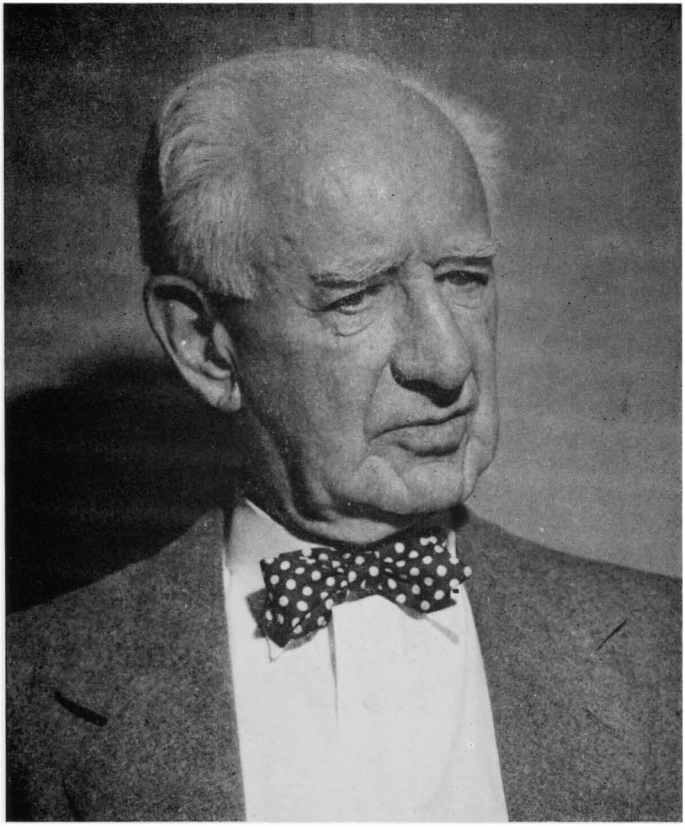

ROBERT MEARNS YERKES

May 26, 1876–February 3, 1956

BY ERNEST R. HILGARD

THE CAREER of Robert Mearns Yerkes[1] well represents the development of American psychology during the first half of the century—a development in which he played a leading part. His investigations of the behavior of infrahuman animals, especially the higher primates, for which he is best known, helped maintain and emphasize the strong biological cast of American psychology. His original work with animals antedated the rise of behaviorism, took Gestalt psychology in its stride, and remained throughout in the broad evolutionary, physiological, and functional tradition that he called comparative psychobiology. This tradition, as he lived it, was objective in method, but without any restrictive negatives about the appropriate subject matter of psychology. As he saw it, psychology dealt with man also, including self-observation, and as the psychologist primarily responsible for the development of the mental testing program in the army during World War I, he left his mark on an important development in human psychol-

[1] His own autobiography (through 1929) is "Robert Mearns Yerkes, Psychobiologist," in C. Murchison, ed., *History of Psychology in Autobiography*, 2(1932):381-407. See also E. G. Boring, "Robert Mearns Yerkes," in the *Year Book of the American Philosophical Society*, 1956, pp. 133-40; L. Carmichael, "Robert Mearns Yerkes: 1876-1956," *Psychol. Rev.*, 64(1957):1-7; L. Carmichael, "R. M. Yerkes, Psychobiologist," *Science*, 126 (1957):498; R. M. Elliott, "Robert Mearns Yerkes (1876-1956)," *Am. J. Psychol.*, 69 (1956):487-94.

ogy. Again in World War II he exerted strong leadership in maintaining the unity of psychology as a science, as a profession, and as a means of promoting human welfare—the last of these objectives being especially important to him.

EDUCATION

Born on a farm in Bucks County, Pennsylvania, on May 26, 1876, Robert grew up as a farm boy, the eldest son of a family of five children. He was much alone; the next child, a sister, was born four years after him, and died of scarlet fever at the age of three. He also had a severe case of scarlet fever at the time, and attributed to its sequelae some fatigability throughout life—a fatigability of which he gave no outward signs, in view of his erect posture, decisive manner, and ability to get things done. The other children (two boys and a girl) were born so much later that they seemed to him to be "charges" rather than "playmates." The second sister also died in early childhood.

He attended an ungraded school from the age of eight until fifteen, when he was sent for a few months to the State Normal School at West Chester, Pennsylvania. Although his father would have preferred to have him return to the farm, and his mother would have preferred to have him enter the ministry, Robert had already decided upon a career in medicine. This decision was influenced by acquaintance with the manner of life of the only college-trained members of his circle of relatives, a cousin, Dr. John B. Carrell (also the family physician), and an uncle, Dr. Edward A. Krusen (with whom Robert was to live while working his way through college).

At the age of sixteen Robert went to Collegeville, Pennsylvania, to live in the household of Dr. Krusen, and there to work for his board while attending Ursinus College. He completed

his preparatory work through one year in the Ursinus Academy, then entered the collegiate department and graduated with an A.B. degree in 1897, at the age of twenty-one.

The expectation that he would go on to the study of medicine at Jefferson Medical College in Philadelphia was sidetracked by an unexpected loan of one thousand dollars for a year at Harvard. After earning an A.B. degree there in 1898 he continued as a graduate student for a year in zoology, working with E. L. Mark, G. H. Parker, C. B. Davenport, and W. E. Castle. Then, under the influence of Josiah Royce and Hugo Münsterberg, he shifted to animal psychology and received his Ph.D. in 1902, with a dissertation on the sensory reaction and physiology of the nervous system of the jellyfish.

ACADEMIC CAREER

His academic career began, as he tells it, when Professor Münsterberg offered him an instructorship in comparative psychology, with half time for research and a salary of one thousand dollars per year. Münsterberg asked the friendly question: "Can you afford to accept it, Yerkes?" To this Yerkes replied: "No, but I shall, nevertheless." Thus began a fifteen year period of service to Harvard, first as an instructor (1902-1908), then as an assistant professor of comparative psychology (1908-1917). While at Harvard he married Ada Watterson, a biologist (botanist) in her own right, and an occasional collaborator with him in later years. Their two children, Roberta and David, were born there. The slow academic advancement at Harvard had no relation to the distinctiveness of his contributions to psychology, nor to the outside recognition that he received, for he was early perceived as a leader in the psychology profession and was elected to the presidency of the American Psychological Association while still an assistant professor.

Despite some inevitable frustrations due to lack of administrative support and encouragement, the years at Harvard were good ones, and were recalled by him as happy ones, in the departmental company of such men as Josiah Royce, George Herbert Palmer, William James, Hugo Münsterberg, Francis Peabody, Dickinson Miller, Robert MacDougall, Edwin B. Holt, and Ralph Barton Perry. A developing interest in human psychopathology led Yerkes to accept a half-time appointment with E. E. Southard at the Boston Psychopathic Hospital during the years 1913-1917, providing an important preparation for the war service soon to follow.

America's entrance into World War I came just after Yerkes had accepted the headship of the Department of Psychology at the University of Minnesota, a position he held *in absentia* for two years. The decision to go to Minnesota was made after it became clear to him that the only chance for advancement at Harvard was to shift to education, a move he was reluctant to make. He selected a promising young staff at Minnesota to add to those already there (his additions being Richard M. Elliott, William S. Foster, Mabel Fernald, and Karl S. Lashley) but he never did join them at the university. His plans for a strong department were ably realized under Elliott's leadership.

His academic career, interrupted by the war, was resumed at Yale in 1924 when he became a professor in the newly created Institute of Psychology, soon to be incorporated in the Institute of Human Relations. Here he joined his old friends Raymond Dodge, who came to Yale from Wesleyan, and Clark Wissler, who came there from the American Museum of Natural History. Yerkes continued actively at Yale, shifting his departmental connection to become Professor of Comparative Psychobiology in the Laboratories of Comparative Psychobiology, affiliated with the Department of Physiology in the Yale School of Medicine; thus in some sense his earlier

identification with medicine remained.[2] He became an emeritus professor in 1944, after twenty years of service. The two universities in which his life was chiefly spent—Harvard and Yale—jointly took over his favorite legacy, the Yale Laboratories of Primate Biology at Orange Park, Florida, after he relinquished the directorship in 1941; these laboratories were then fittingly renamed the Yerkes Laboratories of Primate Biology.

With the continuation of his life's work assured, he could look back on his career with the satisfaction that his earlier dreams had been realized, and that the impetus of what he had begun would endure. At the time of his death on February 3, 1956, the laboratories bearing his name had continued for fifteen years beyond his retirement as director. He had the satisfaction of leaving the directorship in the hands of Karl S. Lashley, one of those young psychologists of promise whom he had early chosen to be on his staff at Minnesota. Death came after two years of invalidism caused by a coronary thrombosis.

RECOGNITION AND HONORS

Yerkes' contributions to psychology and to science generally led to a number of honors. In addition to his membership in the National Academy of Sciences he was a member of the American Philosophical Society and a fellow of the American Academy of Arts and Sciences. His psychological colleagues elected him to the presidency of the American Psychological Association to serve in 1916-1917; two decades later (in 1938)

[2] The shift from psychology to physiology was apparently his own choice, representing at the time some dissatisfaction with the direction psychology was taking at Yale. In his strong identification with biology he urged his students to read *Biological Abstracts* along with or even in preference to *Psychological Abstracts*. His students continued to be drawn primarily from psychology, however, and to take their Ph.D.'s in psychology; his services to psychology during World War II show that he continued to feel deeply his affiliation with psychology.

he was chosen as president of the American Society of Naturalists. His honorary degrees included the LL.D. degree from his alma mater, Ursinus College, and the D.Sc. degree from Wesleyan. Russian scientists recognized him by placing his bust in the Darwinian Museum in Moscow. He was awarded the Gold Medal of the New York Zoological Society in January 1954, at which time he was described as "a true pioneer in comparative psychology and animal behavior, whose lifetime work in this field has justified his title of 'Dean of Comparative Psychology.' "

PLANNER AND ADMINISTRATOR

Yerkes' non-university career both interrupted and accompanied his work within the universities. He had a habit of planning ahead on a large scale, not only for his primary interest—comparative psychobiology—but in many other directions as well.

Plans for primate research. He early began thinking about an institute for psychobiology and already had this in mind during his first trip to Europe in 1903, when he visited laboratories in Germany and Switzerland. In 1915 he spent a sabbatical year in Santa Barbara, California, working with a former student, G. W. Hamilton, who had succeeded in setting up an independent laboratory of monkeys and one orangutan (Julius, the subject of an important monograph by Yerkes). During this year, Yerkes continued to expand his plans and the following year he published a specific proposal for the provision of laboratories devoted to the study of monkeys and apes—a proposal that had partial fulfillment when he set up a laboratory at New Haven with four chimpanzees eight years later, and substantial realization when in 1930 the Orange Park laboratories were opened, where some 90 chimpanzees were studied during his term as director.

Planning for psychology during and immediately after World War I. World War I found Yerkes, as president of the American Psychological Association, ready to mobilize the American psychologists for the war. He personally took charge of the intelligence testing program of the U. S. Army, from which resulted the famous Army Alpha test (for literates) and the Army Beta test (for illiterates). This took genuine leadership, beyond merely organizational and administrative ability, for such tests were not then well known nor always highly respected. Yerkes saw the program over its obstacles, and published an extensive report of the findings as a Memoir of the National Academy of Sciences in 1921, a report of some 700,000 words. He held a commission as major, and finally as lieutenant colonel, attached to the Surgeon General's Office.

At the same time (1917-1919) he was also chairman of the Psychology Committee of the newly created National Research Council, the forerunner of the Division of Anthropology and Psychology that was to become a part of the National Academy of Sciences–National Research Council.

During the time that he remained in Washington after the war (until 1924) he undertook a number of committee chairmanships, one of which continued for many years thereafter. These included his service as chairman of the Research Information Service, National Research Council (1919-1924), participation in founding and a director of Science Service (1921-1925), chairman of the National Research Council Committee on Scientific Problems of Human Migration (1922-1924), and, finally, chairman of the National Research Council Committee for Research in Problems of Sex, a committee that he headed for the record period of twenty-six years, from 1921 to 1947. The story of this committee is an impressive illustration of Yerkes' leadership in supporting not-always-popular types of research, including that of Dr. Kinsey and his associates.

Planning in World War II. One might suppose that yeoman service in one world war would have been enough, but this was not the case: once we became embroiled in World War II, Yerkes, retired at sixty-five from the directorship at Orange Park, but still on active university duty at Yale in New Haven, traveled frequently to Washington, clearing the way for a favorable utilization of the services that psychologists were now prepared to give on a wider front than in World War I. He saw the Adjutant General's Office as a more favorable place for the psychological services than the Surgeon General's Office (where they were located before), and helped open that door. The Emergency Committee in Psychology, within the National Research Council, became the body representing psychology to the various facets of government and the armed services, with Professor K. M. Dallenbach as its chairman. It had 12 standing committees and 26 other committees. As the organization became more cumbersome, the chairman felt the need of a subcommittee not under the pressure of specific assignments to take on a planning function and think of the future of the psychological profession as a whole. This Subcommittee on Survey and Planning fell naturally under Yerkes' chairmanship, and with a diverse membership (in addition to Yerkes, E. G. Boring, Alice I. Bryan, Edgar A. Doll, Richard M. Elliott, Ernest R. Hilgard, Rensis Likert, Carl R. Rogers, and Calvin P. Stone) met eight times for three days at a time in the years 1942-1944. The deliberations included discussion of psychology's services during the war and the role of psychology after the war. As Boring has put it: "Here Yerkes was at his best—always wise, always eager to explore new possibilities, never ready to surrender when no means seemed to be available or success seemed improbable."

The vigorous development of applied psychology between the two wars, evidenced by the demand for many kinds of

applied services during World War II, had caused a growing feeling of difference between the older and more academic American Psychological Association and the newer American Association of Applied Psychologists, which represented the nonacademic and technological interests of an energetic fraction of the psychological profession. Sensing that this kind of split in identification might lead to an eventual disruption of psychology as a unified profession, the Subcommittee on Survey and Planning, through the Emergency Committee on Psychology, proposed that an Intersociety Constitutional Convention be called, to represent not only these two major groups but several other societies of psychologists, all of which were represented on the Emergency Committee. This convention was held in New York on May 29-31, 1943, under the temporary chairmanship of Yerkes, who then stepped aside when the convention elected a member of his subcommittee, Dr. Boring, as its permanent chairman. The convention resulted in a rewriting of the bylaws of the American Psychological Association to provide a divisional structure representing the various interests, scientific and professional, of the many qualified but diverse American psychologists. The American Association of Applied Psychologists disbanded, and some of the specialized societies became divisions of the parent organization. The general success of the newly united organization of psychologists, now with an established central office in Washington, is a credit to Yerkes' leadership at a crucial time.

The continued planning role. This was not to be the end of his career as a planner. His chairmanship of the Committee for Research in Problems of Sex continued for another four years, until 1947, but he was still ready to take on something new. In 1941 the Fels Research Institute in Yellow Springs, Ohio, after twelve years of expanding operation, decided to undertake a self-appraisal and to plan for its future. Mr. Fels

turned to his old friend Yerkes, who spent two weeks at the Institute, read all its publications, got well acquainted, and wrote a report incorporating proposals for the future. Partly as a result of the enthusiastic report he produced, the Institute received a million dollar plant, and a board of scientific advisers was appointed as a continuing part of the operation of the Institute. Yerkes became in 1944 the first chairman of this board and continued to serve as a member of it until his death. Thus his vision of himself as a planner never faltered, and he fulfilled this vision to the end.

SCIENTIFIC CONTRIBUTIONS THROUGH RESEARCH

Yerkes was in many respects America's most persistent pioneer in comparative psychology and its most consistent advocate and devotee. He was among the first to enter the field, although it was opened up by Edward L. Thorndike at Columbia a little earlier and by W. S. Small, working under E. C. Sanford at Clark. Yerkes always viewed Thorndike as his senior, although Thorndike was only two years older; this was due in part, no doubt, to the fact that he had once been Thorndike's assistant during a summer session at the Marine Biological Laboratory at Woods Hole.[3] John B. Watson was two years younger than Yerkes; while they corresponded a great deal, and collaborated on one important paper, they never did work together. Animal psychology was formally announced as part of experimental

[3] Two amusing stories date from this experience with Thorndike. For demonstration purposes Thorndike had imported cats from New York City, which he housed in an old residence, one of Yerkes' duties being to feed them. Through the inadvertence of an attendant, the cats escaped, and because Yerkes had been their feeder he could no longer walk down the street without having one or more of them dart out of an alley and trail him with persistent meows. The other story has to do with Thorndike's confident conjecture that chicks could swim, even though they disliked water; when Thorndike was challenged by a class member, the class gathered on the shores of a pond while he tossed a chick into the middle, only to have to dive in, clothes and all, to rescue it, admitting scientific defeat, but restoring his reputation for being humane.

psychology at Harvard in 1899-1900, and two rooms (later three) in Dane Hall were equipped with vivaria and apparatus for experimentation. The initial equipment included a tank for frogs, cases for birds, and a box for tortoises. Yerkes and two student investigators (Hugo Linenthal and F. D. Bosworth) worked there during that initial year. When Emerson Hall was in the design stage, Yerkes joined with E. B. Holt in planning the animal facilities, so that Emerson Hall, opened in December 1905, had in it the first especially designed and equipped laboratory for comparative psychology.

In view of the elaborate equipment now considered necessary for research, Yerkes' reports of expenditures for the first active years of the Harvard laboratory are of some interest.[4] The expenses, during the first ten years of operation, are listed as follows:

Year	*Expenses*	*Number of Investigators: In Dane Hall (3 rooms)*
1899-1900	$ 75.00	3
1900-1901	26.78	5
1901-1902	36.34	3
1902-1903	15.00	5
1903-1904	20.00	4
1904-1905	50.00	4
		In Emerson Hall (6 rooms)
1905-1906	120.00	4
1906-1907	15.00	5
1907-1908	140.00	8
1908-1909	300.00	5

That university funds had to be supplemented by outside funds even in those days is evident from the report. The first indication of outside money is $150 raised privately by Yerkes in 1909-1910, and then a grant of $500 in 1912-1913 from

[4] From a typewritten report entitled "Sketch of Development of Work in Animal Psychological Laboratory since 1899," kindly furnished by Mrs. Yerkes.

the Bache Fund of the National Academy of Sciences for an investigation of color vision in birds. During that year the facilities for animal work were further expanded by the development of the fourth floor of Emerson Hall as a laboratory of animal psychology.

Sub-primate investigations. During these early years we see Yerkes the evolutionist at work, studying a great variety of animal forms, invertebrate as well as vertebrate; the tendency had not yet developed for psychologists to limit themselves to a few forms of animal life, chiefly mammalian. His own publications began with a report on the light responsiveness of small fresh-water crustacea (Entomostraca), and went on to studies of the fiddler crab, the turtle, the jellyfish, the green crab, the crayfish, the frog, the dancing mouse, the earthworm, the rat, the ring-tailed dove, the crow, the pig. These reports covered the years 1899-1915; after that he concentrated on the primates.

These investigations fell into three main groups: the study of sensory receptibility, habit formation, and problem-solving or intelligence. In each of the areas he showed ingenuity and innovation. For example, in the study of the reactions of the frog a device was prepared so that the frog's leg, attached to a lever, indicated precisely the amount of movement in response to stimulation, and served as an indicator of sensitivity to sound. When paired stimuli were used, the reactions varied with the time interval, thus demonstrating facilitation and inhibition with successive stimuli. Pavlov thought of these experiments as precursors of his own on conditioned reflexes, although Yerkes, strictly speaking, never used the conditioned reflex method; however, his review (with Morgulis) in 1909 introduced Pavlov's method to the American psychological public.

The studies of habit formation required adapting apparatus to organism. Thus, in studying learning in the earthworm,

Yerkes developed a simple T-maze, one arm leading to sandpaper and shock, the other to moisture and darkness. The problem of handling an earthworm had to be solved, if it was to run some 200 trials in this simple maze. Yerkes found after a while that this could all be managed, and he proceeded to show that the worm could learn. When the head was severed the worm persisted in its habit, but the habit was broken when the head regenerated! Only today, with advances in neurophysiology and neurochemistry, have these experiments been tried again with some chance of appropriate explanation.

Two invented devices from this period have remained the prototypes for a number of similar devices, the Yerkes-Watson apparatus for the study of vision in animals (1911), and the multiple-choice apparatus (1915). The Yerkes-Watson apparatus involved, for its time, sophisticated devices for presenting lights with independent control of hue and brightness on two panels, one panel associated with a right turn, the other with a left turn. If the animal turned to the "correct" side, it was rewarded with food; if it turned the other way it was punished or frustrated. The clue as to the direction in which to turn was given on the lighted panels; if it could make the correct choice, it could discriminate between the presented visual stimuli. The multiple-choice apparatus provided a kind of intelligence test suitable to a variety of animals. It consisted in the simultaneous presentation of a number of response opportunities, the "correct" choice being a matter of relative position, such as extreme left, middle, or extreme right. These opportunities were presented in different absolute positions within a bank containing a larger potential number. For example, the whole bank might contain 12 doors, of which any three neighboring ones could be opened at once, in any portion of the whole panel of 12. A problem can then be set, such as "middleness." In this case, the middle of three is correct (yielding food re-

ward), regardless of where the set of three appears. The problem can be made as difficult as desired; for example, a larger number of doors can be opened at once, to see if the concept of middleness will continue to be used. By appropriate use of doors of various sizes for smaller animals, of windows for horses, of keys for human subjects, the method is very versatile, and permits a kind of ordering of animals according to their abilities to solve abstract problems. The first publications were on the crow and pig, making use of the facilities of a field station established at the Yerkes summer home in Franklin, New Hampshire, in 1913-1914. The crow was found to be able to solve first open door (on right or left), but unable to solve second from left; the pig was able to solve both these problems, plus simple extreme-right–extreme-left alternation.

The method has continued in use, and is often one of the exercises in laboratory courses in experimental psychology.

Primate investigations. Some primate studies had begun before the infra-primate studies were completed. Among them was M. E. Haggerty's study of imitation in monkeys, first undertaken in 1907-1908 under Yerkes' direction. Yerkes' first publication on primates, apart from the review of work of others, was on maternal behavior in the monkey, reported in 1915, followed by an important monograph in 1916 based on the work in Santa Barbara with G. V. Hamilton's orangutan. The beginning of World War I had prevented Yerkes from spending 1915 as planned at the ape laboratory on the island of Tenerife, in the Canary Islands, where Köhler was presently to do his work on insight in chimpanzees. In his work with Julius, the orangutan, Yerkes studied insight by the multiple-choice method, and proposed a set of criteria for insight, prior to the appearance of Köhler's studies. The two sets of studies were, of course, quite independent, and no matter of priority is involved; the relations between Yerkes and Köhler, estab-

lished in 1914, were always cordial and mutually supportive. The move into other fields during World War I now intervened, and it was not until 1925 that Yerkes again published on primates. That year saw the appearance of two books, one (with Blanche W. Learned) on vocal expression in the chimpanzee, the other, entitled *Almost Human,* a popular naturalistic account based on observations in Madame Abreu's chimpanzee colony in Cuba, prior to the establishment of the new Yale laboratories.

Active work with chimpanzees began before the Yerkes residence was moved from Washington. In August of 1923 two young chimpanzees, a male (Chim) and a female (Panzee), were privately purchased and taken to the Yerkes farm in New Hampshire through September. They were then taken to live in the Washington residence, a special cage having been constructed in a third-floor-back bedroom, formerly occupied by his daughter, connected with an enclosed sunporch. The first of the two books published in 1925 is based largely on observations made on this pair. Panzee lived only a few months, dying of tuberculosis. Yerkes visited Cuba in January 1924, and on his return in June took along Chim, in excellent health. Chim served for numerous observations there by Yerkes and Dr. Harold C. Bingham during the summer, but Chim, too, became ill, and died of pneumonia before the end of the summer. The second book is based on observations made in Havana.

By the fall of 1924 the Yale professorship had become a reality and a new primate laboratory was prepared at New Haven, with four chimpanzees to be ready for experimentation by the fall of 1925. Two of these (a male Bill and a female Dwina) were acquired and taken in the early summer of 1925 to the Yerkes farm, where initial experimentation was begun with the collaboration of Dr. Bingham. They were brought in

the fall to the new primate laboratory in New Haven where they were joined by two more (a male Pan and a female Wendy), so that the new laboratory was then fully under way.

Arrangements were made by Yerkes to do some experimentation each of three winters with a young mountain gorilla, Congo, the work being done on the estate of Mr. James Burbridge at Jacksonville, Florida. For some time the question of where to locate a laboratory that would include a breeding station remained open, with Cuba one possibility and Florida another. Yerkes' familiarity with the Jacksonville area made the negotiations easier when the decision was finally made to establish the chimpanzee colony at Orange Park, near there. Studies of the gorilla appeared in 1927 and 1928, and thereafter a great many publications emerged, chiefly on the chimpanzee, as work at New Haven and Orange Park expanded.

Two summaries in book form are monuments to this period, a substantial book on all that was known up to that time about the behavior of anthropoids, *The Great Apes* (1929), prepared in collaboration with his wife, Ada W. Yerkes, and *Chimpanzees: A Laboratory Colony* (1943), giving a discursive, highly valuable account of the experiences involved in setting up a breeding colony and experimental station, with many little details that scientific articles seldom include.

What can be said of the specific contributions of these studies? They are too varied to be readily summarized, and those bearing Yerkes' name are but a fraction of the studies that emerged from the laboratories during the period that he directed them. His own list follows:

"To list topics of research or to present a complete bibliography would be tedious. I shall instead name a few general areas of research which are well represented in our reports and which, because of the nature of our discoveries and their relations to human life, are obviously significant.

"There are studies of (a) physical characteristics, growth, and maturation; (b) the sexual and reproductive cycles, and especially oestrus, ovulation, gestation, and parturition; (c) aspects of sexual and reproductive behavior; (d) auditory and visual sensory and perceptual processes; (e) neural correlates of behavior; (f) behavioral adaptations, as in discrimination learning and other modes of habit formation; (g) factors, both internal and environmental, which affect behavioral adaptation; (h) memory and imagination; (i) capacity for the modification of environment as in the shaping and use of tools; (j) symbolism, ideation, insight, or their counterparts; (k) linguistic expression and capacity; (l) suggestibility; (m) emotional traits and their modes of expression; (n) social relations and organizations; (o) drug addiction and drug susceptibility; (p) parasite control and related problems of health and hygiene."[5]

The estimate of where these studies have led would require an estimate of contemporary psychology. They are simply part and parcel of psychology's slow march toward a firm basis of fact and theory that will lead eventually to an understanding of the behavior of lower organisms and of man. Psychology has been less fortunate than other sciences in having a few great discoveries or dramatic breakthroughs to which to point; psychologists have thus far contributed more through patient accumulation than through dramatic forward leaps.

Investigation of intelligence. Yerkes had begun to make contributions to intelligence testing before World War I; he was chosen to direct the work during the war because of this preparation and interest, as well as because of his administrative skill. His Point Scale for measuring intelligence was published (with J. W. Bridges and R. S. Hardwick) in 1915.

[5] Quoted, with permission, from *Chimpanzees: A Laboratory Colony* (New Haven, Yale University Press, 1943), pp. 300-301.

This was intended as an alternative to the mental age scales of the Binet type, and was felt to make possible sounder interpretations of the growth of intelligence than the mental age method permitted. There followed several articles in 1916 and 1917 on problems of intelligence measurement and the applications of intelligence measurement to police and court cases, and to children in need of special care. The Point Scale considerably influenced the development of later group scales of intelligence, but its identity was gradually lost, although there was a revision (with J. C. Foster) as late as 1923. The Point Scale was overshadowed by the Army Alpha and the Army Beta tests, and the monumental report on them that was Yerkes' classical contribution to this field.

Summary of research contributions. Thus we see Yerkes as a pioneer in animal psychology working his way through invertebrate and amphibian forms up through birds and mammals to the primates and man, then becoming identified in research most extensively with the great apes. In the preprimate period he will be remembered particularly for developing the discrimination method for studying vision and the multiple-choice method for studying higher processes. One "law" from this period now bears his name: the Yerkes-Dodson law. This law expresses a curvilinear relationship between the amount of painful shock used as motivation in a learning experiment and the speed of learning. Within limits, increasing the intensity speeds learning, but beyond that increases of intensity introduce interferences which reduce learning. This law has recently been generalized for the understanding of human behavior by Eysenck and his collaborators at Maudsley Hospital, London. The one hardbound book from this early period, that on *The Dancing Mouse* (1907), reads well even today as an illustration of the methods of animal psychology. The intelligence studies are well archived in the report on the

army tests of World War I; no contemporary book on testing fails to give this source due credit.

The most distinguished contributions undoubtedly will be felt to fall in the field of primate behavior, to which he not only devoted more continuous years than to any other type of investigation but promoted the scientific productivity of numerous colleagues and students. He developed a number of interesting devices, such as a box-and-pole test for ideational behavior and a turntable for delayed reaction studies. His collaborators developed a great many also but they do not have the dramatic quality today that the earlier introduction of the visual discrimination and multiple-choice methods had. This is not because originality was lessened but because, as many more workers entered the field, innovations appeared less striking. Even though we cannot point to exciting new "laws," the knowledge we now have of primate behavior that is on a firm basis is due largely to Yerkes' vision and patience. Many areas of psychology are richer because of the impetus that his studies, and those he inspired, have given.

NON-RESEARCH PUBLICATIONS

A man with such an active and alert mind could not content himself with writing only about the data from experiments; he would naturally wish to prepare teaching materials for his classes, to discuss larger scientific and professional issues, and occasionally to express himself on matters of public policy.

Two publications little related to his research interests are noteworthy as an indication of his breadth as a teacher of psychology. The first of these is a general textbook entitled *Introduction to Psychology* (1911), dedicated to his teacher Münsterberg. The book was written from the point of view of the introspective psychology of its time, and its exercises at the end of the chapters are nearly all exercises in introspection.

Purely psychological knowledge, as he then saw it, is guided by self-observation; once this knowledge of mental processes has been obtained it is a further step to relate these processes to bodily ones. He acknowledged that his own personal inclinations turned him more to physiology, but while writing psychology he was *not* writing on physiology or physiological psychology. The book apparently did not catch on; there were competing textbooks of introspective psychology, and the new behaviorism was soon to make the position represented somewhat obsolete. The second publication, designed for students, prepared with D. W. LaRue, was actually a short pamphlet entitled *Outline of a Study of the Self* (1913). This was in its own way a predecessor of the personality inventories to be developed by others in later years. These two publications show that Yerkes the teacher did not confine himself to an interest in subhuman species.

There were a number of theoretical papers, based indirectly on the laboratory, but concerned with more general issues. These had to do with the criteria of the psychic, reactions to Watsonian behaviorism, the anthropocentrism in psychology, the nomenclature of comparative psychology, the relations between psychology and biology, the relations between comparative psychology and medicine. Abstract theoretical writing was not his forte, however, and these papers, while sensible and cogent, were not vigorous enough to produce debate; he was at his best in making careful observations in the laboratory, and his best theoretical writing is that which is very close to his observations, as in establishing criteria for insightful behavior.[6]

Occasionally he was tempted to write upon large public issues, when he showed confidence in science as a servant of

[6] As an illustration, note may be made of his criteria for insight reported in his monograph on the gorilla, *The Mind of a Gorilla: I*, Genet. Psychol. Monogr., vol. 2, 1927, p. 156.

mankind, trust in democratic processes, and a general confidence that intelligent men of good will could work out their own salvation. Some of the topics he covered were progress and peace (1915), racial well-being (1916), science and community trusts (1921), scientific method in making laws (1930), and psychology in world reconstruction (1946).

PERSONAL TIES AND INFLUENCES

It was no doubt a rare good fortune for the young Yerkes to find himself a graduate student at Harvard when he did, and to become affiliated there with a group of distinguished young men who were to remain his friends. One of his last letters, written January 20, 1956, just two weeks prior to his death, was addressed to Ralph Barton Perry in response to an inquiry about the early days of a club to which they both belonged, an association which evoked fond memories.[7] Known as the Wicht Club, it was named for a mythical character in German folklore, a funny little figure wrapped in a scarlet cloak. Yerkes mentions in his letter how he prizes a framed picture of a Wicht that Roswell P. Angier (one of the club members) had sent from Germany. Founded in 1902, the club consisted chiefly of graduate students who had just returned from Germany, or young instructors or assistant professors. According to Mrs. Yerkes, the members enjoyed adding suffixes in German fashion to the Wicht name, so that as the men married their wives became Wichtinnen, and the first child in the group was the Wichtlein.

Each of the club members sent his reprints each year to E. B. Holt, who had them bound into a volume called "Was Wichtiges," the name being a kind of pun on the club's name joined with the weighty and serious nature of the members' contributions. The original members were Edwin B. Holt,

[7] A copy of the letter, and additional descriptions of this club, were kindly furnished by Mrs. Yerkes.

Roswell P. Angier, and Robert M. Yerkes from psychology; Ralph Barton Perry, Wilmon H. Sheldon, and William Montague from philosophy; Walter B. Cannon and Ernest E. Southard from the medical school; George W. Pierce and Harry W. Morse from physics; Gilbert N. Lewis from chemistry; E. V. Huntington from mathematics; and Arthur O. Norton from education.

The Wicht Club was partly social (sometimes a little too free with liquid refreshments for Yerkes' taste) and partly intellectual; at the monthly meeting at a Boston restaurant the men came in tuxedos worn with red ties; wives were admitted to dinner once a year, but the members were on such friendly terms that there were many informal gatherings in their homes between times. In later years the Wicht Club became the Discussion Group and wives were regularly included. The personal attachments were strong; the Yerkeses, Cannons, and Pierces became summer neighbors at Franklin, N.H., after the Yerkeses bought their farm there in 1912, and thus enduring friendships were established. The sense of membership in an elite must have engendered considerable motivation toward scientific production. Each year members received their bound copies of reprints; this went on from 1903 to 1911. How important it must have been to have something to include![8] Whenever a member received a full professorship the club held a party in his honor. It may be noted that four of the original twelve later became members of the National Academy of Sciences; not all were eligible as scientists, but each achieved distinction in his own field.

This affiliation with men from both his own and neighboring fields of scholarly interest continued. In considering the years in Washington during World War I, Yerkes men-

[8] While the stimulation of such a group is noteworthy, Yerkes scarcely needed it if we judge by the energy he showed early in his career. For example, he submitted essays for the Bowdoin prize in 1899 and for the Boylston prize in 1903 and again in 1905, winning the last two.

tions specifically the influence upon him of friendship and professional association with George E. Hale (astronomer), John C. Merriam (paleontologist), Raymond Dodge (psychologist), Clarence E. McClung (zoologist), Victor C. Vaughan (bacteriologist-physician), and William H. Welch (pathologist).

Among the psychologists whom Yerkes admired through the years, mention should be made of E. B. Titchener, whose erudition impressed him, Lewis M. Terman, because of an affection dating to their association in World War I, R. M. Elliott, his protégé at Minnesota, and E. G. Boring, whom he considered "Mr. Psychology" during the years of World War II and thereafter. Yerkes was capable also of strong personal dislikes, but to my knowledge these were expressed privately and did not interfere with his professional effectiveness.

A man who pioneers as Yerkes did attracts able men to him, who then carry on the work that he inspires. Because of the long interruption in World War I, the Harvard Ph.D.'s represent an age group now retired or deceased: J. C. Bell, C. S. Berry, F. S. Breed, L. W. Cole, M. E. Haggerty, J. E. Rouse, K. T. Waugh. The Yale Ph.D.'s are mostly at the height of their careers: D. K. Adams, J. T. Cowles, J. H. Elder, M. C. Forster, C. M. Louttit (deceased), Vincent Nowlis, K. W. Spence, S. D. S. Spragg.[9] The many able postdoctoral fellows working in Yerkes' laboratories at Yale (both New Haven and Orange Park) makes the listing of his own Ph.D.'s only a partial indication of those whose careers he influenced.

The Yerkes family always welcomed graduate students, postdoctoral fellows, and colleagues into their home on an informal and friendly basis. As one who enjoyed these associations during graduate student days and as a young instructor, I can only attest to the significance this has for identification with a profession, leading to a feeling that somehow a

[9] The list of Yale Ph.D.'s was provided through the kindness of Dr. Claude E. Buxton, chairman of Yale's Department of Psychology.

career in the chosen field can turn out to be a satisfying one.

Yerkes brought to all his activities a sense of high purpose, of forthrightness, and of ethical sensitivity. There was privately printed, toward the end of his life, a statement of his personal creed, in the form of the following ten statements:

PERSONAL CREED

"I believe:

"In knowledge of the natural order as basis of man's life.
"In the supernatural—soul, spirit, absolute—as possible.
"In religious experience as awareness of super-individual influence or being.
"In man's responsibility for his life, but not for eternity, destiny, immortality.
"In the obligation of man to strive to guarantee to every individual the inalienable right to be well-born and well-reared.
"In the dignity and perfectibility of man as part of the natural order.
"In the worship of ideal manhood rather than godhood and of manliness rather than saintliness.
"In usefulness through fellow service as incomparably worthy ambition.
"In the natural origin of conscience, morality, and codes of human conduct.
"In the priority of life over death, effort over prayer, knowledge over faith, and resolution over wishfulness."

This is one fragment we have of a twelve-chapter autobiographical manuscript that he prepared late in life, but never published.[10] He could look back on a life that had been lived according to his creed, always placing a high value upon work, always willing to sacrifice personal convenience to public service, ever questioning nature in order to find new truths.

[10] One extract from his autobiography has been published in the *Yale Journal of Biology and Medicine* for 1963 and has been included in his bibliography.

CHRONOLOGY

1876	Born May 26, Bucks County, Pennsylvania
1891	State Normal School, West Chester, Pennsylvania
1892	Ursinus Academy, Collegeville, Pennsylvania
1893-1897	Ursinus College, A.B., 1897
1897-1898	Harvard University, A.B., 1898
1898-1902	Graduate student, Harvard, first in zoology, after 1899 in psychology; Ph.D., psychology, 1902
1899	First published paper: "Reaction of Entomostraca to stimulation by light"
1902-1908	Instructor in comparative psychology, Harvard
1903	First European visit, to Germany and Switzerland
1905	Marriage to Ada Watterson (Children, Roberta and David)
1907	*The Dancing Mouse*
1908-1917	Assistant professor in comparative psychology, Harvard
1909	With S. Morgulis, "The method of Pavlov in animal psychology"
1909	Spent spring in Baltimore, learning surgical techniques with Harvey Cushing
1911	With John B. Watson, "Methods of studying vision in animals"
1911	*Introduction to Psychology*
1913-1917	Half time with E. E. Southard, Boston Psychopathic Hospital
1915	With J. W. Bridges and R. S. Hardwick, *A Point Scale for Measuring Mental Ability*
1915	Sabbatical year in Santa Barbara, California, with G. V. Hamilton
1915	Multiple-choice method introduced
1916	"Provision for the study of monkeys and apes" (Anticipates establishment of later laboratories)
1916	Director, National Committee for Mental Hygiene
1916-1917	President, American Psychological Association
1917-1919	Professor at University of Minnesota, but never in residence
1917-1919	Service in World War I: Chairman, Psychologists Committee, National Research Council; psychological

	officer attached to Surgeon General's Office, first as Major, later as Lieutenant Colonel
1919-1924	Chairman, Research Information Service, National Research Council
1920	With C. S. Yoakum, *Army Mental Tests*
1920	Second European visit, to England and France
1921	Editor, "Psychological examining in the United States Army"
1921-1925	Director, Science Service
1921-1947	Chairman, National Research Council Committee for Research in Problems of Sex
1922-1924	Chairman, National Research Council Committee on Scientific Problems of Human Migration
1924	Summer in Havana, with colony of chimpanzees of Madame Abreu
1924-1929	Professor of Psychology in Yale Institute of Psychology
1925	*Almost Human*
1925	With B. W. Learned, *Chimpanzee Intelligence and Its Vocal Expressions*
1929	With Ada W. Yerkes, *The Great Apes*
1929	Third European visit, including visit to Africa
1929-1941	Professor of Comparative Psychobiology, and Director of Yale Laboratories of Primate Biology
1938	President, American Society of Naturalists
1941	Retires as Director, Yale Laboratories of Primate Biology
1941-1944	Continues as Professor of Comparative Psychobiology, Yale University
1942-1944	Service in World War II: Chairman, Subcommittee on Survey and Planning, Emergency Committee in Psychology, National Research Council
1943	Temporary Chairman, Intersociety Constitutional Convention, called at the instigation of the Subcommittee on Survey and Planning
1943	*Chimpanzees: A Laboratory Colony*
1944	Retires as emeritus professor
1944-1956	First chairman, then member of Advisory Board, The Fels Research Institute, Yellow Springs, Ohio

1945 "Plan for a history of psychological services in the war"
1951 "Gorilla census and study"
1954 "The biologist's point of view"
1954 "Personal creed"
1956 Died in New Haven, Connecticut, February 3

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KEY TO ABBREVIATIONS

Am. J. Phys. Anthropol. = American Journal of Physical Anthropology
Am. J. Physiol. = American Journal of Physiology
Am. J. Psychol. = American Journal of Psychology
Am. Museum J. = American Museum Journal
Am. Naturalist = American Naturalist
Anat. Record = Anatomical Record
Ann. Am. Acad. Political Social Sci. = Annals of the American Academy of Political and Social Science
Behavior Monogr. = Behavior Monographs
Biol. Bull. = Biological Bulletin, Woods Hole
Boston Med. Surg. J. = Boston Medical and Surgical Journal
Bull. Mass. Comm. Mental Diseases = Bulletin of the Massachusetts Committee on Mental Diseases
Bull. Nat. Res. Council = Bulletin of the National Research Council
Bull. Wagner Free Inst. Sci. = Bulletin of the Wagner Free Institute of Science
Century Mag. = Century Magazine
Comp. Psychol. Monogr. = Comparative Psychology Monographs
Genet. Psychol. Monogr. = Genetic Psychology Monographs
Harvard Psychol. Studies = Harvard Psychological Studies
J. Abnormal Psychol. = Journal of Abnormal Psychology
J. Animal Behavior = Journal of Animal Behavior
J. Appl. Psychol. = Journal of Applied Psychology
J. Comp. Neurol. = Journal of Comparative Neurology
J. Comp. Psychol. = Journal of Comparative Psychology
J. Consulting Psychol. = Journal of Consulting Psychology
J. Criminal Law Criminol. = Journal of Criminal Law and Criminology
J. Educ. Psychol. = Journal of Educational Psychology
J. Genet. Psychol. = Journal of Genetic Psychology
J. Personnel Res. = Journal of Personnel Research
J. Phil. Psychol. Sci. Methods = Journal of Philosophy, Psychology, and Scientific Methods

J. Psychol. = Journal of Psychology
J. Social Psychol. = Journal of Social Psychology
Lit. Dig. Internat. Book Rev. = Literary Digest International Book Review
Mental Hyg. = Mental Hygiene
Nat. School Serv. = National School Service
Proc. Am. Acad. Arts Sci. = Proceedings of the American Academy of Arts and Sciences
Proc. Am. Phil. Soc. = Proceedings of the American Philosophical Society
Proc. Nat. Acad. Sci. = Proceedings of the National Academy of Sciences
Proc. Roy. Soc. London = Proceedings of the Royal Society of London
Proc. Soc. Exp. Biol. Med. = Proceedings of the Society for Experimental Biology and Medicine
Psychol. Bull. = Psychological Bulletin
Psychol. Rev. = Psychological Review
Quart. Rev. Biol. = Quarterly Review of Biology
Yale J. Biol. Med. = Yale Journal of Biology and Medicine
Yale Sci. Mag. = Yale Scientific Magazine

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