

## Celebrating E. L. Thorndike a Century After *Animal Intelligence*

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*This section of the American Psychologist was prepared to celebrate the centenary of the publication of Edward L. Thorndike's 1898 doctoral dissertation, "Animal Intelligence: An Experimental Study of the Associative Processes in Animals." The author explores Thorndike's life and work in animal psychology, educational psychology, and mental testing. Thorndike was a "sane positivist," who believed strongly in the scientific method and the application of the results of scientific research for the betterment of humanity.*

This is a year in which to celebrate the career of one of the most productive and influential of all American psychologists, Edward Lee Thorndike (1874–1949). It is the centenary of the publication of his doctoral dissertation, "Animal Intelligence: An Experimental Study of the Associative Processes in Animals" (E. L. Thorndike, 1898), a key work in shifting the focus of much thought about animal behavior and in the development of animal experimental psychology. However, Thorndike's influence was much wider than this. His animal research was confined primarily to the early years of his career. His work on psychometrics and educational psychology dominated most of his academic career and had considerable impact.

In the set of articles that follows, we explore various aspects of Thorndike's career. Rather than try to provide a comprehensive treatment, we deal in as much depth as possible in articles of this length with three divergent aspects of Thorndike's oeuvre. More comprehensive treatments of Thorndike's life and career can be found in the book-length biography of Joncich (1968a), the autobiographical chapter of E. L. Thorndike (1936), or the articles by Gates (1949), Humphrey (1949), Goodenough (1950), Joncich (1968b), R. L. Thorndike (1991), and Woodworth (1952).

### Synopsis of the Life and Career of E. L. Thorndike

Thorndike was born in Williamsburg, Massachusetts, the second of four children, each of whom would have important academic careers. He received a bachelor of arts degree from Wesleyan University in 1895, a second bach-

elor of arts from Harvard University the next year, and a Harvard master of arts degree in 1897. Thorndike received his doctorate from Columbia University in 1897. His three-year career as a graduate student was a busy one. His interest in Harvard had been piqued by William James's (1890) *Principles of Psychology*. Thorndike began research at Harvard with studies of the facial expressions of young children in mind-reading experiments. When the university would not permit him to continue this line of work, he switched to animal research and studied the behavior of chickens, first in the room in which he lived, and later in the cellar of James's home. Granted a fellowship, Thorndike took himself and his two "most educated chickens" (E. L. Thorndike, 1936, p. 265) to Columbia University to complete graduate work under James McKeen Cattell. There he completed his dissertation work on animal intelligence. After a year on the faculty of Western Reserve University, Thorndike returned to the Teachers College at Columbia, where he spent the rest of his career.

As psychology was developing during the early years of the century, there was a greater demand for applied work than for work in animal intelligence (Dewsbury, 1992; O'Donnell, 1985) and Thorndike responded to the pressures and helped to develop the fields of applied psychology. Most of the remainder of his career was in educational psychology.

By the time Thorndike's career was over, his bibliography included some 508 titles, including over 50 books. This includes work in such diverse areas as animal learning and imitation, mental testing, educational psychology, children's dictionaries, and the relative evaluation of different cities as places to live.

### Work in Animal Learning

In the field of animal learning, E. L. Thorndike's (1898) dissertation, which psychologists are celebrating this

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year, was followed up with several additional articles; the material from five articles was brought together with two original essays in *Animal Intelligence: Experimental Studies* (E. L. Thorndike, 1911). Thorndike's position, resulting from his experimental work, was that learning is the result of trial and error followed by accidental success. This process was most clearly illustrated by his classic studies of cats escaping from puzzle boxes. The successes lead to a strengthening of connections, a process that Thorndike termed the *law of effect*, but that today, shorn of some terminology judged to be mentalistic, would be called *reinforcement*. Learning is gradual, not the result of understanding, reasoning, or insight. It does not require conscious processes: The greater the number of repetitions, the better the learning; this is Thorndike's law of exercise. Furthermore, all animals learn in fundamentally the same way. Differences among species are merely a matter of degree, not kind. Thorndike's thinking on this issue changed from 1898 to 1901 and 1911 as he came to think of human learning as more similar to that in other species than he had originally thought (see Bruce, 1997).

Thorndike's work was not without its problems. C. Lloyd Morgan, who inspired some of Thorndike's research, was critical of several aspects of Thorndike's formulation (Morgan, 1898). For instance, Morgan believed that Thorndike's experimental situation did not provide a good opportunity for reasoning to occur: "The conditions of his experiments were perhaps not the most conducive to the discovery of rationality in animals if it exist" (Morgan, 1898, p. 249). This theme was expanded by T. Wesley Mills (1899), who also believed that Thorndike gave his animals no opportunity to display reasoning; he wrote "as well enclose a living man in a coffin, lower him, against his will, into the earth, and attempt to deduce normal psychology from his conduct" (Mills, 1899, p. 266). This critique, in turn, led to a sharp reply from E. L. Thorndike (1899).

It was immediately apparent that Thorndike's work signaled a shift from speculation to experimentation under controlled conditions. Morgan (1898) applauded Thorndike's "experiment under conditions allowing for some control" (p. 249) and expressed "the hope that comparative psychology has passed from the anecdote stage to the higher plane of verifiable observation, and that it is rising to the dignity of science" (p. 250). At the same time, it appears that Thorndike's view that all species learn in roughly the same manner led animal psychologists to concentrate on a few species, such as laboratory rats, rather than develop a broader and more comprehensive science of behavior (but see Bruce, 1997).

### **Woods Hole<sup>1</sup>**

An important influence on Thorndike's later work, deserving of further study, was the summers he spent in Massachusetts beginning in 1899 at the Marine Biological Station at Woods Hole. There, he met and interacted with such scientists as Robert Yerkes, Jacques Loeb, and Charles Otis Whitman.

Two of Thorndike's Woods Hole lectures were published (E. L. Thorndike, 1900a, 1900b). The second dealt with animal learning and the first with instinct. The instinct lecture followed Whitman's (1899) lecture, which is often considered to have provided the conceptual foundation for the development of European ethology. Thorndike accepted Whitman's arguments concerning the inherited nature of instinctive behavior, a notable event in the history of comparative psychology. Further, however, he cautioned that "since instinctive activities are the results of gradual development, they should be, not merely enumerated, described, and explained as to their utility, but also explained as to their development and relationships" (E. L. Thorndike, 1900b, p. 67). This passage is remarkable because it states concisely the issue that would divide many American comparative psychologists from European ethologists half a century later (e.g., Lehrman, 1953). The lecture also reflects the sympathy for evolutionary approaches that was characteristic of true comparative psychologists throughout the past 100 years.

In his work with human intelligence, Thorndike, like many of his contemporaries, was a strong hereditarian. It is likely that these Woods Hole experiences were important in shaping these views.

### **Work in Educational Psychology**

Thorndike carried the same positivistic approach he had applied to research with nonhumans to his work with humans. One area of interest was in the famous transfer of training work done with Robert S. Woodworth (E. L. Thorndike & Woodworth, 1901). They studied the transfer of learning from one situation to another and concluded that the degree of positive or negative transfer was a function of the number of elements shared between the two situations. Extending this result led to a refutation of the belief that training in a narrow area, such as learning Latin or Greek, would benefit later performance in a wide variety of situations.

Thorndike's view of intelligence was consistent with that in animal learning. Thorndike "held that the only general ability was the ability to learn associations or connections. A higher level of ability simply depends on more numerous and more subtle connections" (Woodworth, 1952, p. 214).

Although he was not well trained in mathematics, Thorndike's approach to mental testing was a quantitative one. His *The Measurement of Intelligence* (E. L. Thorndike, Cobb, Woodyard, & staff, 1926) presented his CAVD scale based on completion, arithmetic, vocabulary, and directions. A total of 17 levels of difficulty were included. Thorndike thus promoted a doctrine of specificity of abilities and opposed Charles Spearman's construct of a general factor in intelligence (g). Thorndike viewed the correlations among tasks found by Spearman

<sup>1</sup> *Woods Hole* was spelled *Woods Holl* when Thorndike studied there. The titles of his publications from this period use the earlier spelling.

as due to the proportion of connections shared among tasks.

### **Human Learning**

Thorndike returned to the study of learning during the 1920s and 1930s (e.g., E. L. Thorndike, 1931, 1932). The positive effects of reward in the law of effect were confirmed but he revised his view that punishment led to a weakening of connections. Although punishment sometimes can be beneficial, he now believed that it worked mainly by causing the organism to shift its behavior to another response.

### **Other Work**

It is impossible to capture the range of Thorndike's interests in a short introduction. One systematic program was the investigation of the value of different cities as places in which good people might live (e.g., E. L. Thorndike, 1939). This effort is carried on by others today and causes a great flurry of publicity when the results are announced each year.

A major contribution was the production of English dictionaries written for school use with careful attention so that the words used in providing definitions would be those already familiar to the young readers (E. L. Thorndike, 1935). Similarly, he helped to develop mathematics textbooks with problems phrased in ways that would be easily understood by children (E. L. Thorndike, 1917). Thorndike's studies of word frequencies in the English language (e.g., E. L. Thorndike & Lorge, 1944) were of considerable help in such endeavors.

When Thorndike entered the field of vocational guidance (E. L. Thorndike, 1934), it was again with the goal of permitting solid decisions to be based on solid data. The results were generally disappointing, however (R. L. Thorndike, 1991).

### **What Kind of Man?**

Joncich (1968a), following Robert Woodworth, entitled her biography of Thorndike *The Sane Positivist*. Clearly, Thorndike was that. He was a Progressive in a progressive era; he believed in the betterment of humankind and that empirical science provided the road to that betterment. Thorndike was a scientist first and foremost. He was not a visionary or a dreamer; he was not a planner. In the words of his son, "he was not by temperament a systematist but rather an empiricist, a conductor of investigations and an analyzer of data" (R. L. Thorndike, 1991, p. 140). He conducted experiments. He created situations in which experimental treatments would lead to fairly precise conclusions under controlled conditions. He then tried to apply his results in a no-nonsense manner to the alleviation of problems in society. As his son put it, "he applied a certain amount of formal psychology and a considerably larger dose of shrewd common sense to rationalizing instruction in a wide range of fields" (R. L. Thorndike, 1991, pp. 141–142). In a very American way, the line between theoretical and applied science

was blurred. His positivism was "sane" in that it was reasoned, eclectic, useful, and down-to-earth.

Joncich (1968b) treats him as "victim of the optimistic and widespread assumptions of nineteenth century positivism" (p. 440). "That knowledge is power, that truth can be known, that facts can be trusted—these approached copybook maxims in Thorndike's youth, and such ideas no less distinguished those inducted into science in its perhaps most optimistic age" (p. 440). Such sentiments are still present in parts of psychology, but many other parts have been strongly influenced by positions of relativism, postmodernism, and social constructionism. Adherents to such views would regard Thorndike's position as naive, but perhaps characteristic of the Progressivism of the time.

Physically, Thorndike was described as a bear of a man, but a man who was friendly, generous, and kind. He had a buoyant good humor and a sparkling wit. These made him a fine companion and teacher. In his younger days he was an avid tennis player. Outside of his academic life, he fit the role of a country gentleman (Gates, 1949). He was a workaholic largely because analyzing data was what he enjoyed more than anything else (R. L. Thorndike, 1991).

### **Recognition**

Edward L. Thorndike received many of the awards and other signs of recognition one would expect of a psychologist of his accomplishment and stature. He received honorary doctorates from Columbia University (1929), the University of Chicago (1932), the University of Athens, Greece (1937), the University of Iowa (1923), and the University of Edinburgh (1936). He received the Butler Medal from Columbia University in 1925. Thorndike was elected to the National Academy of Sciences in 1917 and the American Philosophical Society in 1932. He was elected a fellow of the American Academy of Arts and Sciences in 1934. He was elected a fellow in 1901, Vice President in 1902, and President in 1919–1920 of the New York Academy of Sciences; a Fellow in 1901, Vice President in 1911, and President in 1934 of the American Association for the Advancement of Science; President of the American Psychological Association in 1912; President of the Psychometric Society in 1936–1937; and President of the American Society for Adult Education in 1934–1935. In addition, he received various lectureships, election to various committees, and memberships in such organizations as Phi Beta Kappa, Sigma Xi, the British Psychological Society (honorary), the Leningrad Scientific–Medical Pedological Society (honorary), and the Comenius Educational Association of Czechoslovakia (honorary) (Woodworth, 1952).

### **The Articles in This Commemorative Section**

This section begins with a reprinting of the first eight pages of Thorndike's PhD thesis, the work we are commemorating. Here, Thorndike lays out the philosophy

guiding his animal research and much that would follow in animal psychology. It is here that he rails against eulogies for animals, pointing to the need to understand not only their intelligence but their stupidity as well. Animal psychology must have a firm basis in experimentation under controlled conditions.

In the first article of the set, Bennett G. Galef, Jr. writes in the positivistic tradition of Thorndike, celebrating his rejection of anecdotes, anthropomorphism, and introspection. He puzzles, however, over the discrepancies between Thorndike's apparent grasp of fundamental biological principles in places and his apparent naivete regarding these principles in others. This, Galef contends, led to a dissociation of parts of animal psychology from foundational principles of biology much to the detriment of the development of psychological principles.

In the second article, Henderikus J. Stam and Tanya Kalmanovitch explore similar territory but from a somewhat different perspective. They focus on the relationship between the animal and the psychologist and the manner in which the animal was conceptualized. Each animal species has evolved and adapted to a particular habitat. However, some animal psychologists sought a perfect animal as a laboratory model for humans and tended to strip the animal of its unique characteristics in an effort to construct one that was better suited to their experimental purposes. They thus exchanged the anthropomorphism of their predecessors for what the authors term a "mechanicotheriomorphism."

In the third article, Barbara Beatty focuses on Thorndike's work in educational psychology. She shows how the methods and spirit of this work were linked to his earlier animal studies. Thorndike helped to establish an important place for psychologists in the educational establishment. She points to Thorndike's interest in moral issues and its impact on the development of Thorndike's psychology.

A fourth article, to deal with Thorndike's efforts in the mental testing movement, was projected. Unfortunately, the author was unable to complete the article within the allotted time frame.

We hope that these articles advance understanding of these aspects of Thorndike's work and provide an illustration of how commemorative work done in celebration of an important event in psychology need not lack critical perspective and historical insight.

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