Mirror, Mirror on the Wall, Who was First of All? Simultaneous Discovery in Psychology and Behavior Analysis

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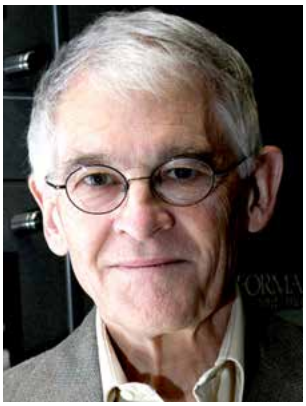

The historian Barbara Tuchman titled her history of the Late Middle Ages, *A Distant Mirror: The Calamitous 14th Century*, suggesting we view the past as but an image seen from far away. Scientists who created the histories we now view as mirrored reflections themselves also looked into Tuchman's mirrors. They saw not only the past, but sometimes also saw, standing over their shoulder, an eerie scientific doppelgänger, their own ideas created concurrently by another.

Simultaneous discovery in science is as old as science itself. In the late 1600s, Gottfried Wilhelm Leibniz and Isaac Newton had quite a row over who got to calculus first. A little later, Lavoisier, Priestly, And Scheele all bumped into oxygen at about the same time. In 1858, a letter from Alfred Wallace to Charles Darwin described the former's own theory of natural selection that closely paralleled Darwin's then-still-simmering account. Wallace and Darwin soon thereafter jointly reported their findings to the Linnaean Society, only two or three months after Wallace's letter had arrived.

Years after his discovery of the conditioned reflex, Ivan Pavlov wrote the following about the discovery of the type of conditioning that bears his name:

> Some years after the beginning of the work with our new method I learned that somewhat similar experiments had been performed in America, and indeed not by physiologists but by psychologists. Thereupon I studied in more detail the American publications, and now I must acknowledge that the honor of having made the first steps along this path belongs to E. L. Thorndike. By two or three years his experiments preceded ours and his book [Animal Intelligence] must be considered a classic, both for its bold outlook on an immense task and for the accuracy of its results. (Pavlov, 1928)

Figure 1. E. B. Twitmyer shown, ironically, holding two dogs.

Pavlov seems to have missed the pioneering work of another contemporary, an American psychologist, whose work more precisely than Thorndike's, paralleled Pavlov's own, which, according to Boakes (1984, p. 120) began in 1897. Working at Johns Hopkins University in Baltimore, E. B. Twitmyer (Figure 1) paired a tone with a stimulus that elected the knee-jerk response of human subjects only to discover that after a few pairings, the tone presented by itself came to elicit the knee-jerk response. Pavlov first reported his work on conditioning at the International Congress of Medicine conference in Madrid in 1903. Twitmyer's dissertation describing the conditioned knee jerk response was published in 1902. Seligman (2018) noted that Twitmyer described the work at a meeting of the American Psychological Association on December 29, 1904, presided over by none other than the father of American psychology, William James. Seligman suggested that Twitmyer's work received relatively little attention because James called for lunch immediately following

Twitmyer's presentation, cutting off any discussion of his potentially discipline-changing research. Indeed, it was not until five long years later that, following a visit to Pavlov's lab in Russia that Yerkes and Morgulis published the first English-language account of "Pawlow's" (as they spelled it) research (Yerkes & Morgulis, 1909).

In 1930, Skinner published a paper involving what eventually would be labeled operant conditioning. The topic was satiation and in it Skinner described a feeding device that permitted "the animal to obtain uniform pieces of a prepared food ... in such a way to make an electrical contact for each piece taken" (p. 434). In a subsequent article accepted for publication on February 15, 1932, Skinner (1932) changed the hinged door out for "a horizontal section of heavy wire ... forming part of a lever" (p. 278) that when moved downward completed an electrical circuit that recorded the response.

Three months after Skinner's first description of a rat lever, on April 12, 1932 a British psychologist named G. C. Grindley submitted for publication a paper describing the apparatus shown in Figure 2. A guinea pig was restrained in a two-element harness similar to that used by Pavlov to restrain dogs in his experiments on classical conditioning. Rather than recording salivation from the guinea pigs, however, upward movements of the guinea pig's head were detected mechanically. This was done via "two cloth-covered metal strips (of which S-S is one) pressing lightly against the animal's cheeks [to] ensur[e] that any movement of the head to either side [vertical movements were not recorded] was transmitted to a ..." (Grindley, 1932, p. 129) wooden arm (EE). This arm in

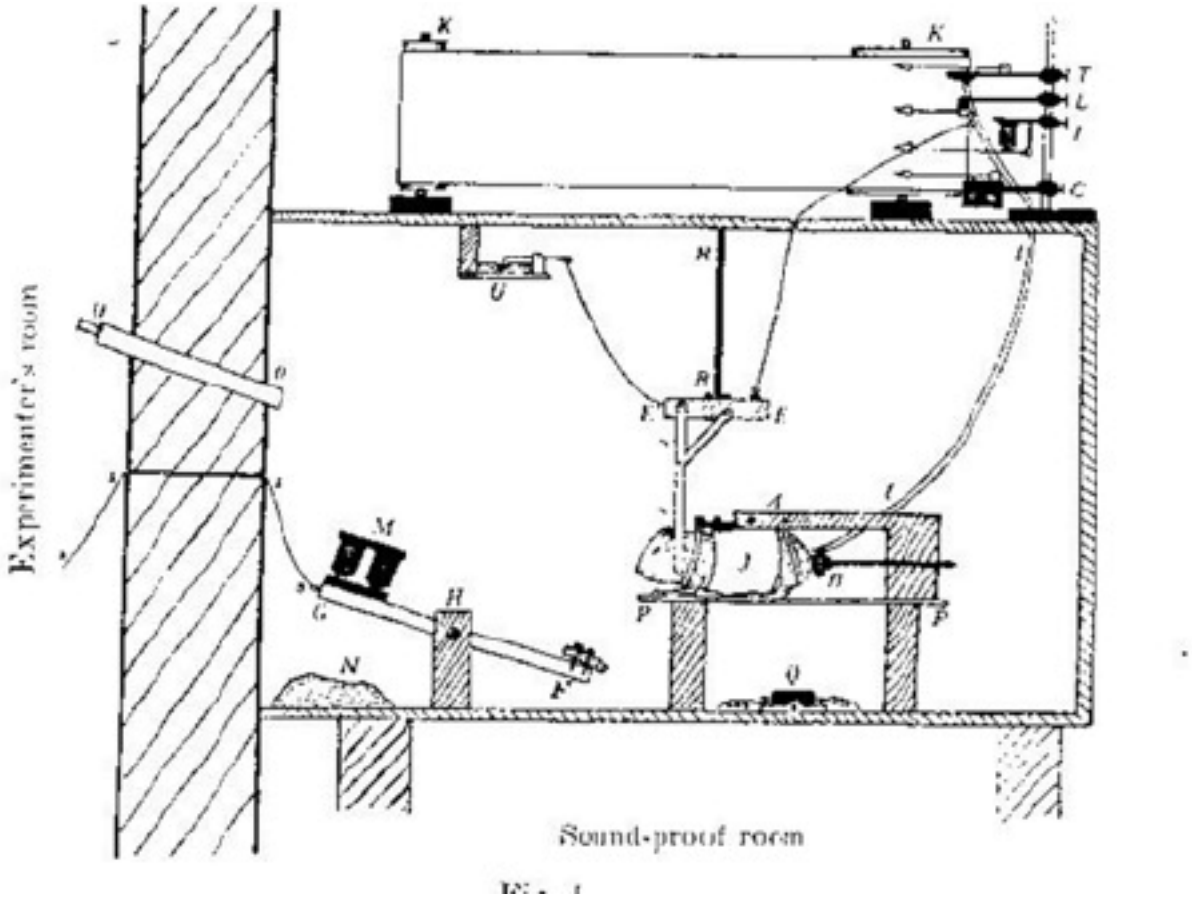

Figure 2. Grindley's (1932) apparatus for studying the behavior of guinea pigs.

turn was connected with fish line to the pen on a kymograph located above the enclosure housing the guinea pig and to an electrical switch (U). Head movements thus were recorded mechanically on the kymograph. The switch (U) was connected to an electromagnet (M) that, when activated, held in place a metal plate at the end of a lever (G). At the other end of the lever (G), Grindley tied a piece of carrot that was accessible to the guinea pig only if the metal bar was released from the other end of the lever by de-activating the electromagnet. After the guinea pig partook briefly of the carrot, the experimenter, observing form another room through a telescope, (O; recall last month's piece in this newsletter about Ogden Lindsley's behavior scope, a later version of a recording system for

surreptitious observation), the experimenter could pull the string (s s s) and reactivate the magnet, holding the bar to it and thereby removing access to the carrot. Grindley generate data on acquisition, extinction, and what he called "reversal of habit" – turning to the opposite side to which they originally were trained. Although the data were orderly and consistent with other instances of such behavioral phenomena, Grindley reported that the apparatus was not optimal. The automatic recording of head movements seems to have been unreliable, or at least inconsistent. Thus, some of the data he collected and reported in the paper were based on direct visual observation. Predicting what Skinner (1932) already had reported, Grindley concluded that "[i]t is desirable that in future work of this kind the response used should be one which can be recorded automatically and accurately" (1932, p. 131).

Grindley (1932) discussed whether his findings revealed a type of conditioning different from that described by Pavlov, concluding that explanations of the type of learning exhibited by the guinea pigs "...seem to involve a number of fresh assumptions in addition to the assumptions made by Pavlov" (1932, p.145). Thus, along with Kornorski and Miller (e.g., 1928; Miller & Kornorski, 1937) and Skinner (1935), a distinction between Pavlov's type of conditioning and what would come to be called operant or instrumental conditioning was on the horizon. As with other instances of concurrent discovery, the apparatus that led to the operant-respondent distinction seems to have been brewing in the Zeitgeist of the 1930s. Grindley subsequently conducted research on visual perception and was a founding member of the Experimental Psychology Society. Reflected through Tuchman's distant mirror, his work stands near the shoulders of both Skinner and Kornorski and Miller.

Footnote

I thank Professor Phil Reed of the University of Swansea for directing me, in 1997, to Grindley's work and Professor Iver Iversen of the University of North Florida for valuable background information about Grindley.

References

Boakes, R. A. (1984). *From Darwin to behaviourism: Psychology and the minds of animals*. Cambridge University Press.

Grindley, G. C. (1932). The formation of a simple habit in guinea pigs. *British Journal of Psychology, 23*, 127-147.

Konorski, J., & Miller, S. (1937). On two types of conditioned reflex. *Journal of General Psychology, 16*, 264-272.

Miller, S., & Konorski, J. (1928). Sur une forme particulière des réflexes conditionnels. C. r. Soc. Biol., 99, 1155-1157. (An English-language translation of this paper appears as: Miller, S., & Kornorski, J. [1969]. On a particular form of conditioned reflex. *Journal of the Experimental Analysis of Behavior, 12*, 187-189.)

Pavlov, I., (1928). *Lectures on Conditioned Reflexes*. Petrograd, Preface to the First Edition.

Seligman, M. E. P. (2018). When William James got hungry. *The Pennsylvania Gazette*, May/June, pp. 56-60.

Skinner, B. F. (1930). On the conditions of elicitation of certain eating reflexes. *Proceedings of the National Academy of Sciences, 16*, 433-438.

Skinner, B. F. (1932). Drive and reflex strength: II. *Journal of General Psychology, 6*, 38-48.

Skinner, B. F. (1935). Two types of conditioned reflex and a pseudo type. *Journal of General Psychology, 12*, 66-77.

Skinner, B. F. (1937). Two types of conditioned reflex: A reply to Kornorski and Miller. *Journal of General Psychology, 16, 272-279.*

Yerkes, R. M., & Morgules, S. (1909). The method of Pawlow in animal psychology. *The Psychological Bulletin, 6,* 257-273.