

*PAVLOV AND SKINNER:
TWO LIVES IN SCIENCE
(AN INTRODUCTION TO B. F. SKINNER'S
"SOME RESPONSES TO THE STIMULUS 'PAVLOV' ")*

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The sesquicentennial of Ivan Petrovich Pavlov's birth in September 1999 is being celebrated in Russia by a special issue of the *Russian Journal of Physiology* (the former *I. M. Sechenov Physiological Journal*, founded by Pavlov in 1917). The following article and the address by Skinner that it introduces are scheduled to appear in Russian translation in that special issue. Skinner's "Some Responses to the Stimulus 'Pavlov'" was his presidential address to the Pavlovian Society of North America in 1966. The following article provides the context for Skinner's address by describing some ways in which Pavlov's research influenced Skinner's contributions.

Key words: Ivan Petrovich Pavlov, B. F. Skinner, Pavlovian Society of North America, respondent conditioning, classical conditioning, operant behavior

I began to build a library, starting with Bertrand Russell's "Philosophy," John B. Watson's "Behaviorism," and I. P. Pavlov's "Conditioned Reflexes"—the books which had, I thought, prepared me for a career in psychology. (Skinner, 1979, p. 4)

This quotation is drawn from B. F. Skinner's account of his student days and the circumstances that led him to his research on behavior. His account acknowledged the important intellectual influence of the philosopher Bertrand Russell and the psychologist John B. Watson. But for the young Skinner, Ivan Petrovich Pavlov was not just an influence: Pavlov was his hero. As Skinner wrote in an earlier brief autobiography, "Russell and Watson had given me no glimpse of experimental method, but Pavlov had: Control the environment and you will see order in behavior" (Skinner, 1967, p. 399). Throughout his life, Skinner's most generous statements of intellectual debt were to Pavlov. His most extensive acknowledgment of that debt was the following article, which, most appropriately, was his presidential address to the Pavlovian Society of North America. The address appeared in the first volume of the journal, *Conditional Reflex* (Skinner, 1966) and was later reprinted in a collection of Skinner's papers called *Cumulative Record* (Skinner, 1972,

1999). We introduce it here as a contribution to the celebration of Ivan Petrovich Pavlov's sesquicentennial.

"The International Congress of Physiology met at the Harvard Medical School in August 1929, and Ivan Petrovich Pavlov gave the principal address!" (Skinner, 1979, pp. 41–42). The exclamation point, which is rare in his writings, allows us to judge the significance of this event to Skinner. He was then a 25-year-old graduate student and attended the Congress as a volunteer (one of his tasks was to operate a slide projector). He tells of the event in his autobiography as well as in his own Pavlov address:

I heard Pavlov's presidential address (in German) but did not try to shake his hand. I did get his autograph. A photographer was taking orders for a portrait and had asked Pavlov to write his name on a slip of paper so that his signature could appear on each print. I offered to buy a copy if I could have the slip of paper when the photographer was through with it, and he sent it to me. (Skinner, 1979, pp. 42–43)

This photograph traveled with Skinner throughout his life. When he took the chairmanship of the Department of Psychology at Indiana University, "I moved into the Chairman's office and hung up my autographed portrait of Pavlov" (Skinner, 1979, p. 302). The photograph stayed with him when he moved back to Harvard after 2 years at Indiana University. According to his daughter, Ju-

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lie S. Vargas, it is still on the wall of his study in their home in Cambridge, accompanied only by photographs of his wife and daughters and of the psychologist, Fred S. Keller, a lifelong friend and confidant since their days together in graduate school (see Figure 1).

In his Pavlov address, Skinner also tells of his reaction to an ethical question posed by H. G. Wells, which pitted Pavlov's fate against that of the playwright, George Bernard Shaw.

If Shaw were drowning on one side of a pier and Pavlov on the other, and you had only one life preserver, to which would you throw it? Wells's decision to throw it to Pavlov had confirmed my decision to abandon literature for behavioral science. (Skinner, 1979, p. 91)

When he came to write his autobiography, Skinner expanded his story with the full quotation from Wells, who, on asking himself what the good is of Shaw and of Pavlov, concluded that Pavlov "is a star which lights the world, shining above a vista hitherto unexplored. Why should I hesitate with the life belt for one moment?" (quoted in Skinner, 1976, p. 301).

Skinner's Citations of Pavlov

In Skinner's seminal work, *The Behavior of Organisms* (Skinner, 1938), Pavlov has 44 references in the index. No other scholar comes close. Charles S. Sherrington has 14 entries, Edward L. Thorndike has three, and Charles Darwin has only one. Of those other two authors who were early inspirations to Skinner, John B. Watson has six entries and Bertrand Russell has none.

Soon after *The Behavior of Organisms* was published, a review argued that the title was pretentious. According to the reviewer, "Experiments with white rats are certainly not enough to establish a system of behavior. A better title would have been 'Properties of Certain Specific Complex Reflex Mechanisms in the White Rat.'" Skinner then added: "I was surprised by this because I had only followed Pavlov, who had not added 'in the Dog' to his title, and Sherrington, who had not added 'in the Cat'" (Skinner, 1979, pp. 231-232).

Skinner cited Pavlov often in his writings throughout his career. In the 1,115 pages of his three-volume autobiography (Skinner, 1976, 1979, 1983), he first mentions Pavlov

only very late in the first volume, but thereafter the name appears 64 times (the total would be larger if "Pavlovian" were included in the count). The density of references to Pavlov is especially high in the sections in which Skinner describes his experimental work during the early 1930s. Some contemporaries, such as colleagues and family members, are more often cited, but Pavlov has no others who could be counted as competitors among Skinner's references to his scientific antecedents.

Near the end of his autobiography, Skinner looked upon his own life in terms of the science of behavior. He did not appeal to personality concepts or patterns of development. Instead, he said of the abiding themes in his career that "they can be traced to environmental sources rather than to traits of character. . . . So far as I am concerned, Darwin and Pavlov offer a better explanation than Sophocles and Freud" (Skinner, 1983, p. 401).

The Science of Behavior

Skinner's work followed from Pavlov's in its insistence on the primacy of data and on the importance of studying the behavior of individual organisms rather than that of groups. But he diverged from Pavlov's precedence in two major ways, one theoretical and the other empirical. Skinner argued for the primacy of a science of behavior and against the postulation of inferred neurological processes, and he discovered methods for studying environment-behavior interactions that differed from those that occurred in Pavlovian conditioning. Skinner introduced the term *operant* as a name for the kinds of behavior that entered into these interactions.

One of Pavlov's earliest works on conditioning available in English is his Huxley lecture delivered at Charing Cross Hospital in England on October 1, 1906. It begins:

For a consistent investigator there is in the higher animals only one thing to be considered—namely, the response of the animal to external impressions. . . . Strictly speaking, natural science is under an obligation to determine only the precise connection which exists between the given natural phenomenon and the responsive faculty of the living organism with respect to the phenomenon—or, in other words, to ascertain completely how the

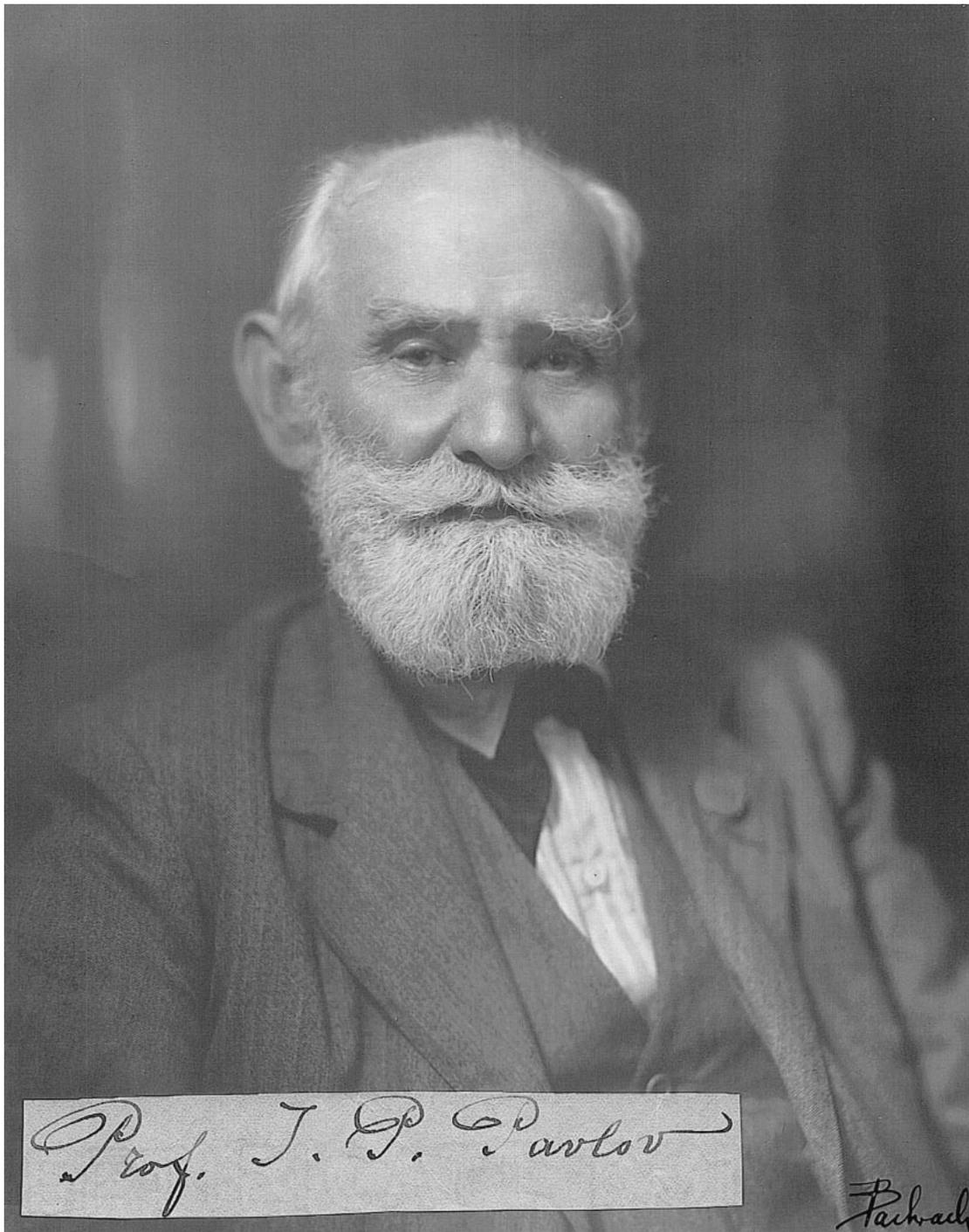


Fig. 1. B. F. Skinner's treasured picture of Ivan Petrovich Pavlov, taken by a photographer at the 1929 International Congress of Physiology, with Pavlov's signature attached.

given living object maintains itself in a constant relation with its environment. (Pavlov, 1906, pp. 613–614)

Responses in relation to environments were precisely the objects of study for those psychologists who called themselves behaviorists, and Skinner counted himself among them from the outset of his career in psychology.

For Skinner, behavior was worthy of study in its own right, not as a symptom to be used as a window on physiological processes, and thus Skinner valued above all Pavlov's behavioral observations. This did not imply that he disapproved of physiology:

It was not true, however, that I was opposed to physiological research. . . . I had, of course, criticized the conceptual nervous systems of Sherrington, Pavlov, and Hull and the use of merely inferred neural entities to explain the behavior from which they were inferred. Direct observation of the nervous system called for special techniques, and I was content to leave it to the physiologists. Meanwhile an experimental analysis of behavior would give them a correct assignment. (Skinner, 1983, p. 367)

Skinner argued that neuroscientists needed a science of behavior; without it, they would not know what to look for in the nervous system and therefore might look for things they would never find. In the final analysis, physiological functions are important because of what they allow organisms to do.

Respondent Behavior and Operant Behavior

Skinner called the kind of behavior that entered into Pavlovian conditioning respondent behavior. The conditional stimulus sets the occasion for presentations of the unconditional stimulus, and under these circumstances the conditional stimulus comes to produce behavior related to the behavior that had earlier been elicited by the unconditional stimulus. The prototypical example, of course, is the elicitation of salivation by a conditional stimulus that has consistently preceded presentations of an unconditional stimulus, food. In Skinner's operant behavior, however, the contingencies are different: A discriminative stimulus sets the occasion on which responses have some consequence; in the absence of the stimulus, responses do not produce that consequence. The prototypical example is the lever pressing of the rat whose presses

produce food in the presence but not in the absence of a light. The rat comes to press the lever in the presence of the discriminative stimulus, the light, but not in its absence. As we shall see, at first the respondent and operant vocabularies overlapped: It took Skinner a long time to distinguish between the Pavlovian conditional stimulus and the operant discriminative stimulus. (The origins of Skinner's distinction between operants and respondents in his research program, briefly described here, is recounted in more detail in Skinner, 1979, and Iversen, 1992.)

Skinner eventually summarized the difference this way:

Pavlov himself called all events which strengthened behavior "reinforcement" and all the resulting changes "conditioning." In the Pavlovian experiment, however, a reinforcer is paired with a *stimulus*; whereas in operant behavior it is contingent upon a *response*. Operant reinforcement is therefore a separate process and requires a separate analysis. . . . (We note, incidentally, that these two cases exhaust the possibilities: an organism is conditioned when a reinforcer [1] accompanies another stimulus or [2] follows upon the organism's own behavior). (Skinner, 1953, p. 65)

Nevertheless, it took Skinner some time to appreciate the significance of the differences between his findings and Pavlov's.

My main interest was conditioning . . . , and I now tackled it head on. I would apply the techniques I had developed for the study of eating to a much more important process. I was recapitulating Pavlov's history, for he had also studied ingestion before moving on to conditioned reflexes. (Skinner, 1979, p. 87)

For a while, Skinner stayed close to the Pavlovian formula, but eventually his data forced him to give it up. At first, he distinguished between two types of conditioned reflex, calling the first, as in Pavlov's experiment, Type I; Type II involved responses, as when the lever is pressed and the pellet is eaten, but those responses too depended on antecedent stimuli.

Skinner suspected that he had "found a process of conditioning that was different from Pavlov's and much more like most learning in daily life" (Skinner, 1979, p. 89). But he moved with caution. At about the same time, Pavlov had been struggling with the same problem.

In November 1931, two Polish physiologists, Konorski and Miller, had gone to Leningrad to persuade him to change his theory. They had done some experiments in which a hungry dog flexed its leg "to produce food." . . . Pavlov discussed this topic in his Wednesday seminar on April 20, 1932. (Skinner, 1979, pp. 92-93; cf. Pavlov, 1957; Kimmel, 1976).

It was in a response to Konorski and Miller's work that Skinner first used the term *operant*, reserving *respondent* for the Pavlovian case. "It would have been the right time to abandon 'reflex,' but I was still under the control of the work of Sherrington, Magnus, and Pavlov" (Skinner, 1979, p. 184).

I had come to psychology devoted to Pavlov, and I had soon discovered Sherrington and Magnus. They seemed to be closer than any of their contemporaries to a true science of behavior. The concept of the reflex had served them well, and in my thesis I had said that it was all that was needed in the study of behavior. I knew better by the time I began to write my book [Skinner, 1938]. My field was the operant rather than the respondent. . . . I could not break my chains, however. I went on talking about reflexes. (Skinner, 1979, p. 201)

Skinner did eventually break his chains, but it took a long time. It is therefore not surprising that others have sometimes not easily recognized Skinner's distinction between respondent and operant behavior (Skinner makes that point in his address, in describing his interaction with Mr. Filatov, the bear trainer from the Moscow Circus).

In current behavior analysis, operant behavior is behavior that is emitted rather than elicited. Antecedent (discriminative) stimuli set the occasion on which such behavior may occur, but its emission in the presence of those stimuli depends not on its relation to other, eliciting stimuli (the unconditional stimuli of Pavlov), but rather on its past consequences. It is a profoundly simple idea: Present behavior depends on the consequences the behavior has produced in the past, as when the rat's lever presses occur now because earlier they produced food. To say it in another way: The consequences of current responses select the responses that will occur subsequently. Despite its simplicity, we are still a long way from fully exploring its implications. (Skinner later noted that the selection of behavior by its consequences within the

lifetime of an individual organism has features in common with the selection of members of a population in the evolution of species, but elaboration of that point would take us too far afield; see Skinner, 1981.)

A Visit to Russia

In 1961, Skinner and his wife Eve spent more than 3 weeks in Russia as part of a delegation of American psychologists. On May 13, he gave a television talk from Moscow. He was told that it was seen by about 30 million Russians. While in Moscow he visited a museum on the site of Sechenov's laboratory; it included many pictures of Pavlov, some of which he tried to photograph. Skinner was in Leningrad only from May 14 through 17 and describes this time very briefly in his autobiography: "In Leningrad we visited Pavlov's laboratory, talked with Anokhin, one of his students, went to the Hermitage and Peterhof" (Skinner, 1983, p. 197).

In an account sent to some friends, he wrote "We saw the chair Pavlov sat in, the hole in the door he peeked through to observe the movements of his dogs, and a classical Pavlovian experiment, amplified now with photographic recording of electrocardiographs, pneumatic responses, and so on." He noted that "Everyone worships Pavlov," and that questions were often answered by appeal to Pavlov's authority: "You see, Ivan Petrovich Pavlov said . . ." He was himself an admirer of Pavlov, but he did not approve. Like Pavlov, he regarded data (facts) as having priority over appeals to authority in the defense of procedures or ideas.

Skinner in Defense of Pavlov

Skinner only occasionally involved himself in politics. The misuse of Pavlov's name during the Korean War provided one such occasion.

It was said that prisoners of war in Korea were being "brainwashed." The term was apparently a translation from the Chinese, but as a Communist practice the press quickly associated it with Pavlov and coined the term "pavlovize." I drafted a letter to the *New York Times*. (Skinner, 1983, p. 62)

The letter began, "As scientists actively engaged in the study of conditioned reflexes, we wish to protest the current misuse of the name of I. P. Pavlov. The greater part of Pav-

lov's work on conditioning was done prior to the communist regime, and he was frequently called to account by that regime for expressing unsympathetic views." The letter went on to state that "Communist techniques in dealing with military and political prisoners (in particular, the so-called 'brainwashing') have nothing in common with the experimental procedures of Pavlov, or the processes discovered by him," and concluded that it should "never occur to anyone to think of his work when presented with the facts concerning the treatment of prisoners" (Skinner, 1983, p. 63). The letter was cosigned by Liddell and by Gantt, both of whom had worked in Russia with Pavlov (1928; Heaton, 1986; Liddell, 1956), but the *New York Times* did not publish it.

Later in his autobiography, in connection with comments on the problems of mixing science with political philosophy, he provided the following Pavlovian anecdote but did not identify its source: "Pavlov was once called before the Russian equivalent of a Senate Investigating Committee to explain why he had criticized the regime. At one point he looked at his watch, said 'Gentlemen, I have an experiment,' and was allowed to walk out" (Skinner, 1983, pp. 182–183). Skinner approved of Pavlov's position and used it in support of the point that psychologists are not behaving as scientists when they aspire to develop theories of human behavior consistent with democratic (or any other) political philosophies.

Skinner and the Pavlovian Society of North America

Here is the passage from Skinner's autobiography in which he describes his involvement with the Pavlovian Society of North America and the circumstances that led to his address on Pavlov:

Horsley Gantt and Howard Liddell, two Americans who had worked with Pavlov, founded the Pavlovian Society, and I was invited to join. At one meeting Gantt said, "You should be President," and before long I found myself in that office, apparently appointed by the board of directors. I presided at a meeting in Princeton, and gave my Presidential Address, called "Some responses to the stimulus 'Pavlov,'" at another at Harvard. (Skinner, 1983, p. 287)

As noted in passing in his address, research

on cardiac conditioning was a major theme among the papers at the Harvard meeting.

After recapitulating how he obtained Pavlov's autograph at the International Congress of Physiology in 1929, Skinner went on,

I learned from Pavlov a respect for controlled experimental conditions and for simple facts: "On December 15, 1911, at exactly 1:55 in the afternoon a dog secreted nine drops of saliva." I expressed my respect for him in a way I was sure he would have approved by listing some differences. He had really studied behavior rather than, as he supposed, the nervous system, and he had never taken the consequences of behavior into account. (Skinner, 1983, p. 287)

Skinner's presidential address to the Pavlovian Society follows below. Skinner begins it by teasing his audience with religious metaphors describing some of the ritualistic features of academic practices. Especially during the first half of the 20th century, American psychologists often divided themselves into schools, typically centered around particular individuals. Those schools have in fact been compared with religions from time to time. It was in this context that Skinner, after having seen a review of *The Behavior of Organisms*, wrote to the American psychologist E. L. Thorndike that the review "has reminded me of how much of your work in the same vein I failed to acknowledge. . . . It has always been obvious that I was merely carrying on your puzzle-box experiments but it never occurred to me to remind my readers of that fact," to which Thorndike replied, "I am better satisfied to have been of service to workers like yourself than if I had founded a 'school'" (Skinner, 1979, p. 233). But the ritual to which Skinner referred in his address was a relatively subtle verbal one: The Pavlovian Society so strongly favored *conditional* over *conditioned* as the appropriate English translation of the key term from the title of Pavlov's great book (1927) that it named its journal *Conditional Reflex* rather than *Conditioned Reflex* (see Catania, 1998, chap. 13 and glossary, for a discussion of the English-language vocabulary of conditioning).

Skinner was President of the Pavlovian Society in 1966. After his death in August 1990, the Society dedicated its 1991 meeting to his memory. The dedication, in noting the profound importance of both Pavlov's *Condi-*

tioned Reflexes and Skinner's *The Behavior of Organisms*, remarked on how fitting it was that a society honoring Pavlov should also honor Skinner. It is also fitting that both Pavlov and Skinner have been honored by the American Psychological Association. Skinner's last paper, accompanied by an editorial tribute and a citation for Outstanding Lifetime Contribution to Psychology, appeared in the year of his death (Skinner, 1990). A special issue dedicated to his work followed later (Lattal, 1992). More recently, the *American Psychologist* celebrated the centennial of Pavlov's "Work of the Digestive Glands" in a special section of articles (Dewsbury, 1997). The inclusion of Skinner's address on Pavlov in the celebration of Pavlov's sesquicentennial closes the circle in one sense, but it does not complete it, for the work of these two great scientists will continue to be carried forward by future generations of their students.

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