# FORGENENI

B.F. SKINNER (1904–1990)

# IN CONTEXT

APPROACH
Radical behaviorism

BEFORE

**1890** William James outlines the theories of behaviorism in *The Principles of Psychology.* 

**1890s** Ivan Pavlov develops the concept of conditioned stimulus and response.

**1924** John B. Watson lays the foundations for the modern behaviorist movement.

1930s Zing-Yang Kuo claims that behavior is continually being modified throughout life, and that even so-called innate behavior is influenced by "experiences" as an embryo.

AFTER

**1950s** Joseph Wolpe pioneers systematic desensitization as part of behavior therapy.

**1960s** Albert Bandura's social learning theory is influenced by radical behaviorism.

urrhus Frederic Skinner, better known as B.F. Skinner, is possibly the most widely known and influential behaviorist psychologist. He was not, however, a pioneer in the field, but developed the ideas of his predecessors, such as Ivan Pavlov and John B. Watson, by subjecting theories of behaviorism to rigorous experimental scrutiny in order to arrive at his controversial stance of "radical behaviorism."

Skinner proved to be an ideal advocate of behaviorism. Not only were his arguments based on the results of scrupulous scientific methodology (so they could be proved), but his experiments tended to involve the use of novel contraptions that the general public found fascinating. Skinner was an inveterate "gadget man" and a provocative self-publicist. But behind the showman image was a serious scientist, whose work helped to finally sever psychology from its introspective philosophical roots and establish it as a scientific discipline in its own right.

Skinner had once contemplated a career as an author, but he had little time for the philosophical 66

The ideal of behaviorism is to eliminate coercion, to apply controls by changing the environment.

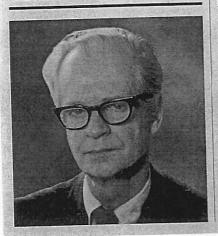
**B.F. Skinner** 



theorizing of many of the early psychologists. Works by Pavlov and Watson were his main influence; he saw psychology as following in the scientific tradition, and anything that could not been seen, measured, and repeated in a rigorously controlled experiment was of no interest to him.

Processes purely of the mind, therefore, were outside Skinner's interest and scope. In fact, he reached the conclusion that they must be utterly subjective, and did not exist at all separately from the body. In Skinner's opinion,

# **B.F. Skinner**

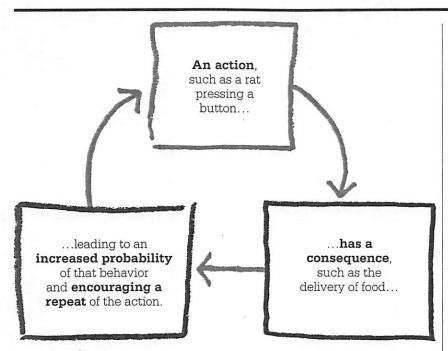


Burrhus Frederic Skinner was born in 1904 in Susquehanna, Pennsylvania. He studied English at Hamilton College, New York, intending to be a writer, but soon realized that the literary life was not for him. Influenced by the works of Ivan Pavlov and John B. Watson, he studied psychology at Harvard, gaining his doctorate in 1931 and becoming a junior fellow. He moved to the University of Minnesota in 1936, and from 1946 to 1947 ran the psychology department at Indiana University. In 1948, Skinner returned to Harvard, where he remained for

the rest of his life. He was diagnosed with leukemia in the 1980s, but continued to work, finishing an article from his final lecture on the day he died, August 18, 1990.

### **Key works**

1938 The Behavior of Organisms: An Experimental Analysis 1948 Walden Two 1953 Science and Human Behavior 1957 Verbal Behavior 1971 Beyond Freedom and Dignity See also: William James 38-45 = Ivan Pavlov 60-61 = John B. Watson 66-71 = Zing-Yang Kuo 75 = Joseph Wolpe 86-87 = Albert Bandura 286-91 = Noam Chomsky 294-97



the way to carry out psychological research was through observable behavior, rather than through unobservable thoughts.

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Although a strict behaviorist from the outset of his career, Skinner differed from earlier behaviorists in his interpretation of conditioning, in particular, the principle of "classical conditioning" as described by Pavlov. While not disagreeing that a conditioned response could be elicited by repeated training, Skinner felt that this was something of a special case, involving the deliberate, artificial introduction of a conditioning stimulus.

To Skinner, it seemed that the consequences of an action were more important in shaping behavior than any stimulus that had preceded or coincided with it. He concluded from his experiments that behavior is primarily learned

from the results of actions. As with so many great insights, this may appear to be self-evident, but it marked a major turning point in behaviorist psychology.

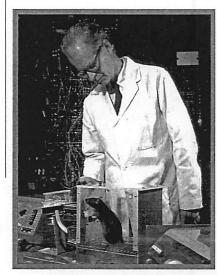
# Skinner boxes

While working as a research fellow at Harvard, Skinner carried out a series of experiments on rats, using an invention that later became known as a "Skinner box." A rat was placed in one of these boxes, which had a special bar fitted on the inside. Every time the rat pressed this bar, it was presented with a food pellet. The rate of bar-pressing was automatically recorded. Initially, the rat might

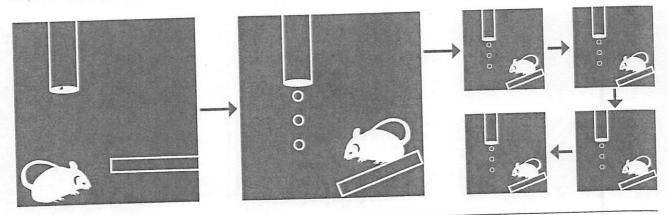
**Skinner boxes** were one of many ingenious devices that the psychologist created, giving him total control over the environment of the animals whose behavior he was observing.

press the bar accidentally, or simply out of curiosity, and as a consequence receive some food. Over time, the rat learned that food appeared whenever the bar was pressed, and began to press it purposefully in order to be fed. Comparing results from rats given the "positive reinforcement" of food for their bar-pressing behavior with those that were not, or were presented with food at different rates, it became clear that when food appeared as a consequence of the rat's actions, this influenced its future behavior.

Skinner concluded that animals are conditioned by the responses they receive from their actions and environment. As the rats explored the world around them, some of their actions had a positive consequence (Skinner was careful to avoid the word "reward" with its connotations of being given for "good" behavior), which in turn encouraged them to repeat that behavior. In Skinner's terms, an "organism" operates on its environment, and encounters a »



**Positive reinforcement** can stimulate particular patterns of behavior, as Skinner demonstrated by placing a rat in one of his specially designed boxes, fitted with a lever or bar. Pellets of food appeared every time the animal pressed the bar, encouraging it to perform this action again and again.



stimulus (a food pellet), which reinforces its operant behavior (pressing on the bar). In order to distinguish this from classical conditioning, he coined the term "operant conditioning;" the major distinction being that operant conditioning depends not on a preceding stimulus, but on what follows as a consequence of a particular type of behavior. It is also different in that it represents a two-way process, in which an action, or behavior, is operating on the environment just as much as the environment is shaping that behavior.

In the course of his experiments, Skinner began to run short of food pellets, forcing him to reschedule the rate at which they were being given to the rats. Some rats now received a food pellet only after they had pressed the bar a number of times repeatedly, either at fixed intervals or randomly. The results of this variation reinforced Skinner's original findings, but they also led to a further discovery: that while a reinforcing stimulus led to a greater probability of a behavior

occurring, if the reinforcing stimulus was then stopped, there was a decrease in the likelihood of that behavior occurring.

Skinner continued making his experiments ever more varied and sophisticated, including changes of schedule to establish whether the rats could distinguish and respond to differences in the rate of delivery of food pellets. As he suspected, the rats adapted very quickly to the new schedules.

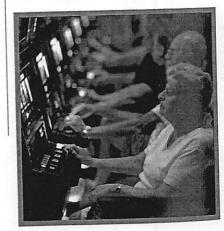
# **Negative reinforcement**

In later experiments, the floors of the Skinner boxes were each fitted with an electric grid, which would give the rats an unpleasant shock whenever they were activated. This allowed for the investigation of the effect of negative reinforcement on behavior. Again, just as Skinner avoided the word "reward," he was careful not to describe the electric

Winning at gambling often boosts the compulsion to try again, while losing lessens it, just as changes in the rate at which Skinner's rats were fed made them modify their behavior.

shock as "punishment," a distinction that became increasingly important as he examined the implications of his research.

Negative reinforcement was not a new concept in psychology. As early as 1890, William James had written in *Principles of Psychology*: "Animals, for example, awaken in a child the opposite impulses of fearing and fondling. But if a child, in his first attempts to pat a dog, gets snapped at or bitten, so that the impulse of fear is strongly aroused, it may be that for years to come no dog will excite in him the



impulse to fondle again." Skinner was to provide the experimental evidence for this idea.

### Positive reinforcement

As expected, Skinner found that whenever a behavior resulted in the negative consequence of an electric shock, there was a decrease in that behavior. He went on to redesign the Skinner boxes used in the experiment, so that the rats inside were able to switch off the electrified grid by pressing a bar, which provided a form of positive reinforcement arising from the removal of a negative stimulus. The results that followed confirmed Skinner's theory—if a behavior leads to the removal of a negative stimulus, that behavior increases.

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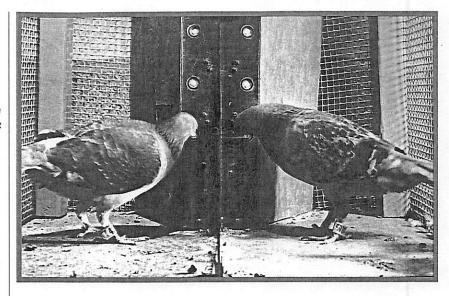
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However, the results also revealed an interesting distinction between behavior learned by positive reinforcement and behavior elicited by negative stimuli. The rats responded better and more quickly to the positive stimuli (as well as the removal of negative stimuli), than when their behavior resulted in a negative response. While still careful to avoid the notions of "reward" and "punishment," Skinner concluded that behavior was shaped much more efficiently by a program of positive reinforcement. In fact, he came to believe that negative reinforcement could even be counter-productive, with the subject continuing to seek positive responses for a specific behavior, despite this leading to a negative response in the majority of cases.

This has implications in various areas of human behavior too; for example, in the use of disciplinary measures to teach children. If a boy is continually being punished for something he finds enjoyable, such as picking his nose, he is



likely to avoid doing so when adults are around. The child may modify his behavior, but only so far as it enables him to avoid punishment. Skinner himself believed that ultimately all forms of punishment were unsuitable for controlling children's behavior.

# Genetic predisposition

The "shaping" of behavior by operant conditioning has striking parallels with Charles Darwin's theory of natural selection-in essence, that only organisms suited by their genetic make-up to a particular environment will survive to reproduce, ensuring the "success" of their species. The likelihood of a rat behaving in a way that will result in a reinforcing stimulus, triggering the process of operant conditioning, is dependent on the level of its curiosity and intelligence, both of which are determined by genetic make-up. It was this combination of predisposition and conditioning that led Skinner to conclude that "a person's behavior is controlled by his genetic and environmental histories"—an idea that he explored

**Skinner's pigeon** experiments proved that the positive reinforcement of being fed on the achievement of a task helped to speed up and reinforce the learning of new behavior patterns.

further in his article *The Selection* by Consequences, written for the journal *Science* in 1981.

In 1936, Skinner took up a post at the University of Minnesota, where he continued to refine his experimental research in operant conditioning and to explore practical applications for his ideas, this time using pigeons instead of rats. With the pigeons, Skinner found that he was able to devise more subtle experiments. Using what he described as a "method of successive approximations," he could elicit and investigate more complex patterns of behavior.

Skinner gave the pigeons positive reinforcement for any behavior that was similar to that he was trying to elicit. For example, if he was trying to train a pigeon to fly in a circle clockwise, food would be given for any movement the pigeon made to the right, however small. Once this behavior had »

been established, the food was only given for longer flights to the right, and the process was repeated until the pigeon had to fly a full circle in order to receive some food.

### **Teaching program**

Skinner's research led him to question teaching methods used in schools. In the 1950s, when his own children were involved in formal education, students were often given long tasks that involved several stages, and usually had to wait until the teacher had graded work carried out over the entire project before finding out how well they had done. This approach ran contrary to Skinner's findings about the process of learning and, in his opinion, was holding back progress. In response, Skinner developed a teaching program that gave incremental feedback at every stage of a project—a process that was later incorporated into a number of educational systems. He also invented a "teaching machine" that gave a student encouraging feedback for correct answers given at every stage of a long series of test questions, rather than just at

the end. Although it only achieved limited approval at the time, the principles embodied in Skinner's teaching machine resurfaced decades later in self-education computer programs.

It has to be said that many of Skinner's inventions were misunderstood at the time, and gained him a reputation as an eccentric. His "baby tender," for example, was designed as a crib alternative to keep his infant daughter in a controlled, warm, and draft-free environment. However, the public confused it with a Skinner box, and it was dubbed the "heir conditioner" by the press, amid rumors that Skinner was experimenting on his own children. Nevertheless, the baby tender attracted publicity, and Skinner was never shy of the limelight.

# War effort

Yet another famous experiment called "Project Pigeon" was met with skepticism and some derision. This practical application of Skinner's work with pigeons was intended as a serious contribution to the war effort in 1944. Missile



The objection to inner states is not that they do not exist, but that they are not relevant in a functional analysis.

**B.F. Skinner** 



quidance systems were yet to be invented, so Skinner devised a nose cone that could be attached to a bomb and steered by three pigeons placed inside it. The birds had been trained, using operant conditioning, to peck at an image of the bomb's target, which was projected into the nose cone via a lens at the front. This pecking controlled the flightpath of the missile. The National Defense Research Committee helped fund the project, but it was never used in combat, because it was considered too eccentric and impractical. The suspicion was that Skinner, with his passion for gadgets, was more interested in the invention than in its application. When asked if he thought it right to involve animals in warfare, he replied that he thought it was wrong to involve humans.

In later life as an academic at Harvard, Skinner also expanded on the implications of his findings in numerous articles and books.

Praise or encouragement given at frequent intervals during the progress of a piece of work, rather than one large reward at the end, has been shown to boost the rate at which children learn.



Walden Two (1948) describes a utopian society based on behavior learned with operant conditioning. The book's vision of social control achieved by positive reinforcement caused controversy, and despite its benign intent was criticized by many as totalitarian. This was not a surprising reaction, given the political climate in the aftermath of World War II.

### Radical behaviorism

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Skinner remained true to his behaviorist approach, coining the term "radical behaviorism" for the branch of psychology he espoused. Although he did not deny the existence of thought processes and mental states, he believed that psychology should be concerned solely with the study of physical responses to prevailing conditions or situations.

In his book, Beyond Freedom and Dignity, Skinner took the concept of shaping behavior even further, resurrecting the philosophical debate between free will and determinism. For the radical behaviorist Skinner, free will is an illusion; selection by consequences controls all of our behavior, and hence our lives. Attempts to escape this notion are doomed to failure and chaos. As he put it: "When Milton's Satan

falls from heaven, he ends in hell. And what does he say to reassure himself? 'Here, at least, we shall be free.' And that, I think, is the fate of the old-fashioned liberal. He's going to be free, but he's going to find himself in hell."

Views such as these gained him notoriety, and prompted some of his fiercest critics. In particular, the application of his behaviorist ideas to the learning of language in *Verbal Behavior* in 1957 received a scathing review from Noam Chomsky, which is often credited as launching the movement known as cognitive psychology.

Some criticism of Skinner's work, however, has been based on misunderstanding the principles of operant conditioning. Radical behaviorism has often been linked erroneously to the European philosophical movement of logical positivism, which holds the view that statements or ideas are only meaningful if they can be verified by actual experience. But it has in fact much more in common with American pragmatism, which measures the importance or value of actions according to their consequences. It has also been misinterpreted as presenting all living beings as the passive subjects of conditioning, whereas to Skinner operant conditioning



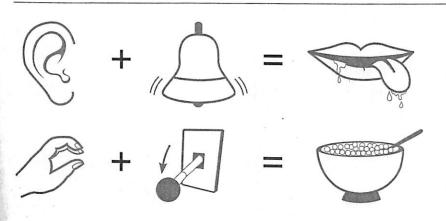
Skinner has an unbounded love for the idea that there are no individuals, no agents—there are only organisms.

## **Thomas Szasz**



was a two-way process, in which an organism operates on its environment and that environment responds, with the consequence often shaping future behavior.

In the 1960s, the focus in psychology swung away from the study of behavior to the study of mental processes, and for a time Skinner's ideas were discredited, or at least ignored. A reappraisal of behaviorism soon followed, however, and his work found an appreciative audience in many areas of applied psychology, especially among educationalists and clinical psychologists—the approach of cognitive behavioral therapy owes much to his ideas.



Classical conditioning creates an automatic behavioral response to a neutral stimulus, such as salivating in expectation of food when a bell is rung.

**Operant conditioning** creates a higher probability of repeated behavior through positive reinforcement, such as releasing food by pulling a lever.