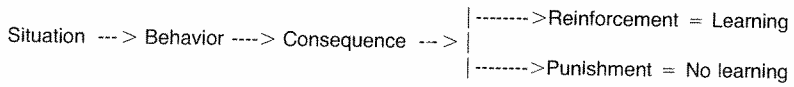
KNOCK WOOD!

Skinner, Burrus Frederick (1948) Superstition in the pigeon. *Journal of Experimental Psychology, 38,* 168–72.

In this chapter we examine one study from a huge body of research carried out by one of the most influential and most widely known psychologists ever, B.F. Skinner. Deciding how to present Skinner and which of his studies to explore was a difficult task. It is clearly impossible to represent adequately in one short chapter his contributions to the history of psychological research. After all, Skinner is considered by most to be the father of radical behaviorism, is the inventor of the famous (or infamous) "Skinner Box," and is the author of over a dozen books and over 70 scientific articles. This article, with the somewhat humorous-sounding title "Superstition in the pigeon," has been selected from all of his work because it allows for a clear discussion of Skinner's basic theories, provides an interesting example of his approach to studying behavior, and offers a "Skinnerian" explanation of a behavior with which we are all familiar: superstition.

Skinner was called a *radical* behaviorist because he believed that all behavior in either human or non-human animals is caused, shaped, and maintained by its consequences. To put it in basic terms: If, in a given situation, you behave in some way and your behavior is followed by a rewarding event (such as food, praise, or money), you will tend to behave that way again. On the other hand, if you do something that produces an unpleasant event (such as pain or embarrassment), you will be less likely to do that again in identical or similar situations. Rewarding events are called "reinforcement" and unpleasant events are called "punishment." Skinner called this learning process *operant conditioning*. It may be diagrammed as follows:



Within this conceptualization, Skinner also was able to explain how behaviors are lost or unlearned. Once a behavior has been reinforced and the reinforcement is then discontinued, the behavior will slowly decrease until it disappears completely. This unlearning process is called "extinction."

If you think about it, these ideas are not new to you. The process we all use to train our pets follows these same rules. You tell a dog to sit, it sits, and you reward it with a "dog yummy." After a while the dog will sit when told to, even without the immediate reward of a dog yummy. You have applied the principles of operant conditioning. This is a very powerful form of learning and is effective with all animals, even old dogs learning new tricks and, yes, even cats! Also, if you want a pet to stop doing something, all you have to do is remove the reinforcement, and the behavior will stop. For example, if your dog is begging at the dinner table, there is a reason for that (regardless of what you may think, dogs are not born to beg at the table!). You have conditioned this behavior in your dog through reinforcement. If you want to "put that behavior on extinction," the reinforcement must be totally discontinued. Eventually, the dog will stop begging. By the way, if one member of the family "cheats" during extinction and secretly gives the "beggar" some food once in a while, extinction will never happen.

Beyond these fundamentals of learning, Skinner maintained that *all* human behavior is created and maintained in precisely the same way. It's just that with humans, the exact behaviors and consequences are not always so easy to identify. Skinner was well-known for arguing that if a human behavior was interpreted by others (such as cognitive or humanistic psychologists) to be due to our highly evolved consciousness or intellectual capabilities, it was only because psychologists had been unable to pinpoint the reinforcers that had created and were maintaining the behavior. If this feels like a rather extreme position to you, remember that Skinner's position was called *radical* behaviorism and was always surrounded by controversy.

Skinner often met skepticism and defended his views by demonstrating experimentally that behaviors considered to be the sole property of humans could be learned by lowly creatures such as pigeons or rats. One of these demonstrations involved the seemingly human activity of "insight," or working on a problem until a solution presented

itself in a flash of finger-snapping illumination. Skinner set up an experiment in which a pigeon solved a problem of the food dish being too high to reach in a way that appeared to be the same as human insight. Of course it was really operant conditioning—as it is, Skinner argued, for humans as well.

Another challenge accepted by Skinner was the contention by others that superstitious behavior is uniquely human. The argument was that superstition requires human cognitive activity (thinking, knowing, reasoning). A superstition is a *belief* in something, and we do not usually attribute such "beliefs" to animals. Well, Skinner said in essence that superstitious behavior could be explained as easily as any other action by using the principles of operant conditioning. He performed an experiment to prove it.

THEORETICAL PROPOSITIONS

Think back to a time when you have behaved superstitiously. Did you knock on wood, avoid walking under a ladder, avoid stepping on cracks, carry a lucky coin or other charm, shake the dice a certain way in a board game, change your behavior because of your horoscope? It is probably safe to say that everyone has done something out of superstition at some time, even if some of them might not want to admit it. Skinner said that the reason people do this is that they believe or presume that there is a connection between the superstitious behavior and some reinforcing consequence, even though, in reality, there is not. This connection exists because the behavior (such as shaking the dice that certain way) was *accidentally* reinforced (such as a good roll) once, twice, or several times. Skinner called this "non-contingent" reinforcement, a reward that is not contingent on any particular behavior. You *believe* that there is a causal relationship between the behavior and the reward, when no such relationship exists.

"And if you think this is some exclusive human activity," Skinner might have said, "I'll make a superstitious pigeon!"

METHOD

In order to understand the method used in this experiment, a brief description of what has become known as the "Skinner Box" is necessary. The principle behind the Skinner Box (or *conditioning chamber*, as Skinner called it) is really quite simple. It consists of a cage or box that is empty except for a dish or tray into which food may be dispensed. This allows a researcher to have control over when the animal receives reinforcement, such as pellets of food. The early conditioning boxes also contained a lever which, if pressed, would cause some food to be dispensed. If a rat (rats were used in Skinner's earliest work) was placed in one of these boxes, it would eventually, through trial and error, learn to press the lever for food. Alternately, the experimenter could, if desired, control the food dispenser and reinforce a specific behavior. Later it was found that pigeons also made ideal subjects in conditioning experiments, and conditioning chambers were designed with disks to be pecked instead of bars to be pressed.

One of these conditioning cages was used in the study discussed here, but with one important change. In order to study superstitious behavior, the food dispenser was rigged to drop food pellets into the tray at intervals of 15 seconds, *regardless of what the animal was doing at the time*. You can see that this produced non-contingent reinforcement. In other words, the animal received a reward every 15 seconds, no matter what it did.

Subjects in this study were eight pigeons. These birds were fed less than their normal daily amount for several days, so that when tested they would be hungry and therefore highly motivated to perform behaviors for food (this increased the power of the reinforcement). Each pigeon was placed into the experimental cage for a few minutes each day and just left to do whatever a pigeon does. During this time, reinforcement was being delivered automatically every 15 seconds. After several days of conditioning in this way, two independent observers recorded the birds' behavior in the cage.

RESULTS

As Skinner reports:

> In six out of eight cases the resulting responses were so clearly defined that two observers could agree perfectly in counting instances. One bird was conditioned to turn counter-clockwise about the cage, making two or three turns between reinforcements. Another repeatedly thrust its head into one of the upper corners of the cage. A third developed a tossing response as if placing its head beneath an invisible bar and lifting it repeatedly. Two birds developed a pendulum motion of the head and body in which the head was extended forward and swung from right to left with a sharp movement followed by a somewhat slower return. The body generally followed the movement and a few steps might be taken when it was extensive. Another bird was conditioned to make incomplete pecking or brushing movements directed toward but not touching the floor (p. 168).

None of these behaviors had been observed in the birds prior to the conditioning procedure. As you can see, the new behavior had

nothing to do with the pigeon receiving food. Nevertheless, they behaved *as if* a certain action would produce the food: they became superstitious.

Skinner next wanted to see what would happen if the time interval between reinforcements was extended. With one of the head-bobbing birds, the interval between the delivery of food pellets was slowly increased to one minute. When this occurred the pigeon's movements became more energetic until finally the stepping became so pronounced that it appeared the bird was performing a kind of dance during the minute between reinforcement (such as a "pigeon food dance").

Finally, the new behavior of the birds was put on extinction. This meant that the reinforcement in the test cage was discontinued. When this happened the superstitious behaviors gradually decreased until they disappeared altogether. However, it was noted that in the case of the "hopping" pigeon with a reinforcement interval that had been increased to a minute, over 10,000 responses were recorded before extinction occurred!

DISCUSSSION

Clearly, what Skinner ended up with here was six superstitious pigeons. However, he explains his findings more carefully and modestly: "The experiment might be said to demonstrate a sort of superstition. The bird behaves as if there were a causal relation between its behavior and the presentation of food, although such a relation is lacking" (p. 171).

Of course, the next step would be to apply these findings to humans. I am sure it is not difficult for you to think of analogies in human behavior, nor was it for Skinner. He described "the bowler who has released a ball down the alley but continues to behave as if he were controlling it by twisting and turning his arm and shoulder as another case in point" (p. 171). You know, rationally, that behaviors such as these don't really have any effect on a bowling ball that is already halfway down the alley. As Skinner points out in the case of the pigeons in this study, the food was going to appear no matter what the bird did.

An additional and interesting point made by Skinner in this article was that it is not completely correct to conclude that there is no relationship between the twisting and turning of the bowler and the direction of the ball. What is true is that after the ball has left the bowler's hand, the "bowler's behavior has no effect on the ball, but the behavior of the ball has an effect on the bowler" (p. 171). In other words, it is a fact that on some occasions, the ball might happen to move in the direction of the bowler's body movements. That movement of the ball, coupled with the consequence of a strike or a spare, is enough to *accidentally* reinforce the twisting behavior and maintain the superstition.

Finally, the reason that superstitions are so resistant to extinction was demonstrated by the pigeon that hopped 10,000 times before giving up the behavior. When any behavior is only reinforced once in a while, it becomes very difficult to extinguish. This is because the expectation stays high that the superstitious behavior might work to produce the reinforcing consequences. You can imagine that if the connection was present every time and then disappeared, the behavior would stop quickly. However, for humans, the instances of that accidental reinforcement usually occur at large time intervals, so the superstitious behavior often may persist for a lifetime.

CRITICISMS AND SUBSEQUENT RESEARCH

As mentioned before, Skinner's behaviorist theories and research were always the subject of great and sometimes heated controversy. Other prominent theoretical approaches to human behavior argued that the strict behavioral view was unable to account for many of the psychological processes that are fundamental to humans. Carl Rogers, the founder of the "humanistic" school of psychology, and well-known for his debates with Skinner, summed up this criticism:

> In this world of inner meanings, humanistic psychology can investigate issues which are meaningless for the behaviorist: purposes, goals, values, choice, perceptions of self, perceptions of others, the personal constructs with which we build our world . . . the whole phenomenal world of the individual with its connective tissue of meaning. Not one aspect of this world is open to the strict behaviorist. Yet that these elements have significance for man's behavior seems certainly true (Rogers, 1964, p. 119).

Behaviorists would argue in turn that all of these human characteristics are open to behavioral analysis. The key to this is a proper interpretation of the behaviors and consequences that constitute them (see Skinner, 1974, for a complete discussion of these issues).

On the specific issue of superstitions, however, there appears to be less controversy and a rather wide acceptance of the learning processes involved in their formation. An experiment performed by Bruner and Revuski (1961) demonstrated how easily superstitious behavior develops in humans. Four high school students each sat in front of four telegraph keys. They were told that each time they pressed the correct key, a bell would sound, a red light would flash, and they would earn a nickel. The correct response was key number three. However, as in Skinner's study, key number 3 would produce the desired reinforcement only after a delay interval of 10 seconds. During this interval the students would try other keys in various combinations. Then, at some point following the

delay, they would hit the third key again and receive the reinforcement. The results were the same for all the students. After a while they had each developed a pattern of key responses (such as 1, 2, 3, 4, 1, 2, 3) that they repeated over and over between each reinforcement. Pressing the 3-key was the only reinforced behavior; the other presses in the sequence were completely superstitious. Not only did they behave superstitiously, but all the students believed that the other key presses were necessary to "set up" the reinforced key. They were not aware of their superstitious behavior.

CONCLUSION

Superstitions are everywhere. You probably have some, and you surely know others who have them. One study of high school and college athletes found that 40 percent of them engaged in superstitious behavior before or during games (Buhrmann and Zaugg, 1981). A famous story of superstitious behavior was told by hockey player Phil Esposito (of the Boston Bruins and the New York Rangers). Prior to each game he would wear the same black turtleneck, drive through the same tollbooth on the way to the stadium, and get dressed in his uniform in exactly the same sequence. Years earlier, when he had first done all these things, he had been the team's high scorer. He behaved as if there were a causal connection between these behaviors and his performance on the ice, when no such connection actually existed. That's exactly how Skinner defined superstition.

Some superstitions are such a part of a culture that they produce societywide effects. You may be aware that most high-rise buildings do not have a 13th floor. Well, that's not exactly true. Obviously there is a 13th floor, but there is no floor that is *called* "13." This is probably not because architects and builders are an overly superstitious bunch, but it is rather due to the difficulty of renting or selling space on the 13th floor. Another recent example is that Americans are so superstitious about $2 bills that the U.S. Treasury has a pile of 4 million of these bills that people refuse to use!

Are superstitions psychologically unhealthy? Most psychologists believe that even though superstitious behaviors, by definition, do not produce the consequences that you think they do, they can serve useful functions. Often such behaviors can produce a feeling of strength and control when a person is facing a difficult situation. It is interesting to note that people who are employed in dangerous occupations tend to have more superstitions than others do. This feeling of increased power and control that is sometimes created by superstitious behavior can often lead to reduced anxiety, greater confidence and assurance, and improved performance.

BRUNER, A., and REVUSKI, S. (1961) Collateral behavior in humans. *Journal of the Experimental Analysis of Behavior*, 4, 349–50.

BUHRMANN, H., and ZAUGG, M. (1981) Superstitions among basketball players: An investigation of various forms of superstitious beliefs and behavior among competitive basketball players at the junior high school to university level. *Journal of Sport Behavior*, 4, 163–74.

ROGERS, C.R. (1964) Toward a science of the person. In F.W. WANN (ed.), *Behaviorism and phenomenology: Contrasting bases for modern psychology*. Chicago: Phoenix Books.

SKINNER, B.F. (1974) *About behaviorism*. New York: Knopf.