

the variation in phobias was due to *inherited* factors. The authors concluded that, although phobias may be molded by an individual's personal experiences, the role of a person's family in the development of phobias is primarily genetic, not environmental. Imagine: *Born to be phobic!* This view flies directly in the face of Watson's theory and should provide plenty of fuel for the ongoing nature-nurture debate in psychology and throughout the behavioral sciences.

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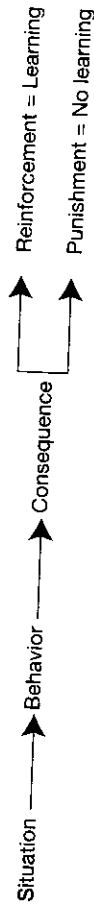
### Reading 11: KNOCK WOOD!

Skinner, B. F. (1948). Superstition in the pigeon. *Journal of Experimental Psychology*, 38, 168-172.

In this reading, we examine one study from a *huge* body of research carried out by one of the most influential and most widely known figures in the history of psychology: B. F. Skinner (1904-1990). Deciding how to present Skinner and which of his multitude of studies to explore is a difficult task. It is impossible to represent adequately in one short article Skinner's contributions to the history of psychology. After all, Skinner is considered by most to be the father of radical behaviorism, he was the inventor of the famous (or infamous) Skinner Box, and he was the author of over 20 books and many hundreds of scientific articles. This article, with the funny-sounding title "Superstition in the Pigeon," has been selected from all 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 is referred to as a *radical behaviorist* because he believed that all behaviors—including public, or external behavior, as well as private, or internal, events such as feelings and thoughts—are ultimately learned and controlled by the relationships between the situation that immediately precedes the behavior and the consequences that directly follow it. Although he believed that private behaviors are difficult to study, he acknowledged that we all have our own subjective experience of these behaviors. He did not, however, view internal events, such as thoughts and emotions, as causes of behavior but rather as part of the mix of environment and behavior that he was seeking to explain (see Schneider & Morris, 1987, for a detailed discussion of the term *radical behaviorism*).

To put Skinner's theory in very basic terms: In any given situation, your behavior is likely to be followed by consequences. Some of these consequences, such as praise, receiving money, or the satisfaction of solving a problem, will make the behavior more likely to be repeated in future, similar situations. These consequences are called reinforcers. Other consequences, such as injuring yourself or feeling embarrassed, will tend to make the behavior less likely to be repeated in similar situations. These consequences are called punishers. The effects of these relationships between behavior and the environment are called reinforcement and punishment respectively (Edward K. Morris, personal communication, September 1987). Reinforcement and punishment are two of the most fundamental processes in what Skinner referred to as operant conditioning and may be diagrammed as follows:



Within this conceptualization, Skinner also was able to explain how learned behaviors decrease and sometimes disappear entirely. When a behavior has been reinforced and the reinforcement is then withdrawn, the likelihood of the behavior reoccurring will slowly decrease until the behavior is effectively suppressed. This process of behavior suppression is called *extinction*.

If you think about it, these ideas are not new to you. The process we use to train our pets follows these same rules. You tell a dog to sit, it sits, and you reward it with a treat. After a while the dog will sit when told to, even without an immediate reward. 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 for the behavior to stop is remove the reinforcement. 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 canine beggar some food once in a while, extinction will never happen, but the dog will spend much more of its begging energy near that person's chair.

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 easy to identify. Skinner was well known for arguing that if a human behavior was interpreted by other theoretical approaches to be due to our highly evolved consciousness or intellectual capabilities, it was only because those theorists

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 contention by others that superstitious behavior is uniquely human. The argument was that superstition requires human *cognitive* activity (i.e., thinking, knowing, reasoning). A superstition is a belief in something, and we do not usually attribute such beliefs to animals. 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 this 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, or change your behavior because of your horoscope? It is probably safe to say that everyone has done something superstitious 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 a connection exists between the superstitious behavior in a certain setting and a reinforcing consequence, even though, in reality, it does not. This connection exists because the behavior (such as shaking the dice that certain way) was accidentally reinforced (by something rewarding, such as a good roll) once, twice, or several times. Skinner called this *noncontingent* reinforcement—that is, 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. "If you think this is some exclusive human activity," Skinner might have said, "I'll create a superstitious pigeon!"

### METHOD

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, and reinforcement, learn to press the lever for food. Alternatively, the experimenter could, if

desired, take control of the food dispenser and reinforce a specific behavior. Later, Skinner and others 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.

These conditioning cages were used in the study discussed here, but with one important change. To study superstitious behavior, the food dispensers were rigged to drop food pellets into the tray at intervals of 15 seconds, *regardless* of what the animal was doing at the time. The reward was not contingent on any particular behavior. This was noncontingent reinforcement: the animal received a reward every 15 seconds, no matter what it did.

Subjects in this study were 8 pigeons. These birds were fed less than their normal daily amount for several days so that when tested they would be hungry and therefore 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 there 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 counterclockwise 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. The new behaviors had no real effect on the delivery of the food. Nevertheless, the pigeons behaved as if a certain action would produce the food—that is, 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 and hopping birds, the interval between each delivery of food pellets was slowly increased to 1 minute. When this occurred, the pigeon's movements became more energetic until finally the bobbing and hopping 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*).

The birds' new behavior was then 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, 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!

## DISCUSSION

In this study, Skinner ended up with 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).

The next step would be to apply these findings to humans. You can probably think of analogies in human behavior, and so did 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. However, due to past conditioning, you believe your antics may help, but the ball, in reality, will go wherever it is going to go regardless of your behavior after it has been released. As Skinner put it, 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, 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 and turning behavior and maintain the superstition. How different is that from Skinner's pigeons? Not very.

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 in a given situation (called *partial reinforcement*), 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, in real life, the instances of accidental reinforcement usually occur sporadically, so the superstitious behavior often may persist for a lifetime.

## CRITICISMS AND SUBSEQUENT RESEARCH

Skinner's behaviorist theories and research have always been the subject of great and sometimes heated controversy. Other prominent theoretical approaches to human behavior have argued that the strict behavioral view is 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 con-  
nective 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 analysis 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 5 cents (worth about 50 cents today). The correct response was key number 3. However, as in Skinner's study, key number 3 would produce the desired reinforcement (the nickel) 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 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, 4, 3, 1, 2, 4, 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 completely unaware of their superstitious behavior.

## RECENT APPLICATIONS

Skinner, as one of psychology's most influential figures, still has a far-reaching substantive impact on scientific literature in many fields. His 1948 article on superstitious behavior is cited in numerous studies every year. One of these studies, for example, compared two types of reinforcement in the development of superstitious behavior (Aeschleman, Rosen, & Williams, 2003). Positive reinforcement occurs when you receive something desirable as a consequence (such as money, food, or praise). Negative reinforcement, which is often confused with punishment, rewards you by *eliminating* something *undesirable* (such as not having to do homework or avoiding pain). The study found that greater levels of superstitious behavior (perceived control over non-contingent events) developed under conditions of negative reinforcement

than under positive reinforcement. In the authors' words: "These findings . . . suggest that, relative to positive reinforcement, negative reinforcement operations may provide a more fertile condition for the development and maintenance of superstitious behaviors" (p. 37). In other words, the study suggested that you are more likely to employ superstitious tactics to prevent bad outcomes than to create good outcomes.

Another thought-provoking article citing Skinner's 1948 study (Sagvolden et al., 1998) examined the role of reinforcement in attention deficit/hyperactivity disorder (ADHD). The researchers asked boys with and without a diagnosis of ADHD to participate in a game in which they would receive rewards of coins or small toys. Although the reinforcement was delivered at fixed 30-second intervals (noncontingent reinforcement), all the boys developed superstitious behaviors that they *believed* were related to the rewards. In the next phase of the study, the reinforcement was discontinued. You would expect this to cause a decrease and cessation of whatever behaviors had been conditioned (extinction). This is exactly what happened with the boys without ADHD. But the boys with ADHD, after a brief pause, became more active and began engaging impulsively in bursts of responses at an even faster pace, *as if* the reinforcement had been reestablished. The authors suggested that this overactivity and impulsiveness implied that the boys with ADHD possessed significantly less ability to cope with delays of reinforcement than did the comparison group of boys. Findings such as these are important additions to our understanding and our ability to treat ADHD effectively.

## CONCLUSION

Superstitions are everywhere. You probably have some, and you surely know others who have them. Some superstitions are such a part of a culture that they produce society-wide effects. You may be aware that most high-rise buildings do not have a 13th floor. But that's not exactly true. Obviously, a 13th floor exists, but no floor is labeled "13." This is probably not because architects and builders are an overly superstitious bunch, but rather it is due to the difficulty of renting or selling space on the "unlucky" thirteenth floor. Another example is that Americans are so superstitious about the two-dollar bill that the U.S. Treasury prints fewer two-dollar notes than any other denomination (less than 1%).

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. This feeling of increased power and control that is sometimes created by superstitious behavior can lead to reduced anxiety, greater confidence and assurance, and improved performance.

Aeschleman, S., Rosen, C., & Williams, M. (2003). The effect of non-contingent negative and positive reinforcement operations on the acquisition of superstitious behaviors. *Behavioral Processes*, 61, 37-45.

Bruner, A., & Revuski, S. (1961). Collateral behavior in humans. *Journal of Experimental Analysis of Behavior*, 4, 349-350.

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Sagvolden, T., Aase, H., Zeiner, P., & Berger, D. (1998). Altered reinforcement mechanisms in attention-deficit/hyperactivity disorder. *Behavioral Brain Research*, 94(1), 61-71.

Schneider, S., & Morris, E. (1987). The history of the term *radical behaviorism*: From Watson to Skinner. *Behavior Analyst*, 10(1), 27-39.

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

## Reading 12: SEE AGGRESSION . . . DO AGGRESSION!

Bandura, A., Ross, D., & Ross, S. A. (1961). Transmission of aggression through imitation of aggressive models. *Journal of Abnormal and Social Psychology*, 63, 575-582.

Aggression, in its abundance of forms, is arguably the greatest social problem facing this country and the world today. It is also one of the most researched topics in the history of psychology. Over the years, the behavioral scientists who have been in the forefront of this research have been social psychologists, whose focus is on all types of human interaction. One goal of social psychologists has been to define aggression. This may, at first glance, seem like a relatively easy goal, but such a definition turns out to be rather elusive. For example, which of the following behaviors would you define as aggression: a boxing match? a cat killing a mouse? a soldier shooting an enemy? setting rat traps in your basement? a bullfight? The list of behaviors that may or may not be included in a definition of aggression is endless. As a result, if you were to consult 10 different social psychologists, you would probably hear 10 different definitions of aggression.

Many researchers have gone beyond trying to agree on a definition to the more important process of examining the sources of human aggression. The question they often pose is this: Why do people engage in acts of aggression? Throughout the history of psychology, many theoretical approaches have been proposed to explain the causes of aggression. Some of these contend that you are biologically preprogrammed to be aggressive because aggression in certain circumstances has been an evolutionary survival mechanism. Other theories look to situational factors, such as repeated frustration or specific types of provocation, as the determinants of aggressive responses. A third view, and the one this study suggests, is that aggression is learned.

One of the most famous and influential experiments ever conducted in the history of psychology demonstrated how children may learn to be aggressive. This study, by Albert Bandura and his associates Dorothea Ross and Sheila Ross, was carried out in 1961 at Stanford University. Bandura is considered to be one of the founders of a school of psychological thought called *social learning theory*. Social learning theorists propose that human interaction