RESEARCH STARTERS
ACADEMIC TOPIC OVERVIEWS

Behaviorism

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Abstract

Behaviorists define learning as a change in behavior brought about by the environment; some deny the existence of mental events altogether, while others concede that mental events might exist, but that they cannot and should not be studied. Behaviorism spans decades, and many individuals have made significant contributions to its development. Two key individuals in the field, Ivan Pavlov and B. F. Skinner, developed classical and operant conditioning theories which can be applied to education. While behaviorism contributed greatly to our understanding of human learning, most now believe it is insufficient for explaining more complex behavior. Thus, behaviorism has largely been supplanted by cognitive theories of learning which focus on the very thing behaviorists were accused of ignoring – the mind.

Overview

Although many people associate behaviorism with the work of B.F. Skinner, it was John B. Watson who coined the term, and who first introduced behaviorist principles into mainstream American psychology. Around the turn of the twentieth century, people began putting their faith in science as the way forward to a better future (Harzem, 2004). Watson shared in this optimism, and suggested that psychology – like the natural sciences such as physics and biology – should become a science as well. In order to do so, he argued, psychologists should study only that which is observable, and turn away from the study of consciousness and methodologies like introspection. In a paper published in 1913 called "Psychology as the Behaviorist Views It," Watson wrote:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods…The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute (as cited in Harzem, p. 6, 2004).

The end of the story is well-known. By denying the existence of mental events – Watson even denied the existence of the mind itself – behaviorists left themselves exposed to attack. And inevitably, the 1970s ushered in a new era of psychology – often called the cognitive revolution – whose subject of study was exactly that which the behaviorists had ignored – unobservable mental events, or what behaviorists refer to as 'the black box.' Behaviorism wasn't necessarily 'wrong' in any fundamental sense, cognitive psychologists argued, but it was incapable of explaining complex human behavior. Thus, behaviorism was edged out of the spotlight, but its principles still hold sway, and its impact continues to be far-reaching. As Harzem (2004) writes, "now behaviorism is like a cube of sugar dissolved in tea; it has no major, distinct existence but it is everywhere. It is an essential ingredient of scientific-psychological thought, whether psychologists wish it to be or not" (p. 12).

But any good story has more than a beginning and end. Behaviorism's contribution to human learning and development is immense, and so it is to the 'stuff in the middle' that we now turn – to the insights of behaviorists and to the theorists themselves. Before doing so, however, we need to take one small step backwards, for although behaviorism became largely an American venture, it began not with Watson in America but in what might seem an unlikely place – in the laboratory of a Russian scientist studying salivation reflexes in dogs.

Keywords

Classical Conditioning

Extinction

Operant Conditioning

Pavlov, Ivan

Punishment

Reinforcement

Response

Shaping

Skinner, B.F.

Stimulus

Watson, John

Classical Conditioning

Ivan Pavlov, a Russian physiologist, stumbled across one of the two major principles of learning that now characterize behaviorism. His research was designed to uncover the neural mechanisms associated with digestion; while conducting his experiments, however, he noticed that his subjects, the dogs, began salivating not just in response to the food, but also in response to other environmental cues, such as the lab attendants who brought the food. As Mazur (1994) writes, "Pavlov recognized the significance of this unexpected result, and he spent the rest of his life studying this phenomenon, which is now known as classical conditioning" (p. 58).

Let's look at the components of classical conditioning by dissecting one of Pavlov's first attempts to study the phenomenon. Pavlov began with what he called a neutral stimulus (NS) – in this particular case, a bell. When presented with the ringing of the bell, the dogs did, virtually, nothing. Pavlov then paired the ringing of the bell with the presentation of the food; he referred to the food as the unconditioned stimulus (UCS) because it elicited an unconditioned response (UCR), salivation. After several pairings of the bell and food, Pavlov then presented the ringing of the bell alone, at which time the dogs began salivating. The bell became a conditioned stimulus (CS), the salivation in response to the bell, a conditioned response (CR). This type of learning is also referred to as signal learning, because it is most effective when the conditioned stimulus is presented just before the unconditioned stimulus (Ormrod, 1990). It has been replicated in humans and animals alike with a variety of reflexive responses, such as blinking, galvanic skin response, and taste-aversions (Mazur, 1994).

Although the formula for classical conditioning is relatively simple, a number of corollary explanations of behavior evolved from it. Psychologists began to investigate how a conditioned response could be extinguished, why certain conditioned responses occurred in the presence of some stimuli and not others, and how classical conditioning could be applied in real world settings.

Extinction

Psychologists discovered that the passage of time has little effect on the strength of a conditioned response. That is, if a day, or week, or year passed before a dog were presented with the conditioned stimulus (the bell) again, the dog would still salivate at its sound (Mazur, 1994). What then, they wondered, would cause a subject to 'unlearn' such a response? Through a process called extinction – the presentation of the conditioned stimulus without the unconditioned stimulus, or in this case, the bell without the food – the conditioned response gradually disappears.

Spontaneous Recovery

The question then arises, is the dog whose conditioned response has been extinguished the same as a dog who was never conditioned in the first place? That is, is the association between the conditioned and unconditioned stimulus permanently erased through extinction? A phenomenon known as spontaneous recovery suggests the association remains intact, although weakened. Dogs who were conditioned on Day 1, for example, and extinguished on Day 2, displayed the conditioned response again on Day 3 even though the conditioned response had been fully extinguished on the previous day. Psychologists disagree about what causes spontaneous recovery, but the phenomenon itself has been well documented (Mazur, 1994).

Rapid Reacquisition

Rapid reacquisition also suggests that the process of extinction does not return an organism to its pre-conditioned state. Dogs who learn to associate the ringing of the bell with the presentation of food, and whose conditioned response is then extinguished, will re-learn the pairing of the two stimuli during a second phase of acquisition much more quickly than they learned it during the first phase.

Stimulus Generalization

Organisms will sometimes display a conditioned response when

presented with a stimulus that is similar to, but not exactly the same as, the original conditioned stimulus. Such a phenomenon is known as stimulus generalization. Pavlov's dogs, for example, might salivate at the sound of a second bell that rings at a different but similar frequency as the first bell.

Stimulus Discrimination

On the other hand, organisms can be explicitly 'taught' to discriminate between two stimuli. If Pavlov repeatedly paired a low-pitched bell with the presentation of the food, but did not pair a high-pitched bell with the presentation of the food, the dogs would learn to salivate at the sound of the first, but not the second.

Higher-Order Conditioning

In some cases, a stimulus that is never directly paired with the unconditioned stimulus can elicit the unconditioned response. For example, after dogs learned the association between the bell and food, Pavlov then began pairing the bell with a light flash, in the absence of the food. Dogs soon began salivating in response to the light flash alone, which they learned to associate with the bell, which they had previously learned to associate with food.

Counter-conditioning

Extinction is sometimes not a reliable way to extinguish conditioned responses (Ormrod, 1990). The rate at which extinction occurs is often unpredictable, and finding opportunities to present the conditioned stimulus without the unconditioned stimulus is often difficult. As a result, psychologists suggest that counter-conditioning may be a more effective may to change behavior. In the classic case of "Little Peter" (Ormrod, 1990), a young boy somehow learned to be afraid of rabbits. By giving Peter candy at the same time he was in the presence of a rabbit, the conditioned response elicited by the candy – pleasure – began to replace the conditioned response elicited by the rabbit – fear. Since pleasure and fear are incompatible responses, Peter couldn't experience both at once; gradually, his fear of rabbits disappeared.

Operant Conditioning

Classical conditioning is just one of two theories of learning that characterize behaviorism. The second, known as operant conditioning, was developed by B.F. Skinner in the 1940s. Although both Pavlov and Skinner are considered behaviorists, they disagreed with one another. An editorial review of a talk given by Skinner at the dinner of the Pavlovian Society in 1966, for example, states that "Although very gracious, polite and deferential, Skinner implied that Pavlov was actually riding the wrong horse when he suggested that conditional reflexes could serve as a window to learned behavior. Skinner, of course, held to the unique power of the operant theory" (Skinner, 1996, p. 1).

How does operant conditioning differ from classical conditioning? Simply defined, operant conditioning states that a response followed by a reinforcer is strengthened, and therefore more likely to occur (Ormrod, 1990). The first distinction then addresses the order of presentation of the stimulus; in classical conditioning the reinforcing stimulus precedes the response, and therefore is often called an antecedent stimulus, whereas in operant conditioning the reinforcing stimulus follows the response, and is thus called a consequent stimulus. Secondly, classical conditioning emphasizes the association between two stimuli – the unconditioned and conditioned stimuli – whereas operant conditioning emphasizes the association between a stimulus and a behavior, or response. Finally, the response itself differs, in that the response elicited in classical conditioning is typically an involuntary response – such as salivation or an eyeblink – whereas the response exhibited in operant conditioning is a voluntary one. In other words, the organism has control over whether or not the behavior occurs, and the term "operant reflects the fact that the organism voluntarily operates on the environment" (Ormrod, 1990, p. 47).

Operant conditioning typically is most effective when certain conditions are met: the reinforcement follows the response; the reinforcement occurs immediately after the response; and the reinforcement is contingent upon the response (Ormrod, 1990). This is not to say, however, that Skinner ignored what occurs before the response, or rather, the context in which it occurs. He argued, in fact, that a response typically occurs in the presence of a discriminative stimulus, such that the relationship between stimulus-response-reinforcement became a three-term contingency (Mazur, 1994). While these conditions provide the basic structure for operant conditioning, a number of corollary principles emerge, many of which have their counterparts in classical conditioning (Mazur, 1994). Extinction, spontaneous recovery and generalization, for example, occur in operant conditioning just as they do in classical. The following provides a brief summary of a sampling of these corollary principles, as well as a review of different schedules of reinforcement.

Free Operant Level

In the operant conditioning paradigm, behaviors (responses) are voluntary. The frequency at which an organism displays a behavior even in the absence of a reinforcement is referred to as the free operant level. In other words, it is the baseline frequency of a behavior before it is reinforced.

Extinction

In classical conditioning, extinction occurs by presenting the conditioned stimulus without the unconditioned stimulus. In operant conditioning, behavior is extinguished when a response is no longer followed by a reinforcer. A response that is not reinforced will decrease, and then eventually return to its baseline rate. However, organisms sometimes exhibit spontaneous recovery of the extinguished response, even in the absence of reinforcement, just as they do in classical conditioning.

Shaping

One of the central tenets of operant conditioning is that learning, or behavior change, occurs gradually. In order to explain the acquisition of more complex behavior, Skinner offered the notion of shaping. In shaping, or what is also known as suc-

cessive approximations, the process begins by reinforcing the first behavior that in any way resembles the desired behavior; once the organism emits the first behavior with regularity, only behaviors that more closely resemble the desired behavior are reinforced, until finally, the desired behavior itself is being reinforced (Crain, 2000; Mazur, 1994)

Superstitious Behavior

When reinforcement is applied randomly, an organism will increase the behavior that occurs immediately beforehand. In an experiment with pigeons, Skinner presented reinforcement at regular intervals, regardless of the responses occurring at the time. Several hours later, each pigeon displayed a strange behavior they 'thought' had been reinforced, such as thrusting the head into the corner of the cage, or swinging their bodies back and forth (Ormrod, 1990). In other words, superstitious behavior occurs when an organism thinks a response and reinforcement are related when in reality they are not.

Types of Reinforcement

Skinner makes distinctions between different types of reinforcement, describing some as primary – those that satisfy a biological need like food, water, and shelter – and others as secondary – because of their association with other reinforcers – such as money, grades, or recognition from one's peers. Reinforcement is also either positive or negative; positive reinforcement occurs when a stimulus is presented after a response occurs, thereby increasing the frequency of the response. Negative reinforcement, on the other hand, increases the frequency of the response through the removal of a stimulus, usually an aversive or unpleasant one.

Punishment

In contrast to negative reinforcement, which increases the response it follows, punishment is likely to decrease a response. There are two types of punishment – type I and type II. Type I involves the presentation of an aversive stimulus, whereas type II involves the removal of a pleasant stimulus.

Schedules of Reinforcement

The consistency with which a reinforcement is applied impacts its effectiveness. A reinforcement might be applied continuously, for example -after each occurrence of the behavior - in which case learning takes place rapidly but is easier to extinguish. Reinforcement can also be applied intermittently, according to either ratio, interval, or differential schedules. Ratio schedules of reinforcement occur after a certain number of responses have been emitted, either a fixed amount or a variable amount of responses. Interval schedules of reinforcement occur when a response is emitted after a certain period of time has elapsed, either a fixed interval of time or a variable interval of time. Finally, a differential schedule of reinforcement is a combination of ratio and interval schedules – reinforcement occurs after a particular number of responses occur within a particular amount of time.

Applications

Although the descriptions of classical and operant conditioning may seem abstract, both have many practical and concrete applications in real-world settings, and in the classroom as well. As Skinner (1969) himself wrote,

An application to education was inevitable, but it has not been unopposed. The fact that much of the early work involved the behavior of lower animals such as rats and pigeons has often been held against it. But man is an animal, although an extraordinarily complex one, and shares many basic behavioral processes with other species (p. 94).

Some of these applications, focusing more heavily on the work of Skinner and his theory of operant conditioning, are as follows:

Classroom Climate

As Ormrod (1990) argues, classical conditioning demonstrates the importance of creating a positive and comfortable learning environment. "When schoolwork, or a teacher, or even the school environment itself is associated with punishment, humiliation, failure, or frustration, school and its curriculum can become sources of excessive anxiety" (p. 41). Experiences of failure, while worthwhile and instructive, should be balanced, perhaps more heavily, by experiences of success. Skinner (1969) too was concerned about the classroom environment; writing during a time when punishment was no longer en vogue, he nonetheless wrote "simply to abandon punishment and allow students to do as they please is to abandon the goals of education" (p. 93). Simply telling students about the long-term value of getting an education, or relying on innate curiosity, he argued, was futile; "all these measures fail because they do not give the student adequate reasons for studying and learning. Punishment gave him a reason, but if we are to avoid unwanted by-products, we must find non-punitive forms" (p. 94). Skinner's solution was to use positive reinforcement – to reward student's for studying and learning. The following are examples of non-punitive reinforcement in the classroom.

Programmed Instruction

Skinner believed that traditional education was ineffective largely because of the delay between response and reinforcement; a student might take a test on Monday, but not receive a grade – the reinforcement – until Friday. As a way to remedy the situation, Skinner developed programmed instruction, which evolved from the teaching machine and has now been applied to textbooks and computers (Ormrod, 1990). Regardless of its form, however, programmed instruction has several common elements: the material is presented in discrete units, students are active responders, students receive immediate feedback, and individual differences in learning rates are accounted for. The earliest teaching machines presented information in frames, with the first frame presenting a small unit of information, the second frame posing a question about the information on the first frame, and then presenting a second bit of information, and so on. With computers, programmed instruction – or computer assisted

instruction - has become more complex, allowing for branching and more sophisticated display of information; it has been shown to be more effective in terms of student achievement and motivation than traditional teaching methods (Ormrod, 1990).

Behavior Modification

Behavior modification is a powerful tool for shaping the behavior of both individuals and groups. While traditionally used to shape appropriate classroom behavior – such as speaking out of turn or fighting with classmates – it can also be applied to behaviors that relate more directly to learning – such as study habits, or attention to task. Behavior modification plans typically include the following elements: defining the present and desired behaviors in measurable and observable terms; finding effective reinforcers; developing an intervention plan; measurement of the behavior before and during treatment; monitoring and making modifications to the treatment plan as necessary; and ultimately phasing out of the treatment (Ormrod, 1990). Behavior modification in groups is often implemented via group contingency plans – that is, the entire class has to perform the desired behavior – the identification of all fifty states, for example – for the reinforcement to occur. Token economies are also used with groups of students. When using token economies, a teacher selects several responses that will be reinforced – sitting quietly at one's desk, raising one's hand before speaking, etc. When a student exhibits such behavior, she is rewarded immediately with a token – such as play money, poker chips, etc. At a later time, the tokens can be redeemed for various reinforcers, such as toys, snacks, or extra recess time.

Behavioral Objectives

The impact of behaviorism on the practice of teaching and learning is perhaps most evident with respect to the emphasis on goals and objectives. Behavioral objectives are specific statements about what behavior – which is both observable and measurable - a student is to exhibit as a result of receiving instruction. As Skinner (1969) argues, "To say that a program is to 'impart knowledge', 'train rational powers', or 'make students creative' is not to identify the changes which are actually to be brought about. Something more specific is needed…" (p. 95). Behavioral objectives, he argues, makes teaching more effective, straightforward, and rewarding. "When goals are properly specified, the teacher knows what he is to do and later, whether he has done it. Behavioral objectives remove much of the mystery from education…" (p. 95).

Viewpoints

Behaviorism, even as it was the preeminent theory of learning in psychology and education, also generated a great deal of controversy. While much of the criticism simply reflected differences of opinion about human learning, much of it also stemmed from misunderstandings and inaccuracies. As Wyatt (2005) argues, misrepresentations of Skinner and other behaviorists are frequent; he cites just one example of a "well-known author, writing in a well-known source" who mistakenly concludes that Skinner viewed all organisms as blank slates upon which the environment and experience would write. "How unfortunate it is that [the author] has evidently not read enough of Skinner to know that Skinner frequently wrote about the genetic contributions to behavior" (Wyatt, 2005, p. 1). Similarly, Crain (2000) corrects those who suggest that Skinner denied the existence of an internal world of thoughts and feelings. While some behaviorists certainly did make such proclamations – Watson to name just one – Skinner simply argued they had no place in scientific psychology.

Even if critics have exaggerated or misrepresented behaviorists with respect to their views on the 'black box' – unobservable mental events – it is also true that the 'black box' itself has increasingly become the very subject of psychologists and educators' study. Even some behaviorists have acknowledged the role of internal events; neo-behaviorists, for example, are sometimes referred to as S-O-R (stimulus-organism-response) theorists as opposed to S-R theorists, because of the role they attribute to the mind (Ormrod, 1990). Nevertheless, behaviorist theories of learning – whether neobehaviorist or not – have largely been supplanted by cognitive theories of learning. The contribution of behaviorism to our understanding of human learning is immense, but as cognitive theorists would argue, also incomplete.

Terms & Concepts

Classical Conditioning: First introduced by Pavlov, classical conditioning is one of two learning paradigms that characterize behaviorism. In the classical conditioning model, an unconditioned stimulus (UCS) elicits an unconditioned response (UCR). A neutral stimulus is then paired the UCS; after repeated pairing with the UCS, the neutral stimulus becomes a conditioned stimulus (CS) which elicits a conditioned response. The conditioned response is similar to, although not exactly the same as, the unconditioned response. The most famous example of classical conditioning is the salivation of Pavlov's dogs at the sound of a bell which had been repeatedly paired with presentation of food.

Extinction: Both operant and classical conditioning suggest that previously reinforced behavior can be extinguished. In classical conditioning, extinction occurs when the conditioned stimulus is presented repeatedly in the absence of the unconditioned stimulus; in operant conditioning, extinction occurs when a response is no longer reinforced.

Operant Conditioning: First introduced by Skinner, operant conditioning if one of two learning paradigms that characterize behaviorism. According to the operant conditioning paradigm, responses that are reinforced will increase in frequency. Operant conditioning differs from classical conditioning in that the reinforcing stimulus occurs after the response, and the response itself is a voluntary one.

Reinforcement: In operant conditioning, reinforcers are presented after a response occurs and increase the frequency of the response. Reinforcers are either positive or negative; positive reinforcers involve the presentation of a positive stimulus after a behavior – for example, food or praise. Negative reinforcers

involved the removal of an aversive stimulus following a behavior – such as a teacher's disapproving glare.

Punishment: Whereas reinforcers typically increase the frequency of a response, punishment descreases the responses it follows. Punishment occurs in two forms. Type I punishment involves the presentation of an aversive stimulus – such as a scolding – where as type II involves the removal of a positive stimulus – such as taking away recess privileges.

Response: Behaviorism defines learning as a change in behavior; in both classical and operant conditioning, a behavior is typically referred to as a response. In classical conditioning, learning involves changes in involuntary responses; in operant conditioning learning involves changes in voluntary responses.

Shaping: In order to explain the acquisition of more complex human behaviors, behaviorists proposed the idea of shaping. In shaping, behaviors that become increasingly more like the desired behavior are reinforced gradually. The first behavior that is reinforced only slightly resembles the desired behavior; after the organism exhibits this behavior consistently, only behaviors that more closely resemble the desired behavior are reinforced, and so forth.

Stimulus: In both the classical and operant conditioning paradigms, behaviorists refer to environmental cues that result in behavior change as stimuli. In classical conditioning, the pairing of two stimuli – the conditioned and unconditioned stimuli – elicits a response. In operant conditioning, a reinforcing stimulus follows a response, and therefore increases its frequency.

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