



BEHAVIORISM AND LEARNING: ANIMALS TO HUMAN

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Abstract

The article incorporated the (missing) links of those doctrines, disciplines and experimental studies that were widely acknowledged as roots of the behaviorism within educational domain. The behavioristic studies commenced, prior to Watson, by a series of experiments on animals' behavior and the inferred findings were extensively applied in educational context – particularly of Skinner – relating with instructional pattern, time domain, contingency and learning styles. In the educational context, the behavioristic methods of investigations widely moved from experiments to survey methods which are evidenced by its most applied and debatable doctrines such as learning styles.

Key words: Learning, learning styles, behaviorism, conditioning, education

Introduction

The philosophical contribution of Aristotle in behaviorism is considered by his essay *Memory* which is accepted as initial foundation of the behaviorism. Later on, Hobbes famous for his book *Leviathan* appeared as traditional behaviorist. He rejected cognitive involvement in learning and supported the experience as validate form of learning because, in his point of view, knowledge excluding experience is almost impossible. Afterwards, Hume appeared as an anti-rationalist by proposing experience as a key factor of knowledge. The philosophical approaches toward behaviorism was not much accepted in those era because the science was at its early stages to develop, even behaviorism was not still embraced the scientific study of human behavior until Watson (1878-1958) appeared who is the pioneer of Behaviorism (Hunt, 2009). He introduced it in Psychology arguing objective behavior –the notion was criticized by his teacher: George Herbert Mead (Shalin, 1989) –as the subject matter of it. Although, Pavlov (1849-1936) has conducted research on dog focusing on external stimuli which expressed him as a behaviorist, but he did not associate it with human behavior. With the emergence of the behaviorism in the social sciences particularly regarding the study of animal behaviors at its initial stage, behaviorists commenced to develop methods to investigate animal behavior. The experimental study was much appreciated and widely accepted for this purpose by several theorists whose researches formed the foundation of behavioristic paradigm.

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Indeed, the doctrine is coined by Watson (Heidbreder, 1933) as a contrary movement to the introspective psychology by criticizing it eloquently. The targeted point for him was the consciousness –an intangible, unapproachable and undefined entity which is not more than a substitutive expression of a historical word soul –it could not be objectively experienced and experimentally understandable, therefore, only the behaviorists could comprehend human behavior more likely as natural scientists and specifically physiologists do, in terms of stimulus and response mechanism (Watson, 1924). The key element or subject matter of psychology in the behaviorism is behavior which must be observable in relation to external environment while the consciousness (the subject matter of Traditional Psychology according to behaviorists) neither observable nor comprehensible. In relation with psychology, Watson described behaviorism: Psychology as the Behaviorist sees 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 method, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness (Watson, 1913, p. 1).

He supported response-stimulus mechanism via an experimental study of emotional conditioning named Little Albert in which a mouse, very dear to Albert who was a nine years old child, was presented along with a sound which scared him (Watson & Rayner, 1920). He concluded that the fear-response of Albert was directly occurred to stimulus without the involvement of mind. After three years of the study Jones (1960) interrogated to reduce fear through another experimental study on Peter and concluded that the conditioned response could be unconditioned. At its basic core, behaviorism focuses on influences of external environment, directly observable behavior and exclusion of mental involvement (consciousness) in response to stimuli (Ritzer, 1996) which is sharp active contrary to the introspective study of human behavior.

Connectionism

Edward Thorndike (1874–1949) was first who used the term connectionism (Cordeschi, 2000). He was famous for his contribution in educational psychology (Thorndike, 1913a, 1913b; 1914) that proposed some learning principles known as law of Exercise, Effect and Readiness. The difference between law of exercise and effect lies in the strength and weakness of bond or connection, based on the consequences. In the law of exercise, practice strengthens the connection while in law of effects its consequences determine its weakness and strength. Thorndike's educational findings brought a revolution in the education history, it was widely accepted and most of the school-based curriculums and learning activities were designed by focusing on his theory.

Classical conditioning

Ivan Pavlov (1849–1936) has been considered as a (an accidental) founder of classical conditioning that made his significant position in learning theories. Prior to the study of Pavlov, Knee-jerk reflex was an experimental study conducted by Twitmyer (1974) which is a form of classical conditioning because he found an association between the bell, he used to ring at each 0.5 seconds before hitting the patellar tendon on kneecap of students, and knee-jerk of students (Twitmyer, 1974). Another experimental study which in fact provides the foundation of classical conditioning was conducted by two students: Vul'fson and Snarkii (Boakes, 1984) in the Pavlov's laboratory. Vul'fson experimented

on salivation of dogs associating it with natural food and dry foods –even sand. He found that dog salivated when he just observed those foods and sour water, whereas, Snarkii extended that experiment to artificial foods like black juice which was artificially colored black and explored that the dog started to salivate when he just observed any sort of black color juice.

Pavlov's experiment comprised of stimulus-response mechanism. Initially, he presented meat powder (unconditioned stimulus) to dog which directly elicited salivation (unconditioned response). Afterwards, Pavlov started to ring bell i.e. Metronome tick, before the meat was presented to the dog. Several times repetition of the neutral stimulus the dog begun to salivate (now conditioned response) right after the bell (now conditioned stimulus) was rung (Domjan, 2014). The conditioned stimulus can be appeared as higher-order condition or unconditioned stimulus but the third conditioning with the second conditioned stimulus is almost hard to formulate (Pavlov, 1927). A new way to conceptualize the logic of classical conditioning was proposed as latent cause theory (Gershman & Niv, 2012).

Classical conditioning theory has other prominent explorations such as extinction, discrimination and generalization. Before the description of these salient features of classical conditioning, some other associated elements with the theory must be explained here. Acquisition is a phenomenon in which the conditioned response becomes more reliable because of the repeatedly pairing of unconditioned stimuli with the conditioned stimuli. In other words, due to the strong pairing of both stimuli the reliable conditioned response acquires and after the acquisition, if conditioned stimulus presents, excluding the pairing, the conditioned response would decrease. The phenomenon is known as extinction (Pavlov, 1932) which was also accidentally discovered by Skinner who claimed that the history of reinforcement determines how quickly the extinction will occur (Skinner, 1953). Regardless of extinction, the spontaneous recovery is possible which is explored by the several researchers (Rosas & Bouton, 1996; Rescorla, 1997). Generalization is the expanded application of the conditioned response to the almost similar stimuli. The dissimilarity of stimuli may reduce the generalization (Harris, 2006) and discrimination will occur when child will not fear to other stimuli except the conditioned stimulus.

The foundational study of conditioned emotional response or conditioned suppression was conducted by Watson & Rayner (1920) on Albert. In the experiment, Watson and his colleague conditioned a steel rod tone, hit by a hammer to produce sound, with the presence of a white rat. Albert have no fear of the rat and he moved to it while they rung the bell, using hammer and steel bar, right behind his head. After the several trails of the conditioning, Albert was conditioned to fear of rat which he expressed through jumping, running and falling down. Later on, he generalized his fear to rabbit, fur coat and other stuff while he was not fear of his toys. Another experimental study supporting conditioned suppression is rat and electric shocks experiments (Estes & Skinner, 1941) which was extensively used by researchers (Fanselow, 1990). In the experiment, they produced electric shocks (US) right after the exhibition of conditioned Stimulus i.e., ringing bell. The rat was trained to press the lever which was conditioned with food. When the rat pressed the lever during the conditioned stimulus, they immediately produced electric shocks. After some trails, the rat became static or freeze on conditioned

stimulus (paired with electric shocks) which denoted his fear that resulted in reduction of frequency of lever pressing. The lick suppression procedure was favored by some researchers (Brennan & Jastreboff, 1991; Safi, Wespy, Welzl, & Lipp, 2006) because it requires less training (Domjan, 2014). Since the experiments by Skinner, CER is broadly being used in Classical conditioning (Kamin, 1965) like CER experimental legacy is followed by Chicago graduate students (Barrett, 2008) and several researches (Brady, 1951; 1956) was also conducted to follow the legacy or to replicate the results. CER can also be described with the therapeutic techniques of systematic Decentralization, developed by Joseph Wolpe and based on pavlovian conditioning mechanism, which is comprised of three steps (Berggren, 2001). The first one is the anxiety-hierarchy; the second is the imagining of pleasant scenario and the third step involves in imagining the least-anxiety, along with the pleasant scenario (Wolpe, 1973).

Eye-Blink Conditioning: The conditioning, to some extent similar to the knee-jerk response (Domjan, 2014), extensively experimented to explore the nature of Pavlovian conditioning (Gormezano, Kehoe, & Marshall, 1983) including human participants to experience (Hilgard & Marquis, 1940) which provided extensive guide to teachers (Woodruff & Steinmetz, 2000). Eye-blink conditioning process involves a puff of air (US), through straw, paired with tone (CS) that leads to blink the eye of participant(s) on both unconditioned stimulus and conditioned stimulus. The prominent figure of eye-blink conditioning related with the neurobiological investigation is Gormezano (1966) who experimented rabbits' eye-blink conditioning. Afterwards, the experimental findings were widely replicated by researchers with some extensions (Allen, Padilla, & Gluck, 2002; Nokia, Penttonen, Korhonen, & Wikgren, 2009).

Auto-shaping: It is devoted to the series of experimental studies conducted on various animals like cats, pigeons, rats and squirrel monkeys (Hearst & Jenkins, 1974; Cleland & Davey, 1982). It represents the CS-US association in which CS is approachable or can be tracked while US (mostly food) provided right after the CS (Brown & Jenkins, 1968). The interesting results indicated by several researches (Brown & Jenkins, 1968; Matthews & Lerer, 1987) that the participants, e.g. pigeons, begun to peck the conditioned stimulus instead moving toward the unconditioned stimulus which is an expected behavior in case of classical conditioning. In such experiments (Hearst & Jenkins, 1974) the pigeons were not trained which is contrary to the rat and lever pressing experiment (see Estes & Skinner, 1941). They did not need to perform any sort of actions to get reinforcement because the food, some experiments used water (Woodruff & Williams, 1976) had been presented to them without their any indication, whereas, blocking was also used in some researches (Leyland & Mackintosh, 1978). The experimental study by Kearns & Weiss (2004) seems to be very interesting because he used Cocaine as unconditional stimulus that produced contrary results to previous studies. The experiment was conducted on rats in which they used lever pressing as CS and the offering of cocaine as US which indicated that in case of the US rats did not tracked the CS. The response of the rats appeared as contrary to the other studies of auto-shaping.

Taste aversion: It is the learning of aversive behavior towards eating of food in association with any kind of aversive consequences. It has some characteristics which distinguished it slightly to the classical conditioning (Yamamoto, Fujimoto, Shimura, &

Sakai, 1995) instead it has been studied as an exemplar of classical conditioning (Lett & Grant, 1996; Sclafani, 1997) which signifies the acceptance of taste-consequences association in classical conditioning (Rozin & Zellner, 1985). The prominent researcher of taste aversion learning is Garcia (Kalat & Rozin, 1973) who studied, along with his colleagues, different aspects of learning (Garcia, Ervin, & Koelling, 1966). After Garcia, TA extensively studied in association with the other stimuli in which running stimulus was widely studied experimentally (Lett & Grant, 1996; Masaki & Nakajima, 2006) but TA investigation was also explored via survey method (Batsell & Brown, 1998).

The classical conditioning has profound literature which is being expanded and concise simultaneously. Such expansion is defining new dimensions like Trace Conditioning, which did not illustrate here because that may derail the discussion of concerned topic. The complex intervention of various variables in new dimensions of classical conditioning would take this discussion more away from the topic under discussion while the salient features of the classical conditioning has been elaborated in relation with its methods and findings about learning phenomenon.

Instrumental conditioning

The basis of the instrumental or operant conditioning could be traced back from the early experimental studies of Edward Thorndike (1874–1949). His scientific work devised law of effect (see Connectionism). The most prominent figure of instrumental conditioning is Skinner, B. F. (1904–1990) who introduced it. He was well renowned as radical behaviorist –his literary persona. Owing to the writings of Watson he became a psychological scientist (Baars, 2003; Dews & Skinner, 1970; Skinner, 1976). His psychological contribution and legendary was honored by several prizes like Howard Crosby Warren Medal, 1942; National Medal of Science, 1968 and President’s Award, New York Academy of Science, 1985 (Smith & Morris, 2004).

Basic Model and Elements: Instrumental conditioning is very complicated (Dragoi & Staddon, 1999), whereas, the most likely model to illustrate operant conditioning is three term contingency that sets an event (S^D) for response (R–desirable response) followed by reinforcement (S^{RF}) (Schunk, 1996). Unlike the classical conditioning, the discriminative stimulus (S^D) does not directly elicit the response (Ormrod, 1999) rather it is an indication or signal or an event for the response that follows the reinforcement which represents the control stimulus –response under the control of stimulus.

Any stimulus which strengthens the prior response or increase the possibility to occur the same response (R) in future, under the same condition or event (S^D), is known as reinforcement that could be negative –turning of light (Smith & Iwata, 1997) – or positive (food as a reward in Skinner’s experiment) but it is important to note that both strengthen the prior response (Miltenberger, 2008a, 2008b). There is also an extensive intellectual debate on the distinction of both negative and positive reinforcement (see Baron & Galizio, 2005, 2006; Chase, 2006; Iwata, 2006; Lattal & Lattal, 2006; Michael, 1975; Sidman, 2006). Negative reinforcement mostly misunderstood due to the expression of the term “negative” (Cooper, Heron, & Heward, 2007). It also has two types: escape – to get ride from the aversive stimuli – and avoidance – to prevent the aversive stimuli (Domjan, 2009) which are natural behaviors (Schlund & Cataldo, 2010). Those stimuli conditioned with the primary reinforcer –a primary stimulus for survival like water and

food – are known as secondary reinforcers. For example, the food cooked by mother could be S^{SR} through its association with food (S^{PR}). Punishment, on the other hand, is a consequence which tends to decrease the probability of a certain behavior to occur in future and it is also divided into negative and positive connotations (Michael, 1975). It was explored by certain researches (Piffner & O'Leary, 1987; Walters & Grusec, 1977) that punishment is effective in abating the unpleasant behavior or response while Skinner himself claimed it as a temporarily effective stimulus.

Schedule of Reinforcement: It refers to the defined plan of reinforcement. In other words, the deliberately formulated plan [that when and how often] to give reinforcement is known as schedule of reinforcement (Skinner, 1938; Zeiler, 1977). Each type of reinforcement has different effects on behavior (Ferster & Skinner, 1957). Indeed, each bar pressing by rat was reinforced with food is known as continuous reinforcement that used to clarify the partial reinforcement or vice versa. Partial reinforcement is, to somewhat, related to the schedules of reinforcement to understand its basics in relation with reinforcement and behavior. The typology of the schedules is as follow: Fixed ratio schedule: Reinforcement will be given after fixed correct responses. Variable ratio schedule: Reinforcement will be given after varying [fixed] responses. VRS produced higher response rate (Catania, Matthews, Silverman, & Yohalem, 1977; McDowell &

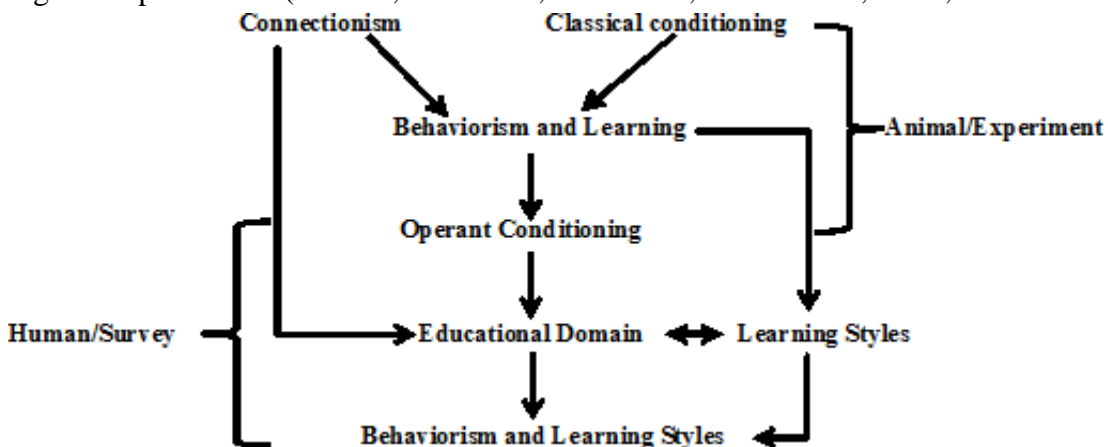


Figure 1.. Behaviorism and Learning: roots, transition and educational implications

Wixted, 1988). Fixed interval schedule: Reinforcement will be given after fixed interval of time. Variable interval schedule: Reinforcement will be given after varying time interval. One distinguished characteristic of operant conditioning to classical conditioning is shaping which involves in the acquisition of desirable response by presenting the reinforcement gradually. It expresses that the desired response, if acquired, has chances to be extinguished in case of reduced reinforcement or temporary elimination of reinforcement. In school, if students do not reinforce, they may not perform the conditioned response. Teachers also desire that student, in some cases, must generalize the learned method e.g., learn practically, and have sense to discriminate the various methods with reference to their appropriate application. One most critical factor in learning is chaining (Gollub, 1977) which means that prior response contribute for post response. In other words, each response in relation to the next response build a chain of responses in which first response serves as a discriminative stimulus that leads to the next response. The process is called chaining (Skinner, 1953).

Behaviorism and educational implications

Apart from the analysis of animal behavior, the extension of behaviorism covered the educational context for the application of behaviorism. The most important work in this regard is of Skinner (1968; 1954; 1961; 1984). His extrapolations in educational context regarding students cover only half of the hedonistic postulates that related with the avoidance of punishment, not with the seeking of learning for pleasure. Therefore, his inferences are semi-hedonistic connotations because he argued that students struggle to perform well not because of the urge to learn rather they perform well because of the fear of punishment like teacher's deduction of marks, criticism, and lack of attention. Further, in relations with the contingencies of reinforcement, his interpretations are artificial-hedonistic connotations. The word "artificial" does not express the denial of his extrapolations rather it denotes the falsifiability of hedonistic orientation because in his interpretations the seeking of reward e.g., good grades, by students is not natural but is artificial which could be developed through the appropriate arrangement of reinforcement. He argued that the application of operant conditioning to education is simple and direct. Teaching is the arrangement of contingencies of reinforcement under which students learn. They learn without teaching in their natural environments, but teachers arrange special contingencies which expedite learning, hastening the appearance of behaviour which would otherwise be acquired slowly or making sure of the appearance of behaviour which otherwise never occur (Skinner, 1968). Skinner claimed that student-teacher learning problems cannot be solved by increasing the instructional time and instructors' pay rather the solution, with respect to the operant condition, lies in the appropriate management of reinforcement. The immediate response of teacher to the student and increasing rewards would increase the efficiency of the student and academic achievement.

Skinner (1960) modified Pressey's machine and applied it on the instructional method. The machine, unlike its original functions, showed the incorrect answers to the students. It is one of the forms of programmed instruction, while nowadays, there are several computerized programs are being used in schools (Jonassen, 1996) to enhance the instructional proficiencies which have ultimate aim to increase the learning ability of students. This programmed instructional material was designed by focusing on the operant conditioning learning module (O'Day, Kulhavy, Anderson, & Malczynski, 1971).

One important model introduced by Carroll (1963, 1965) which is related with behaviorism in the context of environment, focuses on the time required and spent for learning. Dweck (1975) found that short time failure increased the time consumption to success. Time dimension of learning goes to the cognitive ability because mostly the previous experiences shaped the ability of learners to understand the given material. The time spent on learning influences by the permitted time by teacher and desired time (of students) for learning. Teachers spend little than the desired time of students to teach, therefore, the extra classes may increase the academic achievement of students (Lauer, 2006; Mahoney, Lord, & Carryl, 2005).

Recently, learning styles are the most vital pragmatic doctrine in the educational field to comprehend the most appropriate/preferred behavior of students that guide pedagogies

to direct students to accomplish their learning tasks. Despite the fact that the validity and reliability of learning style models was extensively criticized, they have been persistently functioned at school, college and university levels. Many learning style models strived to infer the influences of external environment on the learning behavior of students. Regardless of skinner's reinforcement and punishment mechanism, learning style theorists introduced new terminologies to express the concerned phenomenon in educational field but still the preferences of different terminologies in learning style did not isolate it from behaviorism. Indeed, the doctrine of learning style was introduced under the realm of learning theories; therefore, there are several models of learning styles that directly expressed the legacy of behaviorism in educational context. Although, behaviorism was not initially entered into the educational domain yet the ultimate goal of the theory and experimental studies regarding learning seemed educational implications because experimental findings of learning could be most appropriately applied at most formal or controlled educational places.

Conclusion

It has been identified through the extensive review of behaviorism that initially the foundation of behaviorism was constructed by conducting the experimental researches on animals, whereas, later on, its indulgence in educational domain transferred the methodological approach into survey methods (see fig. 1). Such transformation produced new theories, models and terminologies in educational behaviorism that juxtaposed with Skinner's dialects.

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