Skinner's Radical Behaviorism

vs.

Piaget's Cognitive Development

Three Case Studies

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Radical behaviorism and cognitive development have influenced America's educational system more than any other psychological theories. For years, behaviorism has informed teachers on how to reward their students for their work as well as how to maintain discipline in the classroom. More recently, cognitive development has put more focus on how children's minds grow and what children are capable of understanding. Vastly different and yet equally insightful, each of these two theories provides a wonderfully clear lens through which the psychologist can view the world and an educator can view the classroom.

Cognitive Development

According to Piaget, cognitive development progresses through four distinct stages. Although the rate at which people advance through the stages varies somewhat, everyone does pass through each stage. The first stage is known as the sensorimotor. It consists of children up to the age of two, and is marked by their physical exploration of the world. Bybee and Sund (1982) explain that children in the sensorimotor stage go through a transition from reality of self to a reality of the environment. In other words, babies cannot initially distinguish between themselves and their environment. As they progress through the stage, they come to understand their distinction from the world around them, as well as how they can manipulate this world. During this stage, children also learn object permanence – objects out of sight do not cease to exist.

From about ages two to six, children are in the preoperational stage. By now, they fully understand that they are separate from the environment around them. As a consequence, their level of egocentrism, "the degree to which a child views himself as the center of reality," (Bybee & Sund, 1982, p. 76) is quite high. At this stage, children also begin to understand symbols – particularly those represented in language.

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Concrete operational follows. Children from ages six to eleven or twelve are in this stage. Here, children begin to understand rules and classification. In addition, concrete operational thinkers learn a variety of new logical processes. Consider a child shown three pitchers of water of varying sizes. She can understand that the medium-sized pitcher is larger than the smallest pitcher and at the same time smaller than the largest pitcher. This capacity to understand concurrent relationships is called transitivity. If one of the pitchers is poured into a shallow pan, she knows that when the "height" of the water is reduced, the "width" of the water will increase. This concept of increasing one dimension while reducing another is called reciprocity. Finally, unit concept is the understanding that, while the "shape" of the water is different, the amount of water has not been altered.

The final stage is formal operational. In this stage, people learn to understand abstractions. They understand things as they are and can imagine things as they might be. This can manifest itself in imagining ideals or hypothetical situations. Formal thinkers also practice metacognition – they can think about their own thought processes.

Piaget thought of learning in terms of equilibrium and adaptation. One is in equilibrium when his/her understanding of the environment or a particular situation (what Piaget called "schema") seems to fit reality. When reality challenges a child's schema, the child is said to be in disequilibrium. For example, a boy might think of a key as something that turns on cars. Then the boy sees his father use a key to unlock a door. This does not match his schema of keys, so he is in disequilibrium.

According to Piaget, disequilibrium is necessary for learning to occur. He said it is appropriate for teachers to create disequilibrium in students, so long as they are in the appropriate developmental stage to resolve it. (A preoperational child cannot be asked to

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understand transitivity like concrete operational children can.) Disequilibrium can be resolved in two ways. The child can either adapt or choose to step back from whatever caused the disequilibrium. The first choice, adaptation, is what Piaget considered learning. The second would be, in effect, choosing not to learn.

Adaptation (or learning) comes through a process of assimilation and accommodation. Assimilation, according to Henson and Eller (1999, p. 45), is "altering responses to the environment to be consistent with schemata," while accommodation is "altering schemata to be consistent with the environment." In the example of the boy's understanding of keys, when the boy sees a key unlocking a door, he must accommodate his schema (or understanding) of keys to include unlocking doors. Later, as he is playing, experimenting with keys and trying to unlock doors, he is assimilating – manipulating his environment to test his schema. It is through these cycles of adaptation, assimilation and accommodation that learning occurs, eventually enabling children to progress through the four stages of development.

Radical Behaviorism

Compared the complexities of Piaget's theory, behaviorism is relatively straightforward. Behaviorism developed from the scientific study of animals. As scientists, behaviorists were reluctant to draw conclusions from unobservable events. Radical behaviorists like B. F. Skinner were adamant about this point. He "argued that we must resist the siren call of the mind if we are to maximize psychology's ability to change behavior" (Lieberman, 2000, p. 21). Therefore, instead of focusing on invisible thought processes, behaviorists concentrate on physical actions.

Classical conditioning is the form of behaviorism that deals with instinct and reflex reactions. In classical conditioning, the subject has a natural reaction to a stimulus. Either through chance or a planned sequence of events, the subject comes to associate a new, neutral

stimulus with the natural stimulus. As a result, the subject is conditioned to have the same reaction to both the natural stimulus and the new stimulus. In Pavlov's famous experiment, a dog had the natural reaction of salivating when exposed to the stimulus of food. Pavlov added a new stimulus – ringing a bell – to the introduction of food. This ringing eventually caused the dog to salivate without the presence of food.

Classical conditioning is legitimate but hindered by the need to have a pre-existing reflex reaction (Phillips & Soltis, 1998). Operant conditioning does not have this limitation and is therefore much more powerful as well as more versatile in the classroom.

Where classical conditioning considers what occurs before the desired response, operant conditioning focuses on what follows the response. B. F. Skinner's pigeons serve as an excellent example. When the pigeons exhibited a desired response, such as pressing a lever, they were rewarded with food. Skinner referred to this reward as reinforcement. This reinforcement increases the likelihood of the behavior to repeat. Eventually, Skinner could use a series of reinforcements to train a pigeon to perform complicated actions. This process is called shaping.

There are several different ways to reinforce behavior. The most common, positive reinforcement, occurs when the subject is given something enjoyable after performing the desired activity. Some examples include praise, candy or money. Negative reinforcement consists of removing a negative stimulus. This could be taking away a restriction or removing an annoying sound.

Operant conditioning also addresses how to eliminate undesirable behavior. Punishment is providing an unfavorable response. Extinction is ignoring the behavior until it dies away for lack of attention. Skinner argued that punishment, while perhaps effective in the short term, does

not work and is possibly counterproductive in the end. Extinction might require more patience and tenacity, but Skinner felt that it was much more effective in the long run.

Similarities and Differences

Radical behaviorism and cognitive development are two quite different theories. More than once, Chomsky (1980) noted that the two had very little in common. But, while the differences are significant, the similarities do exist.

Behaviorism and Piaget's theory of cognitive development both deal primarily with the individual's reaction to the environment. Neither takes much into account the affect society has on the learner. To both the behaviorist and supporter of Piaget's theory, learning is a process that occurs within the individual. Social constructivists criticized the omission of society's influence from both theories.

Educators have a great deal to learn from both Piaget's theories and behaviorism. Skinner was greatly interested in how his work influenced education. To him, "the goal of psychology should be practical…making education enjoyable as well as more effective" (Lieberman, 2000, p. 20). While Piaget did not write much about education per se, his work has had a tremendous influence on education. Bybee and Sund (1982, p. 15) summed it up well: "Unfortunately, Piaget had little to say on the topic of education. This is especially true when one considers the importance of his theory for educators."

Despite his recognition of their differences, Chomsky (1980, p. 245) still points to a third similarity between the two theories. He notes that both acknowledge a "uniformity of the mind." In other words, proponents of each theory believe that every cognitive process in the mind occurs according to the rules of the respective theory. Different concepts and styles of learning are not treated differently in the mind.

So much for similarities. Differences between the two are much more obvious. The most significant difference is that the two theories are based on entirely different premises. Radical behaviorism is defined by a refusal to work with the unobservable. Piaget worked with cognitive structures – a theoretical process entirely in the mind and entirely unseen.

Skinner's behaviorism didn't take into account an individual's development. To Skinner, reinforcement affects behavior at any age. What reinforces an adult may not reinforce an infant and vice versa, but the premise still holds. Reinforcement will always affect behavior. Piaget, on the other hand, made the concept of development a cornerstone of his theory.

Another significant difference between the two theories lies in the individual's role in his/her learning. Piaget felt strongly that the learner is active, so much so that Bybee and Sund (1982, p. 57) refer to the sensorimotor stage as that of "the active child." Henson and Eller (1999, p. 42) elaborate on this point: "Piaget reasoned that children are not merely passive recipients of information of their environment…. Piaget believed that children act on the world to understand it." Behaviorism, on the other hand, is much more passive. A subject performs an act and is consequently rewarded or punished for that act. The environment's role is much more significant as that of behavior-shaper, while the subject in question is the passive recipient of learning.

The differences between behaviorism and cognitive development are most evident in their practical application. The following three case studies have been analyzed according to both Piaget and Skinner's theories. While the analyses are strikingly different, each provides a viable insight.

Case Study One

A few months ago, I was substitute teaching a seventh grade English class. This particular teacher's class always started with a vocabulary exercise where students would look up the definition of a new word. Today's word was *chafe*. The teacher had several different dictionaries spread around the room. I asked the students to look up the definition. One student raised her hand and read from her dictionary. "Injury or wear caused by friction" (Merriam, 1979, p. 181). I congratulated the student on finding a correct definition and, knowing that chafe has several definitions, asked if anyone had found something different. A boy raised his hand and read from his dictionary, "To become worn by rubbing" (Lexicon, 1990, p. 162). His definition had different wording, but meant basically the same thing. I was stuck with a dilemma: Do I offer the same praise to this boy? Should I have been clearer in my instructions? I made a quick decision. I praised him for his answer, but asked the class if that wasn't just a rewording of the definition we'd already heard. I was answered with blank stares. "OK," I said, "Can anyone find a definition of chafe that means something other than rubbing together?" I was in for a surprise. It took two more tries before someone offered, "To irritate, annoy" (Merriam, 1979, p. 181).

Piaget's theory of cognitive development explains a great deal of this case. Most of these seventh grade students were just entering the formal operations stage. In the concrete operational stage, they dealt with rules, classes and relations. Like the name implies, concrete operational thinkers work with concrete ideas. Specifics mean something to them; abstracts do not. To a classroom of students in the concrete operational stage, a definition is like a rule – a specific set of words that is set in stone and cannot be changed. Of course, we know that this isn't exactly true. A definition is, after all, not a specific set of words, but the *idea* behind a word. Therefore which words are used isn't the defining factor, but rather the meaning of these words. Piaget would argue that this abstract idea could only be grasped when a when a child has

reached the formal operations stage. Piaget said that children entered the formal operations stage at about age eleven or twelve, but there is a great deal of flexibility in this. This was my first (and only) day with these students. It would be impossible for me to know definitively which were comfortably in the formal operations stage, which had only recently entered the stage and which were still in the concrete operational stage. As such, Piaget would argue that it would be premature to try and explain this abstract idea to them until I was certain they were all in the formal operations stage.

This case can also be explained by behaviorist theory, although it points out a significant criticism of the theory. Behaviorism tells us that if a student (or anyone, for that matter) enjoys a certain outcome, he or she will be more likely to repeat the behavior that brought about the outcome in the first place. Here, a student responded correctly and I praised her for her effort and for finding a correct answer. Skinner would argue that the student's behavior – that of offering a correct answer – has been reinforced by my praise, and the student will try to volunteer more correct answers in the future.

This sort of application works especially well with concrete answers. In mathematics, for example, two plus two always equals four. The issue of what is "correct" is cut and dry. But what about questions of language? Unlike mathematics, the subtleties of language arts are not so well defined. In this case study, simply rewarding (or withholding a reward) cannot explain to the boy why his answer is merely a restatement of the first answer. As such, behaviorism seems to fall short. W. V. O. Quine (as quoted by Chomsky, 1975, p. 199) summed this point well. Behavioral conditioning, he stated, is "notoriously incapable of carrying us far in language" and is "insufficient to explain language learning." While behaviorism can explain these students' motivations, it cannot decipher the complexity of learning language.

Case Study Two

I enjoy playing games on my computer. In particular, I'm a big fan of the *Myst* (1993) series of games. *Myst* is a problem-solving adventure game. I like to think of it as the "thinking man's video game." The game provides a simulated world for the user to explore. As he/she starts the game, the player must explore and become accustomed to this new world. There is a lot to learn! Some lessons are similar to those we know from the real world – learning a new language, finding your way around a strange place, learning how to operate a new machine. Other lessons, however, are entirely new to us. For example, in the world of *Myst* the laws of nature don't always apply. Some objects seem to defy gravity, technological marvels are simply concocted of wood and string, and scientific impossibilities like teleportation are more than possible – they're practically commonplace. In these situations, it is a matter of "unlearning" what we know and expect from our real world experiences before we can accept the new "realities" of *Myst*.

Myst is, after all, a game, and after the player has gained some understanding of this new world, he/she must then figure out how to win. The solution to *Myst* comes in a series of challenges: what is the code to unlock a door, what sequence of events will get electricity flowing, how can a map be deciphered. How to solve these puzzles is up to the player to discover by trial and error, intuition, imitating the actions of other people or even animals, careful study of the surroundings, and sometimes blind luck. Initially, it is random play: "I want to open this door because I'm curious to know what is behind it." As the player gains knowledge, his/her actions become more focused and have a more defined purpose: "I need to figure out how to cross this lake because I know the tool I need is on the other side." Tasks and motives become more complex and clearly defined as the player's understanding continues to grow until the final solution is achieved.

With so many different learning situations in *Myst*, a psychologist could have a field day. Skinner's radical behaviorists would point to the great deal of positive reinforcement offered by the game. When a player has performed the correct sequence of steps, he/she is given a reward. For example, after a stubborn lock has been opened, the player is rewarded with more to explore beyond the door. Sometimes the player knows what specific reward to anticipate (As in "I know there is a tool on the other side of the lake,") and sometimes it is mere anticipation of a reward. In the "locked door" example, a player hopes there is something useful beyond the door, but there is always the risk that the door opens to nothing more than an empty closet. Yet, even without the guarantee of reinforcement, the player still makes the effort to unlock the door. This is consistent with behaviorist theory. Positive reinforcement need not be offered every time an appropriate behavior is performed. In fact, reinforcement that comes in random intervals produces behavior that has a greater chance of continuing after the reinforcement is stopped. Indeed, the game wouldn't be much of a challenge if a green light appeared every time the player took a step in the right direction! Conversely, a player would quickly get frustrated if painstaking work consistently yielded no result at all.

Just as Skinner used reinforcements to shape the behavior of pigeons, so *Myst* shapes the user's behavior. It is a virtual impossibility for a player to accidentally stumble upon the correct sequence of hundreds (if not thousands) of actions required to finish the game. So *Myst* rewards players when they make some progress in the right direction. Eventually, random wandering becomes a specific routine of steps.

The world of *Myst* is incredibly detailed. These details add to the beauty and realistic quality of the *Myst's* world, but also make it easy to become distracted by some element that has no bearing on the game's play. For example, while exploring a house, a player might notice a

stack of books in the corner. Unbeknownst to the player, these books are just for show – a sort of "set design." The player, however, suspects the books are a clue and wants to search them for information. *Myst* helps to guide the player back on track by placing the books out of reach, or by filling them with unintelligible scribbling. Eventually, the player tires of fruitless attempts to gain meaning from the books and moves on. This is extinction. When a behavior is not wanted (searching a worthless stack books), no reinforcement is offered for that behavior. Eventually, the behavior dies away.

Because of its nature as a video game, *Myst* offers a unique affirmation of radical behaviorism. A computer cannot read minds; it only responds to physical behavior that results in input: moving the mouse, typing on the keyboard, clicking a button. Like the radical behaviorist, a computer also only recognizes observable behavior.

Piaget would look at *Myst* in terms of assimilation and accommodation as well as stages of development. As the player has been immersed into an entirely unfamiliar world, it can be said that he/she has reverted to the concrete operational stage. The player thinks in terms of rules, classes and relationships. For example, upon encountering a machine similar to one previously mastered, a player might recognize the similarities and class them together. The player would then try to assimilate the new machine into his/her understanding: "This is a machine like the one on the island. It must operate the same way. I'll try it out." Upon trying, though, the player realizes there is an error in his thinking. His schema is incorrect; the new machine does not operate exactly like its predecessor. This creates a state of disequilibrium, which must be resolved. The player accommodates his thinking to account for the disparity: "Hmm… Not what I expected. I must need a different code to activate the machine. The old machine's code was written on a tree nearby. Perhaps the code for this machine is nearby, as

well." This cycle of assimilation and accommodation continues until the disequilibrium is resolved in one of two ways. First, the solution is successfully achieved, and the player has accommodated a new understanding. Second, and commonly in *Myst*, the player gets frustrated, moves on, and puts it out of mind until later.

Piaget would be intrigued by the "unlearning" that a player must do in *Myst*. He would refer to this as accommodation. For example, a player finds a book. His schema from the "real world" tells him that he can open the book, read it, put it down and continue on. However, upon opening the book, the player finds himself physically transported to another location. His schema from reality does not apply in *Myst*. He must accommodate his understanding. He could conclude that all books in *Myst* are teleportation devices. Or he could decide that some books are teleportation devices. Again, more experimentation, assimilation and accommodation will ensue.

Like behaviorists would enjoy the nature of playing a video game, so would Piaget. Piaget firmly believed that learning was a "hands on" event. One had to become physically involved to achieve learning. This works will with a video game. One cannot learn the secrets of *Myst* simply by staring at the computer. Instead, a player must interact with the simulated environment, find disequilibrium, and assimilate and accommodate in a continuous cycle. This is how Piaget said learning was achieved, and *Myst* fits the bill quite well.

Case Study Three

My nephew Nicholas is a source of entertainment for the entire family. He is two and a half years old and loves to be the center of attention. Of course, my family is more than happy to oblige him. One of his newest games is "Doctor." He takes the hose from his toy fire truck, and pretends it's a hypodermic needle. Then he goes up to someone sitting close to him and

pretends to give him/her a shot. His "patient" plays along with him and says, "Oh thank you, Nicholas! I feel so much better." Then someone else takes up the cue and plays sick. "Nicholas, I'm so sick. Can you give me a shot?" This goes on and on. My nephew would be content to walk around in circles all day, giving shots to his sick family. Unfortunately for him, the adults usually tire of the game well before he does. Nicholas has to be distracted into a new game so everyone else can go about his or her business.

This case study is deceiving in its simplicity. There's actually quite a lot going on here. Nicholas is in the early part of the preoperational stage. This stage is marked by the beginnings of symbolic understanding. The primary indication of this is the ballooning of language skills. That is absolutely true of my nephew, who is beginning to speak in sentences and is always surprising us with what he has to say.

There are many levels of symbolism in Nicholas' doctor game. First and most obvious is the role-playing. Nicholas has become the doctor, and we are his patients. We obviously don't have hypodermic needles lying around the house, so Nicholas has created one from his fire truck's hose. This play is a hallmark of the preoperational stage. "Preoperational children often become fascinated with imitative, or make-believe play…Piaget believes this play fascination, in part, manifests itself because children are now capable of more representational thought" (Bybee & Sund, 1982, p. 79). There is a final example of symbolic representation that, while not as obvious, is perhaps the most striking. Nicholas has associated getting a shot with becoming healthy.

The behaviorist also has much to say about this game and the affect it has on both my nephew and family. A sort of "reinforcement cycle" has developed. After Nicholas pretends to give someone a shot, that person reacts with praises, thank-yous, smiles and laughter. There is a

great deal of attention given to my nephew, which he loves. Nicholas' actions have been reinforced. Skinner tells us that he is now likely to repeat this behavior. How does the family react in this situation? We see Nicholas smiling, laughing and pretending to be a grown-up, which we love. So we all join in the game, pretending to be sick and needing the doctor's help. Watching Nicholas continue his game is reinforcement for the adults in the room. True to Skinner's theory, our behavior (that of pretending to be sick) is likely to continue. As long as the game is entertaining, this cycle continues. Nicholas is reinforced by our behavior and continues his game. We are reinforced because we enjoy his game, so we continue to play along with him.

Alas, all good things must come to an end. Eventually someone wants to pursue behavior that has greater reinforcement. Maybe getting back to work offers negative reinforcement by reducing the stress caused by an unfinished job. Or lying on the couch will bring about much craved rest time. Perhaps the behavior of looking in the refrigerator will yield the reinforcement of finding a snack to eat. Whatever the behavior is, the new reinforcement is novel and more enticing than continuing to play doctor.

But what about poor Nicholas? He's perfectly content to continue the game. Why does he stop playing? There are two reasons. First, his reinforcement is dying away. He isn't getting the same reactions to his doctor act to which he is accustomed. He might get frustrated by this and try harder for the same reaction. Eventually, extinction would take place – there is no reinforcement for his behavior, so he stops that particular behavior. This rarely happens, though. Usually someone comes up with a new game to distract Nicholas. It could be reading a book, playing with toys or watching a movie. Whatever the new potential behavior is, it must offer a greater reinforcement than he is currently getting. As he's already lost the interest of the adults

in the room and is therefore losing the strength of his reinforcement, finding an activity with stronger reinforcement isn't too difficult a task.

The works of Skinner and Piaget are based on very different philosophies and obtain remarkably different results when put into practice. Yet this does not require that they be utilized exclusively of each other. The teacher who considers his/her work from the perspectives of both Skinner and Piaget will not confuse the issue, but rather discover an increased understanding of learning, motivation and behavior. For this reason, educators continue to cite cognitive development and radical behaviorism as the two most significant and useful psychological theories.

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