

## Book Review

### The Power and Limitations of Reinforcement

A review of *The Power of Reinforcement* by Stephen Ray Flora. State University of New York Press, 2004.

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Humans and rats share many genes. Indeed, most of the genes known to be associated with human diseases also exist in the rat genome (Rat Genomic Sequencing Project Consortium, 2004), a consequence of our common ancestry. Yet even in the face of these similarities there are many who still bristle at any suggestion that the rat might provide insight into human psychology. This is especially true in education where, despite over a century of research on animal learning, lessons drawn from animal models are routinely dismissed as “rat psychology” (e.g., Maydosz, 1997). While one would never confuse a rat with a person, the fact that these two species share a common mammalian heritage suggests the possibility of homologies in learning processes (Moore, 2004), homologies that explain the continuing usefulness of the rat in the study of human learning and behavior. For example, both humans and rats undergo a period of impulsivity and decreased reward sensitivity during adolescence (Vaidya, Grippo, Johnson, and Watson, 2004).

For educators the most relevant homology in learning is operant conditioning, the simple idea that reinforcing a behavior increases the probability of that behavior recurring. Operant conditioning, also known as Skinnerian reinforcement, is observed across many species but has been most extensively studied in rats, pigeons, and humans. In education these operant techniques include token economies, contingency contracting, behavior modification, and various forms of programmed instruction. How effective are these operant techniques compared to other teaching methods? In 1984, Herbert Walberg attempted to answer this question through a comprehensive review of the research literature. His conclusion was unambiguous: “Skinnerian reinforcement or reward for correct performance has the largest overall average effect 1.17 deviations” (p. 23). A review of Walberg’s results by Bloom (1984) found that only one-to-one tutoring had a greater effect on student achievement than reinforcement.

It is easy to understand why individual tutoring has not been widely adopted: society simply cannot afford to provide every student with a competent individual

tutor. But why have methods based on reinforcement fallen out of favor? In 1989, Skinner complained that his ideas on teaching were being ignored and, in 1990, Axelrod, Moyer, and Berry reported that it was difficult for behaviorists to publish in the journals of the American Educational Research Association.

Two lines of argument have been advanced against the use of reinforcement in education; first, the idea that instructional techniques drawn from animal models are inherently inappropriate and, second, the belief that the use of rewards and incentives are counterproductive and harmful to students.

Stephen Ray Flora's (2004) new book, *The Power of Reinforcement*, is an important and effective rebuttal to those who have argued against the use of reinforcement. On the first issue, the relevance of rat psychology to human learning, Flora gives convincing examples of the educational application of techniques first developed with animal models. Pediatricians and child psychologists now routinely recommend the use of timeout instead of spanking to modify children's behavior. Flora notes that the term timeout is derived from the phrase "timeout from positive reinforcement" (p. 9) and that the technique was first developed in experiments with rats and pigeons. The notion that studies of animal behavior have nothing to contribute to our understanding of human psychology is akin to asserting human origin by special creation. What ever the differences between species, common ancestry implies the existence of some psychological similarities.

On the second point, instructional and therapeutic interventions based on operant conditioning have long been criticized as oppressive and inhumane (e.g., Packard, 1977, Koestler, 1967). In education this characterization of operant approaches became conventional wisdom with the publication of Alfie Kohn's *Punished by rewards: The trouble with gold stars, incentive plans, A's, praise, and other bribes* in 1993. Kohn's position is extreme, arguing against the use of all forms of rewards, including verbal praise. Kohn's position is indistinguishable from the one taken by free school advocate A. S. Neil in 1960:

the danger in rewarding a child is not as extreme as that of punishing him, but the undermining of the child's morale through the giving of rewards is more subtle. Rewards are superfluous and negative. To offer a prize for doing a deed is tantamount to declaring that the deed is not worth doing for its own sake (p. 162).

But while Neil relied solely on anecdotes, Kohn claims to have "irrefutable evidence that people who are trying to earn a reward end up doing a poorer job on many tasks than people who are not" (p. 49).

Flora (2004), however, labels the notion that reinforcement is harmful a myth:

If "extrinsic reinforcers" really did "undermine intrinsic interest," then no veterinarians would have pets; all former professional athletes (especially those with incentive contracts) would never play or want to

be involved with their former sport; no carpenters electricians, or painters would ever volunteer for “Habitat for Humanity,” an organization that builds houses for the working poor; teachers would not want to teach; doctors would not want to practice medicine, in short, NO professional would enjoy his or her profession (p. xvi).

But the question of the effects of reinforcement cannot be settled by an appeal to common sense, an examination of the evidence is necessary. Kohn disparages programs that reward students for desirable behaviors, but do these programs have the negative consequences that he claims? A case in point is the Pizza Hut “Book It!” program that rewards children with pizza for reading. Kohn (1993) quotes educational psychologist John Nicholls’ prediction that the program would produce “a lot of fat kids who don’t like to read” (p. 73). But Flora has the data; he reports on a follow up study he conducted that compared students who participated in the “Book It!” program with those who did not. The findings were clear:

Answers to direct questions about “Book It!” and parental pay for reading suggest that when a child is extrinsically reinforced for reading, the child will increase the amount read, enjoyment of reading may increase, and if they do not yet know how to read fluently, the programs may help the child learn to read . . . Extrinsic rewards for reading set the conditions where intrinsic motivation for reading may develop. Any concerns that reinforcement programs for reading will decrease later reading behaviors are unfounded (Flora and Flora, 1999, p. 3) (Flora, 2004, p. 63).

With clarity and careful reference to the research literature, Flora lays out the case for the effectiveness of operant approaches in a variety of educational and therapeutic contexts. However, despite his impressive critique of Kohn, the book has certain limitations that must be acknowledged.

There is an old maxim that if you only have a hammer all problems look like nails and, unfortunately, Flora does not recognize the limitations of his behaviorist approach. Since the 1960’s it has been well recognized that the behavioral capacities of animals have evolved to meet specific adaptive challenges that cannot be adequately described by the kinds of general laws of learning that are central to behaviorist psychology (Staddon, 2001). In a widely read 1961 paper, Keller and Marian Breland reported a number of cases where they had experienced unexpected difficulties in conditioning animals. For example, using reinforcement techniques they tried to train a raccoon to pick up coins and deposit them into a box. The raccoon, however, engaged in a coin rubbing behavior that prevented him from completing the task. The Brelands observed that “the rubbing behavior became worse and worse as time went on, in spite of nonreinforcement” (p. 682). After reporting on a number of such “misbehaviors” in a variety of animal species they concluded:

Here we have animals, after having been conditioned to specific learned response, gradually drifting into behaviors that are entirely different from those which were conditioned. Moreover, it can easily be seen that these particular behaviors to which the animals drift are clear-cut examples of instinctive behaviors having to do with the natural food getting behaviors of the particular species (p. 683).

It seems obvious that these animals are trapped by strong instinctive behaviors, and clearly we have here a demonstration of the prepotency of such behavior patterns over those which have been conditioned (p. 684).

Can we find similar prepotencies in humans? The example of phobias comes immediately to mind. While humans can be conditioned to fear a wide array of objects and situations, we seem to be predisposed to certain types of phobias, such as fear of snakes (Öhman and Mineka, 2003). Mineka and Öhman (2002) have proposed the existence of a fear module, rooted in specific brain structures and shaped by evolution that predisposes us to acquire phobias to stimuli that threatened our mammalian ancestors. Models of this type do what behaviorism cannot; they link learning, neurophysiology, and evolution. They allow us to understand why behavioral and medical interventions must be reconciled and not counter posed. Behaviorism is not so much wrong as it is incomplete, notions of conditioning need to be embedded into an evolutionary perspective.

The consequences of the failure to move outside of the behaviorist framework and accept important ideas from cognitive, differential and evolutionary psychology, as well as the neurosciences, can be seen in Flora's discussion of attention deficit hyperactivity disorder (ADHD). Flora sees ADHD in purely behavioral terms and argues that

the most valid approach is to conduct an analysis of the individual's behavior-environment interactions and then to implement an intervention based on that analysis and on the systematic application of general principles of behavior including reinforcement of appropriate operant responses (p. 11).

While there is much to be said for behavioral approaches to the treatment of ADHD, his failure to come to terms with the growing understanding of the underlying biology of ADHD (Reiff and Tippins, 2004, Shastry, 2004) leads Flora to reject the use medication. He argues that "behavioral approaches are just as effective, or more effective than drug therapy, for hyperactivity and attention deficit disorder" (p. 169). Flora cites only two sources for his claim, a research article from 1975 (Ayllon, Layman, and Kandel) and a popular book, *The Hyperactivity Hoax* (Walker, 1998). *The Hyperactivity Hoax* takes the extreme position that "*hyperactivity is not a*

*disease. It's a hoax perpetrated by doctors who have no idea what's really wrong with these children*" (p. 5, emphasis in original) The 1975 study reported on the behavior of 3 students on medication (the stimulant medication methylphenidate, commonly known by the brand name Ritalin), off medication, and with no medication but reinforcement for math and, later, reading. The researchers found that the contingency management approach "controlled the children's hyperactivity at level comparable to that when they were on drugs" (p. 137) and improved their math and reading performance. The study did not test the joint effectiveness of medication and contingency management.

These results seem like a thin reed on which to hang an argument about ADHD, particularly in light of many decades of research. The Multimodal Treatment Study of Children with ADHD (MTA Cooperative Group, 1999) was a large study (n = 576), of the relative effectiveness of four treatments 1) medication, 2) behavioral treatment, 3) combined medication and behavioral treatment and 4) community treatment. For core ADHD symptoms the study found that medication was superior to all other treatments. For other symptoms such as academic performance, social skills, and parent-child relations the combined medication and behavioral treatment was superior. This is consistent with other research findings (see Reiff and Tippins, 2004, Hightman and Greenfield, 2003).

There is a growing body of evidence that ADHD is a real condition with an underlying biological basis and a strong genetic contribution (see Swanson et al., 1998 and Shastry, 2003, for reviews). Here is a case where the relevant animal models argue against simplistic behaviorist approaches. The behaviorist view of an animal model is that it is behavior that is being studied and that the individual characteristics arise only from different patterns of reinforcement. In this view, it is possible to hold the individual organism constant and study behavior itself. Garcia and his colleagues (Garcia, Lasiter, Bermudez-Rattoni, and Deems, 1985) characterized this approach, which ignores both individual differences and evolved species specific learning, as "bodiless learning theories" (p. 10). It has long been known that there are individual genetic differences in the behavior of laboratory animals. Tryon (1940) demonstrated that rats could be selectively bred for maze running ability. In recent years, researchers have bred rat strains, such as the spontaneously hypertensive rat, that have behaviors characteristic of ADHD including hyperactivity, impulsivity, and reduced sensitivity to delayed reinforcement. As in humans, administering stimulant medication to these rats reduces these behaviors (Davids, et al., 2002, Paule et al., 2000, Berger and Sagvolden, 1998).

ADHD appears to be related to problems with the brain's inhibitory control of limbic functions. Stimulant medications appear to increase the inhibitory activity of important brain structures and thus decrease the symptoms of ADHD (Faraone and Biederman, 1998). About 80% of individuals with ADHD benefit from this form of treatment (Swanson et al., 1998). While behavioral interventions are important and helpful, Flora is wrong to counterpose them to pharmaceutical treatments.

But one does not have to agree completely with Flora to recognize that society would benefit from a greater use of operant approaches in education, therapy, and social policy. If Flora succeeds in rekindling interest in the practical effectiveness of reinforcement, he will have made an important contribution and his book should be widely read. Ultimately, however, to reach its full potential operant psychology must be grounded in a larger evolutionary model that accounts for the findings of differential, cognitive, and behavioral psychologies.

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