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LEARNING IN THE LAB:

LIVE ANIMALS vs. COMPUTER SIMULATION

REMEMBERING JERRY ULMAN (1938-2021)

MODERN ANIMAL CARE: A SKINNERIAN PERSPECTIVE ON CHOICE AND CONTROL

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As academics and scientist practitioners, we have each enjoyed many years of teaching the fundamental principles of behavior to undergraduate and graduate students as well as to animal professionals such as trainers, zookeepers, and veterinarians. One of the great joys of this endeavor is sharing Skinner's philosophy of behavior as a physical science, and his widely applicable analyses of complex behavior. Within the past two decades, there has been a surge of interest in the science of behavior within the animal training community. This is a positive development for the discipline of behavior analysis, the field of animal training, and the animals who benefit from the humane application of these principles. Perhaps inevitably, with that surge of interest we have seen misinterpretations of the tenets of operant conditioning and of Skinner's philosophy. Recently we have been dismayed by explanatory articles connecting behavior science and animal training from a more limited, essentially Watsonian perspective. We respond in particular to an article by Farhoody in a previous issue of *Operants*, though others have made similar points. Here we offer a broader, radical behaviorist perspective on some key issues in animal training.

Behavior as a Physical Science

One misunderstanding of the tenets of operant conditioning is that the causes of behavior must exist outside the individual. Skinner's analyses of behavior were revolutionary not because he insisted upon external causes, but because he insisted that behavior is determined, follows natural laws, and is subject to the same analyses as any other physical science. A single behavior is often determined by multiple factors. If we know all of the correlates, we can predict precisely what an individual will do in any given context. If we are able to manipulate all of the correlates, we can control behavior with precision. Although we are unlikely to be able to know and manipulate every determining factor in many practical circumstances, we don't need this degree of precision to make meaningful changes to socially important behavior. As with other physical sciences, we understand that behavioral phenomena are determined by physical events, are lawful, and are knowable even if not yet fully known. While external environmental determinants play a critical role in behavior, individuals bring their own genetics and reinforcement histories to their interactions with the environment, making the precise prediction and control of behavior incredibly complex in practical circumstances, including those involving animals in human care.

On Terms: Choice and Control Defined

Animal care professionals often discuss environmental enrichment as a means of providing opportunities for choice and control to animals in human care. They also sometimes discuss choice and control as desirable features of animal training and an important characteristic of animal welfare. Some behavior analysts have criticized the use of these terms as colloquial and have opined that they are cognitive explanations of behavior. While that type of use can and probably does occur, the terms "choice" and "control" both have long-established definitions in the behavior-analytic literature. Regarding choice, there is an important distinction to be made between choice and choosing. Martin and colleagues defined choice as the presence of multiple, relatively salient discriminative stimuli (S^D), at least one of which is an S^D, and defined choosing as performing a discriminated operant when another is possible, following a choice. Few would argue that, as it relates to quality of life, choices and the opportunity to choose among them is irrelevant for non-human animals. Control refers to the ability to change one's environment. Operant behavior itself is a source of control, provided the consequences are sufficiently consistent. In the words of Ferster and Skinner, "People act on the world, and change it, and are changed in turned by the consequences of their actions." This is a dynamic system between actors and the environment.

Further, the idea that the use of non-technical language to describe behavior principles is inherently problematic has been a subject of much discussion among behavior analysts for decades, about which qualified experts can and do disagree. While there is a need for technical pre-

cision in scientific communication, evidence supports what many practitioners of behavior analysis report from experience: technical behavior-analytic jargon is off-putting to those who are not themselves behavior analysts. Again, in Skinners words, "There are two languages in every field of knowledge, and it would be foolish to insist that the technical version always be used. But it must be used in science, and especially in a science of behavior." Many behavior analysts, from Lindsley in 1991 to Neuman in 2018, have suggested that there is a need to translate technical behavior-analytic jargon for practical application. Neuman, applying a verbal behavior analysis to this issue, noted that we can avoid the potential problems associated with the use of colloquial language by using words that, while nontechnical, accurately describe the principles we are disseminating. Listener effects are more important than precise adherence to the vocabulary we would use in a laboratory report if we are to succeed in our dissemination goals.

The Importance of Control to the Individual

Behavior analysts widely view primary reinforcers as consequent events important to the survival of the individual. One such event would be the manipulation, or control, of one's own environment. The idea that control is a primary reinforcer may be provocative for some, but it is not a new idea in behavior analysis. In his 1953 book *Science and Human Behavior*, Skinner said, "We are automatically reinforced, apart from any particular deprivation, when we successfully control the physical world." Indeed, Skinner discussed control as a generalized reinforcer when he said, "That 'having one's own way' is reinforcing is shown by the behavior of those who control for the sake of control".

Elephant accepting human touch. Photo by: Steve Martin

In the ensuing years, Skinner's philosophical analyses have been borne out by experimental data in the laboratory. As early as the 1960s, the zoologist J. Lee Kavanau showed that deer mice would consistently press a lever to change features in their environment to the opposite state of that currently presented by the experimenter. If the mice encountered an unlocked wheel-running apparatus with the motor turned on, they would press a lever to lock it and turn the motor off. If the apparatus was locked at the outset, the mice would press a lever to unlock it and then run in the wheel. If the experimenter presented an environment with the lights off, the mice would press a lever to turn them on (and vice versa). Many subsequent studies have shown that control is a reinforcer of the behavior of both human and nonhuman animals. The developmental psychologist Carolyn Rovee-Collier showed this effect in infants as young as eight weeks.

Animals have also consistently demonstrated a preference for arrangements allowing greater control over their environments. For example, Catania and Sagvolden showed in the 1980s that pigeons would choose a situation in which they could select from an array of response devices over a situation with just one available response device (with all devices requiring pecking), even when the schedule of reinforcement for responding on the devices was the same in both situations. Further, decades of evidence support the effect known as contrafreeloading, in which animals consistently choose to work (perform an operant response) to obtain reinforcers even when they are freely available.

In addition to the ample evidence that animals prefer situations in which they have opportunities to control their environment, research also supports the idea that these opportunities have positive effects on animals' quality of life. Negative outcomes measured in animal welfare research include indicators of declining physical health, high frequency stereotypic behavior, and cortisol concentrations. When opportunities to engage with the environment to obtain reinforcers are restricted, animals are more likely to show these physical signs and behavioral responses. In contrast, enriched environments with ample opportunities for control, often arranged via choice scenarios, are correlated with better physical health and performance on learning tasks, more frequent and variable activity, and fewer stereotypic behaviors.

Choice and Control in Modern Animal Care

With the positive effects of more complex environmental arrangements well established, animal care professionals are turning their attention to questions about choice and control in the context of training. Much of the animal training conducted in zoos and aquariums, for instance, is for the purpose of providing routine care such as tooth brushing, hoof trimming, and medical examinations without the need for restraints or general anesthesia. It is becoming more common to give animals participating in these discrete trial training sessions the opportunity

to choose between multiple behaviors, including the behavior targeted by the trainer but also including walking away from the trainer. Of course, this theme of providing opportunities for choosing is relevant to companion animals as well. In a context where multiple behaviors are possible, including aggressive and stereotypic behavior, any instance of behavior can be said to be chosen (i.e., a discriminated operant when another is possible). This account furthers trainers' ethical responsibility to provide ample opportunities for animals to engage meaningfully in complex environments, i.e., to emit diverse behaviors that result in a variety of reinforcers.

When a behavior produces reliable changes in the environment, engaging in that behavior can be defined as control. When animal professionals account for choice and control in training, this can simply mean providing an environment rich with reinforcing behavioral opportunities. If, in that context, an animal chooses to engage in a behavior other than the one requested by a trainer, the trainer bears the responsibility for changing the environment such that the requested behavior is sufficiently reinforcing to be chosen over other opportunities, consistent with our philosophy that "the rat is never wrong." This contrasts with training environments in which the only way to access a valuable reinforcer is to comply with a trainer's request, a practice that might be considered coercive. Goldiamond made this distinction between choice and genuine choice.

Modern trainers are exploring the possibility that providing more explicit opportunities for choice during training sessions might result in better outcomes. This is consistent with Catania and Sagvolden's findings, as well as recent work with children by Hanley, Rajaraman, and others showing that the provision of opportunities to choose different ways to access reinforcers during teaching sessions resulted in greater participation in learning activities and fewer serious problem behaviors. This arrangement, known as an enhanced choice model, includes the opportunity to freely access the reinforcers offered for participating in learning activities, as well as the opportunity to leave the teaching environment. This is a promising area of research with quality of life implications for both humans and animals.

Ethical Considerations

Closely related to issues of animal welfare are discussions about the ethics of applying behavior change procedures. Various animal training professional organizations and certifying bodies have adopted ethical guidelines specifying that professionals implement the least intrusive effective behavior change procedure for each individual and situation. Behavior change procedures are placed in a hierarchy of intrusiveness, with positive punishment being the most intrusive procedure and positive reinforcement being the least intrusive.

The organizations adopting these ethical guidelines have been occasionally criticized for oversimplifying behavior science, and for requiring members and certificants to commit to following the principle of least intrusiveness in their animal training practice. For instance, some authors have noted that positive and negative reinforcement and positive and negative punishment, as naturally occurring phenomena, are neither inherently good nor bad. While the forces themselves are facts of nature, these forces also have consistent effects that may be of differing value to us, as strongly argued by Sidman. Understanding these effects can help us determine which procedures are best suited to our goals, which include humane treatment and high quality of life for all individuals. Skinner acknowledged this repeatedly in *Science and Human Behavior*:

> "In the long run, punishment, unlike reinforcement, works to the disadvantage of both the punished organism and the punishing agency."
>
> "As a consistent picture of the extremely complex consequences of punishment emerges from analytical research, we may gain the confidence and skill needed to design alternative procedures in the clinic, in education, in industry, in politics, and in other practical fields."

Indeed, behavior analysts have long recognized the need to develop alternative procedures in this vein. In 2010, the Association for Behavior Analysis International adopted a position statement on the use of restraint and seclusion, including the policy that treatment selection should be guided by the principle of least restrictiveness. This principle is aligned with the least intrusive principle in prioritizing the most favorable risk to benefit ratio when selecting procedures. Similarly, the Behavior Analyst Certification Board (BACB) states in its *Ethical Code for Behavior Analysts* that one of the core foundational principles for behavior analysts is that we work to maximize benefits and do no harm. The code includes three separate guidelines focusing on maximizing benefit and minimizing risk when selecting and implementing assessments and interventions. Most notably,

> *"Behavior analysts select, design, and implement behavior-change interventions (including the selection and use of consequences) with a focus on minimizing risk of harm to the client and stakeholders. They recommend and implement restrictive or punishment-based procedures only after demonstrating that desired results have not been obtained using less intrusive means, or when it is determined by an existing intervention team that the risk of harm to the client outweighs the risk associated with the behavior-change intervention. When recommending and implementing restrictive or punishment-based procedures, behavior analysts comply with any required review processes (e.g., a human rights review committee). Behavior analysts must continually evaluate and document the effectiveness of restrictive or punishment-based procedures and modify or*

discontinue the behavior-change intervention in a timely manner if it is ineffective."

Beyond behavior analysis and animal training, the principle of least intrusiveness/least restrictiveness has been adopted by other professional organizations in education, medicine, law enforcement, and more. Scientific and professional organizations have ethical standards because the consequences of our actions are very real and important in the lives of the individuals we influence and serve. If effectiveness is our only criterion, opportunities for abuse abound. In their article on the history of credentialing in applied behavior analysis, Johnston and colleagues note that abusive practices implemented by under-qualified clinicians were the impetus for the instatement of the certifying body that became the BACB. It has been suggested that those entering helping professions typically have little contact with EAB literature and limited opportunities to build skills in the experimental analysis of behavior. If we accept this premise, why then, should we not provide guidelines for ethical decision making, just as many professional organizations have done in behavior analysis and beyond? Of course we should have a philosophy about how we train animals, just as we have a philosophy about how we educate children.

A sign for visitors. Photo by: Wouter Stellaard

In *Beyond Freedom and Dignity,* Skinner rejected the idea that scientists should remain neutral regarding the application of scientific principles and technologies (emphases ours):

> *"Physics may tell us how to build a nuclear bomb but not whether it should be built. Biology may tell us how to control birth and postpone death but not whether we ought to do so. Decisions about the uses of science seem to demand a kind of wisdom which, for some curious reason, scientists are denied. If they are to make value judgments at all, it is only with the wisdom they share with people in general.* ***It would be a mistake for the behavioral scientist to agree.*** *How people feel about facts, or what it means to feel anything, is a question for which a science of behavior should have an answer. A fact is no doubt different from what a person feels about it, but the latter is a fact also. What causes trouble, here as elsewhere, is the appeal to what people feel. A more useful form of the question is this:* ***If a scientific analysis can tell us how to change behavior, can it tell us what changes to make? This is a question about the behavior of those who do in fact propose and make changes.*** *People act to improve the world and to progress toward a better way of life for good reasons, and among the reasons are certain consequences of their behavior, and among these consequences are the things people value and call good."*

Tactics of Dissemination

With climate change, pandemics, racism, and other urgent problems threatening our very existence, we must embrace the perspective that individuals are operators, not merely hapless victims of circumstance. This is essentially what we do when we create contingencies, when we acknowledge learning history and the co-influences of genes, brains and bodies. We can do this without fear of uprooting our most deeply held philosophy that behavior is a physical science. We should also carefully consider our dissemination goals for the many user groups to whom we offer problem solutions. The elephant in the room, as it were, relates to the widespread relevance of our science to the many professionals whose main expertise is with a different level of analysis. What level of behavior analysis expertise should be required of an animal trainer, zookeeper, or veterinarian? The answer to this question will be different for each group, individual and situation. However, it does raise the question, does everyone need to be a behavior analyst to benefit from the behavioral level of analysis? Under what circumstances is calling in a consulting behavior analyst the best course of action? In our work, we address these questions daily as we navigate the balance between our dissemination goals and animal welfare. Behavior analysis is not a monolith. It is a discipline with richly diverse interpretations about how behavior works. We acknowledge that there will always be differing opinions about defining and disseminating behavior analysis in the animal care world. As Goldiamond said, "There is no single way of looking at behavior, nor one approach into which all behavior must parsimoniously fit. There are useful and useless functional relations that can be established by a variety of procedures." We celebrate the work of animal professionals applying the philosophy and science of behavior analysis to improve the lives of animals.

ABOUT THE AUTHORS:

Dr. Christy Alligood is a sought-after teacher, speaker, and thought leader whose experience spans the science and practice of behavior analysis. Dr. Alligood received an MA (2003) from the University of North Carolina at Wilmington and a Ph.D. (2007) from West Virginia University. She is also a doctoral-level Board Certified Behavior Analyst (BCBA-D).

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For almost 15 years, Dr. Alligood has been a behavior scientist at Disney's Animals, Science, and Environment. In that capacity, she uses her expertise in the application of behavior analysis to enhance the welfare of nonhuman animals through cooperative training, environmental enrichment, behavioral problem solving, and behavior change strategies supporting the conservation of wildlife and wild places. She is the instructor of Behavior Works' How Research Works course for animal professionals.

Dr. Alligood has served in many leadership roles in the Association for Behavior Analysis International, including president of the Applied Animal Behavior Special Interest Group, Coordinator of the Special Interest Groups Board, and At-large Representative to the Executive Council. She is also a past president of the Southeastern Association for Behavior Analysis. She is an instructor for the Association of Zoos and Aquariums Environmental Enrichment in Zoo & Aquariums course and general member of the AZA Behavior Advisory Group serving on the Culture Change working group. She frequently serves as a reviewer for a wide range of peer-reviewed journals, and sits on the editorial boards of Zoo Biology *and the* Journal of the Experimental Analysis of Behavior.

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