ANIMAL RESEARCH IN THE JOURNAL OF APPLIED BEHAVIOR ANALYSIS

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This review summarizes the 6 studies with nonhuman animal subjects that have appeared in the *Journal of Applied Behavior Analysis* and offers suggestions for future research in this area. Two of the reviewed articles described translational research in which pigeons were used to illustrate and examine behavioral phenomena of applied significance (say–do correspondence and fluency), 3 described interventions that changed animals' behavior (self-injury by a baboon, feces throwing and spitting by a chimpanzee, and unsafe trailer entry by horses) in ways that benefited the animals and the people in charge of them, and 1 described the use of trained rats that performed a service to humans (land-mine detection). We suggest that each of these general research areas merits further attention and that the *Journal of Applied Behavior Analysis* is an appropriate outlet for some of these publications.

Key words: translational research, applied behavior analysis, animal subjects

B. F. Skinner and his colleagues used rats, and later pigeons, in most of their pioneering behavior-analytic research (e.g., Skinner, 1953). Nonhuman subjects (hereafter, animals) continue to be used to good avail in behavioral research, as is evident in articles published in the *Journal of Experimental Analysis of Behavior* (*JEAB*) and other basic-research outlets. Interestingly, in the past decade, six studies with animal subjects have appeared in the *Journal of Applied Behavior Analysis* (*JABA*). This mini-review summarizes these studies and discusses the potential applied significance of animal research.

Translational Studies Examining Behavioral Phenomena of Applied Significance

Lattal and Doepke (2001) were the first to publish an animal study in *JABA*. In an attempt to develop a procedure relevant to say–do correspondence in humans, they exposed pigeons to a two-component discrete-trials procedure. In the first (''say'') component, two response keys were lighted in different colors. A peck to either key darkened both keys and, after a blackout, lighted the two keys again, one in the same color of the key just pecked and the other in a different color. Food was delivered in the second (''do'') component if a response occurred on the key lighted in the same color as the key initially pecked, whereas a response on the other key produced a blackout. The procedure was repeated following an intertrial interval. Under these conditions, neither of two pigeons responded substantially more on the second-component key that matched the color of the key pecked in the first component than on the other key. Every one of five birds did, however, respond substantially more on the same-color key when a correction procedure was implemented in which the originally selected sample stimulus was re-presented until a correct response occurred.

Lattal and Doepke (2001) discussed how their experimental arrangement resembled procedures used to establish say–do correspondence in young children and contended that establishment of such correspondence depends on the establishment of strong and appropriate conditional discriminations. In their view, absence of say–do correspondence involves inappropriate training rather than lying, forgetting, or confusion. In this study, pigeons were used to demonstrate behavioral principles

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clearly relevant to, and arguably responsible for, a class of responding of tremendous applied significance that is often construed in mentalistic terms.

A pigeon study by Porritt, Van Wagner, and Poling (2009) took a similar general tack. The applied phenomenon that interested them was fluency, which is evident in responding that is simultaneously fast and accurate. The importance of response speed per se in determining the persistence of accurate responding is unclear from human studies; hence, they examined whether reducing response rate affected the retention of conditional discriminations under repeated-acquisitions procedures that required the birds to learn spatially defined sequences of three responses, such as peck the center key first, the left key second, and the right key last. Food was delivered following the last response in this sequence, and incorrect responses (e.g., a right-key peck in the second component) did not advance the sequence (response chain). Response rates were manipulated by imposing delays within or between response chains. Conditions were arranged such that reinforcement rate and trials per session (variables that are almost always confounded with response rate in human studies) were held constant. The condition that engendered fastest responding engendered the greatest accuracy during training and retention tests, which is consistent with applied findings under conditions in which potential extraneous variables were not so tightly controlled.

Research to Improve Animals' Behavior

As explained in an article by Ferguson and Rosales-Ruiz (2001), animals, in their case horses being loaded into trailers, can be harmed by their own inappropriate responses. These or other responses can also harm the humans who work with animals. To prevent this, Ferguson and Rosales-Ruiz taught five quarter horse mares to load safely and quickly into a trailer on command. Training involved shaping (using food and clicks paired with food as reinforcers) the response of touching the nose to a cloth target. Once this occurred reliably outside the trailer, the horses were taught to touch the target as it was moved progressively deeper into the trailer, until full entry reliably followed each command. The response generalized to other trailers, and inappropriate (including dangerous) responses fell to zero levels. Although aversive stimulation historically has been favored in training horses, these results provide clear evidence that relatively simple positive reinforcement procedures can be of enormous benefit to horses and the people who work with them.

Reinforcement manipulations were also used to good effect in a study by Dorey, Rosales-Ruiz, Smith, and Lovelace (2009), who successfully treated self-injurious behavior (SIB) in a zoo-housed olive baboon. Dorey et al. began with a functional analysis of SIB, which consisted of hair pulling, hand biting, and foot biting. This analysis revealed that SIB was maintained by positive reinforcement in the form of attention from humans. Based on this analysis, an effective treatment involving differential reinforcement of alternative behavior (specifically, lip smacking) and extinction of SIB was developed. This study directly benefited the baboon and indirectly benefited the zoo staff who cared for her, because they had both humanitarian and financial investments in her well-being. Moreover, it provided the first demonstration that functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), which is widely and effectively used in mainstream applied behavior analysis with human participants, can be a valuable tool for improving the behavior of animals.

Functional analysis also was used in a very recent study (Martin, Bloomsmith, Kelley, Marr, & Maple, 2011) to identify the reinforcer that maintained feces throwing and spitting by a captive adult chimpanzee. Differential reinforcement of alternative behavior coupled with extinction of the undesired behaviors was

effective in reducing the responses to acceptable levels. These findings further demonstrate the value of functional assessment in understanding and providing effective treatment for problem behavior in animals.

Research with Animals to Benefit Humans Directly

Land mines currently threaten people in more than 70 countries, and nearly half a million people live with injuries inflicted by mines. Poling et al. (2011) reported that giant African pouched rats, which can be trained using operant-conditioning procedures, are accurate mine-detection animals. The rats, which are being used to find mines in Gaza Province, Mozambique, searched 93,400 m^2 of land, finding 41 mines and 54 other explosive devices. Humans with metal detectors found no additional mines in this area. On average, the rats emitted 0.33 false alarm for every 100 m^2 searched, which is below the threshold given for accrediting mine-detection animals. These findings indicate that pouched rats merit continued and extended use as mine-detection animals.

Discussion

No article with animal subjects appeared in *JABA* from its founding in 1968 until 2001, and only six have appeared since then. We do not know whether the scarcity of such articles reflects a lack of high-quality submissions or a reluctance of *JABA* editors to publish animal research. Be that as it may, *JABA* is ''primarily for the original publication of reports of experimental research involving applications of the experimental analysis of behavior to problems of social importance'' (inside front cover of every issue), and these six articles seem to fall squarely in this domain. They are instructive in illustrating three different ways in which animal research is directly relevant to applied behavior analysis and hence appropriate for publication in *JABA*.

In one, evident in the studies by Ferguson and Rosales-Ruiz (2001), Dorey et al. (2009), and Martin et al. (2011), poorly behaving animals create socially significant problems for themselves or for humans, and behavior analysts intervene to solve those problems. Such problems are far from rare. For example, according to the Centers for Disease Control and Prevention (2010), dogs bite 4.5 million Americans each year; one of five bites requires medical attention. As discussed by Mathews and Lattal (1994), behavior-analytic learning principles provide a useful conceptual foundation for understanding dog bites and for developing effective strategies for preventing or eliminating them. Systematic evaluations of such interventions through the use of within-subject designs and small numbers of subjects, which are characteristic of applied behavior analysis, appear to be an important and feasible research activity, but no such work has appeared in *JABA* or other behavior-analytic journals. We heartily encourage our fellow behavior analysts to do it, and to investigate other areas in which changing animals' behavior is of practical value.

A second way in which animal research is relevant to applied behavior analysis entails the use of animals as part of an intervention intended to address a socially-significant problem, as with the mine-detection rats studied by Poling et al. (2011). Although such applications are not abundant, more than a few exist. For example, initial research suggests that rats can accurately detect the presence of tuberculosis (TB) in human sputum samples. Their use in addition to microscopy increased the TB detection rate by 44% in a study involving over 10,000 people (Poling et al., 2010). Future TB detection research by these researchers is likely to be submitted to *JABA*. The journal also appears to be an appropriate outlet for studies that involve, for example, the use of assistance dogs to help people with cerebral palsy and other disabilities. Moreover, good applied research can easily be envisioned on strategies for training dogs (or other animals) to perform other useful services, such as hunting, police work, and detection of illicit drugs or toxic

compounds. Developing and evaluating programs to teach pet owners how to train their animals to be good companions is another obvious, and related, research area. Many behavior analysts have the skills necessary to work productively in some or all of these areas, and we encourage them to consider doing so.

Finally, studies with animals that clarify behavioral processes that are clearly relevant to human response patterns of applied significance, like say–do correspondence (Lattal & Doepke, 2001) and fluent responding (Porritt et al., 2009), are of direct relevance to applied behavior analysis. Many prominent behavior analysts have pointed out the value of such research, noted that it is surprisingly rare, and encouraged their colleagues to do it (e.g., Lattal & Doepke, 2001; Mace & Critchfield, 2010). We agree on all counts and refer readers to Mace and Critchfield for a careful consideration of the past, present, and ideal future of translational research in behavior analysis.

Poling (2010) argued that applied researchers must tackle a broader range of problems, and basic researchers must focus on research questions of obvious practical significance if the discipline of behavior analysis is to survive and prosper. Four of the six studies reviewed here are both applied, in that they directly addressed socially significant problems, and innovative, in that they focused on applications not previously described in *JABA*, *JEAB*, or other behavior-analytic journals. These studies are noteworthy for that reason, not because they used animal subjects. The other two studies exemplify the use of basic-research procedures, often termed *animal models,* to clarify important aspects of human behavior. This orientation, not the kind of subjects used or the journal in which they appeared, is what merits attention. Animal research in *JABA* is rare, but it is not bizarre, and high-quality studies of this type have real potential for extending both the breadth and the depth of applied behavior analysis.

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