JABAAT issue 1 (2) 3-21
DOI: 10.62981/OPWO6505

The Use of Behavioral Tactics to Train Humans Working with Animals: A Systematic Review

Lana Perich & Rebecca A. Sharp* (contact r.sharp@auckland.ac.nz)
The University of Auckland, Auckland, New Zealand

Author Note

Rebecca A. Sharp: https://orcid.org/0000-0001-6732-6708

Abstract

Behavior-analytic approaches such as training tactics and detailed, objective measurement of functional relations can offer value to the applied animal space. We conducted a systematic review of the literature in which humans working with animals (e.g., trainers, owners) were trained in a skill. We sought articles in which the behavior of the humans and / or the animals was measured using direct observation, and identified a total of 23 studies, most of which involved humans working with dogs. Training methods were predominantly behavioral skills training (BST) or components of BST, and approximately a third measured both human and animal behavior. We discuss our findings in relation to how behavioral research could broaden the behavioral tactics used in training humans who work with animals, the human populations included in this research, and ensuring more comprehensive measurement to understand the functional relations between human and animal behavior in husbandry, care, and domestic settings.

Keywords: trainers, behavioral tactics, animals, husbandry, animal training

The Use of Behavioral Tactics to Train Humans Working with Animals: A Systematic Review

Prior to 2010, there was a paucity of research applying behavior-analytic tactics to improve the lives of animals. Edwards and Poling (2011) found that no studies with non-human subjects were published in the *Journal of Applied Behavior Analysis* between the Journal's inception in 1968 and 2001, and six studies with animal subjects were published between 2001 and 2011. However, animal-focused applied research has since become more common, with behavior-analytic tactics recognised as valuable tools for enhancing animal behavior and welfare in domestic (Novack et al., 2023; Udell & Wynne, 2008), shelter (Protopopova & Wynne, 2014, 2015; Winslow et al., 2018), and zoological settings (Alligood et al., 2017; Fernandez & Martin, 2021; Maple, 2007).

The focus of some behavior-analytic research with animals is on the use of behavioral tactics to teach behavior that allows for better care. Ferguson and Rosalez-Ruiz (2001) used positive reinforcement-based target training and shaping to train horses to load into a horse trailer. All five horses reliably entered the trailer following training, and problem behaviors such as head tossing, freezing, standing, turning, and rearing were eliminated. Furthermore, functional analyses have been conducted with companion dogs to develop effective function-based treatments for problem behavior. Dorey et al. (2012) used an experimental functional analysis to determine that attention and tangible reinforcement were maintaining jumping-up behavior in dogs. They then used a differential reinforcement procedure to successfully decrease jumping. Behavior change interventions for animals such as these can lead to improved outcomes. For example, after a functional analysis and subsequent differential reinforcement intervention for shelter cats who showed aggression when being petted, all of the cats were adopted (Fritz et al., 2022). Similarly, Dadone et al. (2016) used shaping to train giraffes to position their hooves correctly so that the zookeepers could safely conduct diagnostic radiographs and hoof trims. All the giraffes acquired the desired behavior within two years of training, leading to a substantial reduction in the number of giraffes with hoof overgrowth, and a reduction in severity for those still experiencing overgrowth.

In addition to using behavioral tactics to change animal behavior, a number of studies have focused on the behavior of humans in animal settings. For example, Vergason and Gravina (2020) successfully implemented a token economy to increase employee-guest interactions at a zoo. Zoo guests and confederates were recruited to provide zoo employees with tokens for appropriate eye contact and greetings, and these tokens could be exchanged for various prizes.

Evidently, behavior analysis can be successful for training animals to engage in desirable behaviors, as well as in teaching people working in animal settings to engage in desirable behavior. However, these behaviors are not mutually exclusive. Human behavior inevitably impacts animal behavior, and often in indirect or unanticipated ways. For example, Rooney and Cowan (2011) surveyed dog owners about the training methods they used with their dogs, and measured their observable behaviors (e.g., commands, affection, aversive touches, reprimands, play signals) during various activities with their dogs such as play and training. They also

measured dog behaviors such as contact with the experimenter or owner, attention seeking, obedience, play, task ability, and submissiveness. They found that greater reported usage of punishment-based training methods was associated with lower dog-experimenter interactivity, less interactivity during play, and poorer ability on the novel training activity. Meanwhile, greater reported use of positive training methods and greater observed patience, owner involvement in play, and reward provision were all associated with desirable dog behaviors such as task ability and obedience. While this study did not attempt to modify the owners' behaviors, its findings indicate that both prior and current human behavior can have a range of effects on animal behavior. Protopopova and Wynne (2014) observed interactions between shelter dogs and potential adopters, and found that ignoring potential adopters' play attempts reduced chances of adoption while lying in close proximity to potential adopters increased adoption chances. In a follow-up study, Protopopova et al. (2016) conducted a preference assessment to determine shelter dogs' preferred toys, assessed their ability to lay down on command, and created structured potential adopter-dog interactions. Their intervention increased the likelihood of adoption.

Just as the ultimate goal of behavior analysis is to improve people's functional skills, life satisfaction, self-esteem, and community engagement, the role of behavior analysis in the animal care field is to improve animals' quality of life. Promoting the use of behavior analysis within the applied animal field may therefore lead to better understandings of animal behavior and more effective, empirically-valid techniques to improve such behavior. Indeed, behavioral tactics are often used by animal trainers and animal behaviorists who are not trained in the underpinning behavioral principles. An electronic survey by Gray and Diller (2017) found significant overlap between the knowledge bases and techniques used by animal behaviorists and Board-Certified Behavior Analysts. For individuals with no formal behavioral training, however, use of effective behavioral tactics is less likely. Indeed, some lay animal-training techniques commonly promoted in public media have been found to be inconsistent with behavior analysis, and in some cases detrimental for animal welfare and behavior (Herron et al., 2009; Todd, 2018).

Other studies targeting human behavior and measuring animal behavior as a corollary measure include Howard and DiGennaro Reed (2014), who conducted a component analysis of behavioral skills training (BST) to train student shelter volunteers to carry out discrete trial obedience training (DTOT) to teach shelter dogs to "sit." They found that the participants' DTOT accuracy increased with the introduction of each BST component, reaching 88 to 97% accuracy in the feedback and corrective modelling phase. They recorded the level of dog compliance as a secondary measure and found that compliance increased alongside trainer accuracy. Hence, modifying human behavior can have concomitant effects on animal behavior.

There is a paucity of research examining effective means for teaching non- behaviorally trained caregivers and staff to implement behavioral tactics to change animal behavior. Pfaller-Sadovsky et al. (2019b) conducted a systematic review and meta-analysis of human-canine training, and identified a small number of studies and a general insufficient reporting of data. Therefore, the aim of our review was to identify and analyze research on supporting humans who work with or care for animals (including animals other than canines) in which direct measures of human and / or animal behavior were measured. We sought to gain insight into the empirically-supported methods for modifying human behavior to enhance animal behavior.

Method

Search Strategy

On the 9th of May 2023, four databases were searched for relevant articles. The search terms used are described in Table 1. The keywords in each column were combined in parentheses with "OR" between each word, and each column was combined with "AND" between each set of parentheses. Scopus, Web of Science Core Collection, EBSCOhost (Psychology and Behavioral Sciences Collection), and OVID (APA PsycInfo) were searched. Scopus produced 359 document results, Web of Science produced 388 results, EBSCOhost produced 36 results, and OVID produced 151 results, for a total of 934 articles. The articles were exported to an Excel Spreadsheet. Through Excel's automatic duplicate removal function and through manual screening of article titles, we removed 351 duplicates.

Eligibility Criteria

We manually screened the titles and abstracts of 583 against exclusion criteria. We excluded documents that were not in English. We also excluded articles that were not empirical studies assessing direct measures of behavior such as medical texts, non-behavioral scientific research, studies using only self-report and survey-based data, ethnographic studies, reviews, and book chapters. We excluded articles that were not focused on training particular animal behaviors and the training skills of human participants. In total, we included 23 articles after this phase of the search.

Study Selection

The 23 articles were then scanned and retained only if the full texts could be retrieved, and they described direct measures of animal behavior and/or human behavior. Three articles were excluded because the full texts could not be retrieved, and four articles were excluded because they either did not describe the training of human participants or did not include direct behavioral measures. After this phase of the search, we had a total of 13 articles.

We conducted citation pearl growing to find further relevant sources. A backwards search was completed by manually scanning the reference lists of the 13 included articles to find further relevant articles, from which 10 articles were included based on the relevance of the title and abstract. Two of these were excluded because the full texts could not be retrieved, and a single article was excluded because it did not include direct measures of behavior. As such, seven articles identified through backwards searching were included. A forwards search was subsequently completed by searching for each of the included articles in the four aforementioned databases and using the "cited in…" function on each database to identify articles that had references the included articles. The titles and abstracts were manually screened, and six articles were identified as having met the criteria. Upon full text screening, two articles were removed due to not involving animal training or not using direct behavior measures. Therefore, four articles were included from forwards searching. In total, we identified a total of 24 articles that

met the inclusion criteria. We have reported the results in accordance with PRISMA guidelines (Page et al., 2021).

Inter-rater agreement checks were conducted by the second author on 10% of the 583 studies in the search phase. Inter-rater agreement was 100%. The second author also independently extracted variables from eight (33%) of the final included studies. An agreement was recorded if both authors extracted the same information on that variable (e.g., measurement system, target behaviors). Across the 13 variables in the eight sampled studies, agreement was 97%.

Data Extraction

We extracted data on the year and outlet in which each study was published, as well as study design, target species, target behaviors (animal and human), training method / behavioral tactics used, measurement method (for both human and animal behavior), and whether generalization, maintenance, social validity, procedural integrity, and interobserver agreement data were reported.

Data Analysis

Of the 24 articles, 23 (96%) were peer-reviewed journal articles, and one article (4%) was a PhD dissertation from Western Michigan University (Durgin, 2013). Six articles (25%) were published in *Applied Animal Behavior Science*, and four (17%) were from *Animals*. *Behavior Analysis in Practice*, *Journal of Applied Behavior Analysis*, and the *Journal of Veterinary Behavior* each published two included articles (8% each). One included article was published in each of *Anthrozoös*, *Journal of Applied Animal Welfare Science*, *Journal of Extension*, *Journal of Organizational Behavior Management*, *Learning and Motivation*, *The Veterinary Record*, and *Zoo Biology* (4% each).

Measurement and Target Behaviors

Dogs were the animal of focus in 18 of the articles (75%), rats in two articles (8%), and horses, chimpanzees, cattle, and killer whales in one article each (4% each). Of the 24 included articles, 12 (50%) used group designs in which pre- and post-measures were taken or comparisons were made between groups. The 12 remaining articles (50%) used Small-N designs. Animal behavior was the primary measure for 14 articles (58%), and nine articles (38%) used a combination of human behavior and animal behavior measures. One of the nine articles involving both human and animal behavior measures involved three distinct experiments, where the first solely measured human behavior and the remaining studies measured only animal behavior. One article (4%) measured only human behavior, examining shelter volunteers' implementation of dog walking and enrichment protocols without measuring any dog behaviors (Howard & DiGennaro Reed, 2015).

Direct observation was the sole data collection measure for 15 of the articles (63%). Four articles (17%) used both direct observation measures and reports, of which one (4%, of total) also used physiological data. One article (4%) used direct observations as well as test data. Four

articles (17%) used video observation data of which three (13% of total) also used self-report measures. The dimension of the behavior of interest for humans was most commonly topography (e.g., percentage of intervention steps implemented correctly; 93%). One study recorded response timing as the dimension of interest (Lewon et al., 2019) and one study measured knowledge as well as skill (Howard & DiGennaro Reed, 2015). With regard to animal behavior, a large range of topographies of behavior were the target (including vocalizations, facing the handler, task performance, pacing, mouthing, and compliance with medical procedures).

Generality, Procedural Integrity, Social Validity, and Interobserver Agreement

Overall, five studies reported procedural integrity, nine reported social validity, and nine reported interobserver agreement (IOA). Six studies reported generalization data, of which three measured the generalization of animal behavior, two of both human and animal behavior, and one of human behavior only. With regard to the maintenance of behavior change, five studies measured maintenance of human and animal behavior, three measured animal behavior only, two measured human behavior only, and one asked participants to self- report maintenance (11 in total; 46%). These studies measured maintenance after 1 week, 3 weeks, or 1 month. One study measured maintenance at two time points (1 week and 1 month). Only two of the 24 studies (8%) reported all measures of generality, procedural integrity, interobserver agreement, and social validity. Of the twelve studies that used group design, only six included one of these additional measures, and none included more than one. The articles that used Small-N design were much more likely to include one or more of these additional measures.

Behavioral Tactics

Six studies employed an intervention that comprised a single component, and for five of these, the component was instructions or guidance (often unspecified). For the sixth, the single-component intervention was modelling (Marschark & Baenninger, 2002). Five studies employed behavioral skills training, three of which delivered the separate BST components sequentially to determine the additive effects of each component. The remaining 13 studies used component interventions with varying combinations of modelling, instruction, rehearsal, feedback, and troubleshooting that were not described as BST or did not include all of the elements of BST. Four studies used videos as a mode of delivery for instruction but none delivered the intervention solely via video. In 11 studies (46%), the intervention was delivered one-on-one and in 6 studies it was delivered in groups (25%). The intervention comprised both one-on-one and group components in two studies (8%) and the mode of delivery was unclear in the remaining five studies (21%).

A quantified analysis of effectiveness was precluded by the differences in target behavior, method, and measurement. However, of the 10 articles in which human behavior was measured, all reported a change in the target behavior in the desired direction in at least one of the participants. A number of studies reported desired behavior change but either a lack of mastery, or mastery attained only after additional training components (e.g., Howard & DiGennaro Reed, 2015). Of the 23 studies in which animal behavior was measured, all but one study reported a desirable change in behavior for at least one animal or one target behavior. However, Lewon et al. (2019) reported a decrease in rats correct detection of samples after training humans. All

studies that measured the generalization or maintenance of human and / or animal behavior reported at least partial generality, with the exception of Lewon et al.

Discussion

We aimed to identify studies in which humans who work with animals were trained. We focused on studies that directly measured the behavior of the humans, the animals, or both. We found 24 studies that used behavioral tactics to train humans, most of which used behavioral skills training (BST) or components of BST. Clearly, behavioral tactics can contribute to training of animal caretakers or trainers that has been reported to be generally lacking (i.e., skills are often acquired 'on the job'; Meier et al., 2023).

The crucial inclusion criterion we used was to identify studies in which direct measures of behavior were used. This is only one of the key dimensions of applied behavior analysis (i.e., Baer et al., 1968). However, this focus enabled us to avoid more subjective judgements of what was behavior-analytic or not. It is important for behavior analysts to publish outside behavior-analytic journals to broaden dissemination, however doing so may require the use of non-technical language or less technological descriptions of methods. As a result, it can be difficult to determine what is behavior-analytic and what is not. As such, we acknowledge that we captured some studies that are less behavior analytic than others with regard to meeting the other dimensions as described by Baer et al. However, this has led to a more generous summary of how much literature exists on this topic, and it could be argued that the tactics used in these studies (e.g., instruction; Butler et al., 2011) are behavior- analytic (or at least could be conceptualized as such, even if the researchers were not behavior analysts).

We found that despite behavioral tactics being used across a range of animal species and topographies of behavior, there has been less variability in the focus of measurement behavior (i.e., on dimensions of behavior other than topography). The majority of the studies measured whether the behavior of interest occurred or did not occur (i.e., a one-dimensional construct of procedural integrity). The exception was Lewon et al. (2019), who measured the percentage of rat behaviors that were reinforced by trainers correctly, early, and late, how many repeat evaluations (rats re-inspecting samples) the participants allowed, and how accurately the participants collected data on the rats' behaviors against the data recorded by independent observers. We add to suggestions that procedural integrity should be conceptualised as a multidimensional construct (see Saneti & Kratochwill, 2007 for a discussion), and that the focus on measuring the success of training should be broadened to other dimensions of behavior such as locus in time, duration, and quality.

We found that only nine studies measured both animal and human behavior. We suggest that there is value in measuring both; to understand the relations between them (the degree to which human behavior has functional control over animal behavior). For example, MacKellar et al. (2022) found that as trainers' accuracy in discrete trial teaching increased, killer whales' attending behavior concomitantly increased. They also found that the killer whales' attending remained high when trainer accuracy declined over time. By contrast, Lewon et al. (2019) observed a decrease in rat performance upon the trainers' increased procedural integrity, and very high procedural integrity did not translate to improved animal performance in Pfaller-

Sadovsky et al.'s (2019a) study. Substantial improvements in animal performance were found even with imperfect implementation of procedures in Echterling- Savage et al.'s (2015) study. Kodak et al. (2022) offered suggestions for future research evaluating procedural integrity in the context of humans practicing with animals, including in behavior reduction and skill acquisition programs. Our review further supports that there is a paucity of research and therefore, the extent to which human procedural integrity corresponds to animal outcomes requires further investigation. This requires careful measurement of animal behavior, human behavior, and researcher behavior.

Broadly, the studies we reviewed indicated that didactic training or instruction alone may be insufficient to train humans to mastery. For example, Durgin (2013) found that training supervisors to give feedback to rat trainers increased the accuracy of the trainers compared to baseline, but that performance improved further when trainers underwent their own training. Similarly, Howard and DiGennaro Reed (2015) compared shelter volunteers' implementation of dog walking and enrichment protocols. They used the shelter's standard training as the baseline, then implemented video-based training, followed by coaching. Shelter volunteers performed at slightly above 50% correct implementation during the training-as-usual condition. Accuracy increased to between 67% to 83% across participants in the video training phase, but it was only after coaching that implementation increased to meet the mastery criterion of 85% correct. They also found that video training increased the participants' knowledge to almost 100%, showing that increases in knowledge do not correlate to skill acquisition. Overall, they showed that training videos and written instructions may lead to near-perfect understanding of procedures, but rehearsal and consistent feedback may be needed to ensure equally accurate performance for shelter volunteers. Therefore, our review broadly shows that interactive components of training are likely required for meaningful behavior change in humans supporting animals (i.e., as opposed to just didactic training alone), although we also acknowledge that in some studies, there was a lack of reported detail describing the method. Because we found that almost all studies used BST or components of BST, we also suggest a broadening of the training tactics evaluated in research (for example, interventions based on changing the supporting environment, chaining, shaping etc.).

The human participants in the studies we analyzed were predominantly dog owners, with a small number of studies involving animal trainers / handlers / carers. Behavior-analytic training might also have something to offer in the training of veterinary staff. For example, Pritt and Duffee (2007) identified a number of task areas in which veterinary staff work, behaviors which could be easily operationalized to be the focus on training (e.g., sanitising equipment, supporting animals medically post-operatively, training other staff). They advocated for dedicated staff training to ensure high quality animal care. This is an area in which behavioral tactics could be used to good effect.

With a few exceptions, we found a lack of reported generalization and maintenance data for human behavior. This is concerning given that generality of behavior change is likely desirable (e.g., a dog foster carer needs to be able to effectively use their skills to train different dogs with different repertoires in their care, and to continue to use those skills effectively across time). Similarly, the generality of animal behavior is likely to be desirable (see Lattal & Fernandez, 2022 for a discussion of stimulus control in applied animal behavior contexts). Of the studies that did report generality data, some reported achieving desired stimulus generalization

(e.g., MacKeller et al., 2022; Pfaller-Sadovsky et al., 2019a) and others reported requiring additional training to achieve stimulus generalization. For example, dog shelter volunteers were only able to apply the training procedures to teach a new behavior after the training procedures were re-presented in a way that was specific to the new behavior (Howard & DiGennaro Reed, 2014). Therefore, we encourage researchers to measure stimulus generalization and maintenance of both human and animal behavior to determine the effectiveness of training, and the potential need for explicitly addressing generality in training (e.g., booster training, programming for generalization).

We found a small but informative body of literature that shows what behavior analysis could offer in the training of humans who work with animals. In particular, behavioral skills training is an effective method by which to give humans animal-related skills. However, our review identified gaps in the literature with regard to an understanding of the functional relation between animal behavior and the behavior of humans who care for them, in the variety of training tactics explored, and in the evaluation of the generality of the behavior change produced in the training.

Declarations

Funding: This study did not receive any funding.

Ethical approval: Owing to the nature of the manuscript (literature review) no ethical approval was required. No human participants were involved, nor was any primary data collected, precluding approval from an institutional ethics committee.

Data availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of interest: All authors declare that they have no conflicts of interest relating to this manuscript.

This manuscript has not been previously published and has not been and will not be submitted elsewhere during the review process.

References

*Included articles are marked with an asterisk

*Adams-Progar, A. L., Kristula, M., & Hain, M. V. (2019). Dairy cattle handling extension programs: Training workers and cattle. *Journal of Extension, 57*(4), Article 7. ********tigerprints.clemson.edu/joe/vol57/iss4/7

Alligood, C. A., Dorey, N. R., Mehrkam, L. R., & Leighty, K. A. (2017). Applying behavior-analytic methodology to the science and practice of environmental enrichment in zoos and aquariums. *Zoo Biology, 36*(3), 175-185. ********doi.org/10.1002/zoo.21368

*Blackwell, E., Casey, R. A., & Bradshaw, J. W. S. (2006). Controlled trial of behavioural therapy for separation-related disorders in dogs. *Veterinary Record, 158*(16), 551-554. ********doi.org/10.1136/vr.158.16.551

*Bloomsmith, M. A., Stone, A. M., & Laule, G. E. (1998). Positive reinforcement training to enhance the voluntary movement of group-housed chimpanzees within their enclosures. *Zoo Biology, 17*(4), 133-341. ********doi.org/10.1002/(SICI)1098-2361(1998)17:43.0.CO;2-A

*Butler, R., Sargisson, R. J., & Elliffe, D. (2011). The efficacy of systematic desensitization for treating the separation-related problem behaviour of domestic dogs. *Applied Animal Behaviour Science, 129*(2-4), 136-145. ********doi.org/10.1016/j.applanim.2010.11.001

*Clark, G. I., & Boyer, W. N. (1993). The effects of dog obedience training and behavioural counselling upon the human-canine relationship. *Applied Animal Behaviour Science, 37*(2), 147-159. ********doi.org/10.1016/0168-1591(93)90107-Z

Dadone, L. I., Schilz, A., Friedman, S. G., Bredahl, J., Foxworth, S., & Chastain, B. (2016). Training giraffe (Giraffa camelopardalis reticulata) for front foot radiographs and hoof care. *Zoo Biology, 35*(3), 228-236. ********doi.org/10.1002/zoo.21279

*Durgin, A. L. (2013). *Using behavior-analytic techniques to benefit an African nongovernmental organization: improving and expanding services* [Ph.D. dissertation, Western Michigan University]. ScholarWorks at WMU. ********scholarworks.wmich.edu/dissertations/137

*Echterling-Savage, K., DiGennaro Reed, F. D., Miller, L. K., & Savage, S. (2015). Effects of caregiver-implemented aggression reduction procedure on problem behavior of dogs. *Journal of Applied Animal Welfare Science, 18*(2), 181-197. ********doi.org/10.1080/10888705.2014.977383

Edwards, T. L., & Poling, A. (2011). Animal research in the Journal of Applied Behavior Analysis. *Journal of Applied Behavior Analysis, 44*(2), 409-412. ********doi-org.ezproxy.auckland.ac.nz/10.1901/jaba.2011.44-409

*Feng, L. C., Hodgens, N., H., Woodhead, J. K., Howell, T. J., & Bennett, P. C. (2018). Is clicker training (Clicker+food) better than food-only training for novice companion dogs and their owners? *Applied Animal Behaviour Science, 204*, 81-93. ********doi.org/10.1016/j.applanim.2018.04.015

Ferguson, D. L., & RosalesbRuiz, J. (2001). Loading the problem loader: The effects of target training and shaping on trailerbloading behavior of horses. *Journal of Applied Behavior Analysis, 34*(4), 409-423. ********doi.org/10.1901/jaba.2001.34-409

Fernandez, E. J., & Martin, A. L. (2021). Animal training, environmental enrichment, and animal welfare: A history of behavior analysis in zoos. *Journal of Zoological and Botanical Gardens, 2*(4), 531-543. ********doi.org/10.3390/jzbg2040038

*Feuerbacher, E. N., & Muir, K. L. (2020). Using owner return as a reinforcer to operantly treat separation-related problem behavior in dogs. *Animals, 10*(7), 1110. ********doi.org/10.3390/ani10071110

Fritz, J. N., Fletcher, V. L., Dyer, S. P., Carpenter, K. A., Skrbec, M. L., & Yankelevitz, R. L. (2022). Functional analysis and treatment of aggression exhibited by cats toward humans during petting. *Journal of Applied Behavior Analysis, 55*(1), 169-179. ********doi.org/10.1002/jaba.877

Gray, J. M., & Diller, J. W. (2017). Evaluating the work of applied animal behaviorists as applied behavior analysis. *Behavior Analysis: Research and Practice, 17*(1), 33-41. ********doi.org/10.1037/bar0000041

*Hall, N. J., Protopopova, A., & Wynne, C. D. L. (2014). The role of environmental and owner-provided consequences in canine stereotypy and compulsive behavior. *Journal of Verterinary Behavior, 10*(1), 24-35. ********doi.org/10.1016/j.jveb.2014.10.005

Herron, M. E., Shofer, F. S., & Reisner, I. R. (2009). Survey of the use and outcome of confrontational and non-confrontational training methods in client-owned dogs showing undesired behaviors. *Applied Animal Behavior Science, 117*(1), 47-54. ********doi.org/10.1016/j.applanim.2008.12.011

*Howard, V. J., & DiGennaro Reed, F. D. (2014). Training shelter volunteers to teach dog compliance. *Journal of Applied Behavior Analysis, 47*(2), 344-359. ********doi.org/10.1002/jaba.120

*Howard, V. J., & DiGennaro Reed, F. D. (2015). An evaluation of training procedures for animal shelter volunteers. *Journal of Organizational Behaviour Management, 35*(3- 4), 296-320. ********doi.org/10.1080/01608061.2015.1093052

Kodak, T., Bergmann, S., & Waite, M. (2022). Strengthening the procedural fidelity researchbtobpractice loop in animal behavior. *Journal of the Experimental Analysis of Behavior*, *118*(2), 215-236. ********doi- org.ezproxy.auckland.ac.nz/10.1002/jeab.780

Lattal, K. A., & Fernandez, E. J. (2022). Grounding applied animal behavior practices in the experimental analysis of behavior. *Journal of the Experimental Analysis of Behavior*, *118*(2), 186-207. ********doi- org.ezproxy.auckland.ac.nz/10.1002/jeab.789

*Levine, E. D., Ramos, D., & Mills, D. S. (2007). A prospective study of two self-help CD based desensitization and counter-conditioning programmes with the use of Dog Appeasing Pheromone for the treatment of firework fears in dogs (Canis familiaris). *Applied Animal Behaviour Science, 105*(4), 311-329. ********doi.org/10.1016/j.applanim.2006.11.006

*Lewon, M., Webb, E. K., Brotheridge, S. M., Cox, C., & Fast, C. D. (2019). Behavioral skills training in scent detection research: Interactions between trainer and animal behavior. *Journal of Applied Behavior Analysis, 52*(3), 682-700. ********doi.org/10.1002/jaba.566

*MacKellar, M. E., Robeck, T. R., Staggs, L., Wilson, S., Hieneman, M., MacKellar, D., & Cumella, E. (2022). Behavior skills training with zoological staff to increase killer 145 whale attending behavior. *Behavior Analysis in Practice, 16*, 266-283. ********doi.org/10.1007/s40617-022-00719-3

Maple, T. (2007). Toward a science of welfare for animals in the zoo. *Journal of Applied Animal Welfare Science, 10*(1), 63-70. ********doi.org/10.1080/10888700701277659

*Marschark, E. D., & Baenninger, R. (2002). Modification of instinctive herding dog behavior using reinforcement and punishment. *Anthrozoös, 15*(1), 51-68. ********doi.org/10.2752/089279302786992685

Meier, J., Theby, V., Gygax, L., Hillman, E., & Fischer-Tenhagen, C. (2023). Why workshops work: Examining the efficacy of training trainers to train goats. *Animal Welfare*, *32*, e76. ********doi.org/10.1017/awf.2023.94

Novack, L. I., Schnell-Peskin, L., Feuerbacher, E., & Fernandez, E. J. (2023). The science and social validity of companion animal welfare: Functionally defined parameters in a multidisciplinary field. *Animals (Basel), 13*(11), 1850. ********doi.org/10.3390/ani13111850

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *British Medical Journal*, *372*(71). ********doi.org/10.1136/bmj.n71

*Pfaller-Sadovsky, N., Arnott, G., & Hurtado-Parrado, C. (2019a). Using principles from applied behaviour analysis to address an undesired behaviour: Functional analysis and treatment of jumping up in companion dogs. *Animals, 9*(12), 1091. ********doi.org/10.3390/ani9121091

Pfaller-Sadovsky, N., Medina, M., Dillenburger, K., & Hurtado-Parrado, C. (2019b). We don't train in vain: A systematic review and meta-analysis of human and canine caregiver training.

Journal of Applied Animal Welfare Science, 23(3), 265-301. ********doi.org/10.1080/10888705.2019.1646134

Pritt, S., & Duffee, N. (2007). Training strategies for animal care technicians and veterinary technical staff. *ILAR journal*, *48*(2), 109-119. ********doi-org.ezproxy.auckland.ac.nz/10.1093/ilar.48.2.109

Protopopova, A., Brandafino, M., & Wynne, C. D. L. (2016). Preference assessments and structured potential adopter-dog interactions increase adoptions. *Applied Animal Behavior Science, 176,* 87-95. ********doi.org/10.1016/j.applanim.2015.12.003

Protopopova, A., & Wynne, C. D. L. (2014). Adopter-dog interactions at the shelter: Behavioral and contextual predictors of adoption. *Applied Animal Behavior Science, 157*, 109-116. ********doi.org/10.1016/j.applanim.2014.04.007

Protopopova, A., & Wynne, C. D. L. (2015). Improving in-kennel presentation of shelter dogs through response-dependent and response-independent treat delivery. *Journal of Applied Behavior Analysis, 48*(3), 590-601. ********doi.org/10.1002/jaba.217

Rooney, N. J., & Cowan, S. (2011). Training methods and owner-dog interactions: Links with dog behavior and learning ability. *Applied Animal Behavior Science, 132*(3), 169-177. ********doi.org/10.1016/j.applanim.2011.03.007

*Rutter, N. J., Howell, T. J., Stukas, A. A., Pascoe, J. H., & Bennett, P. C. (2021a). Can volunteers train their pet dogs to detect a novel odor in a controlled environment in under 12 weeks? *Journal of Veterinary Behavior, 43*, 54-65. ********doi.org/10.1016/j.jveb.2020.09.004

*Rutter, N. J., Howell, T. J., Stukas, A. A., Pascoe, J. H., & Bennett, P. C. (2021b). Diving in nose first: The influence of unfamiliar search scale and environmental context on the search performance of volunteer conservation detection dog–handler teams. *Animals, 11*(4), 1177. ********doi.org/10.3390/ani11041177

*Rybova, V., Virtues-Ortega, J., Winchester, K., Cowie, S., Hurtado-Parrado, C., & Pfaller-Sadovsky, N. (2022). Controlling separation-induced problem behavior in horses through target training. *Learning and Motivation, 78*, 101816. ********doi.org/10.1016/j.lmot.2022.101816

Sanetti, L. M. H., & Kratochwill, T. R. (2007). Treatment integrity in behavioral consultation: Measurement, promotion, and outcomes. *International Journal of Behavioral Consultation and Therapy*, *4*(1), 95. ********doi.org/10.1037/h0100835

*Stellato, A., Jajou, S., Dewey, C. E., Widowski, T. M., & Niel, L. (2019). Effect of a standardized four-week desensitization and counter-conditioning training program on pre-existing veterinary fear in companion dogs. *Animals, 9*(10), 767. ********doi.org/10.3390/ani9100767

Todd, Z. (2018). Barriers to the adoption of humane dog training methods. *Journal of Veterinary Behavior, 25*, 28-34. ********doi.org/10.1016/j.jveb.2018.03.004

Udell, M. A. R., & Wynne, C. D. L. (2008). A review of domestic dogs' (canis familiaris) human-like behaviors: Or why behavior analysts should stop worrying and love their dogs. *Journal of the Experimental Analysis of Behavior, 89*(2), 247-261. ********doi.org/10.1901/jeab.2008.89-247

Vergason, C. M., & Gravina, N. E. (2020). Using a guest- and confederate-delivered token economy to increase employee–guest interactions at a zoo. *Journal of Applied Behavior Analysis, 53*(1), 422-430. ********doi.org/10.1002/jaba.599

*Waite, M., & Kodak, T. (2022). Owner-implemented functional analyses and reinforcement-based treatments for mouthing in dogs. *Behavior Analysis in Practice, 15*(1), 269-283. ********doi.org/10.1007/s40617-021-00554-y

*Wess, L., Böhm, A., Schützinger, M., Reimer, S., Yee, J. R., Affenzeller, N., & Arhant, C. (2022). Effect of cooperative care training on physiological parameters and compliance in dogs undergoing a veterinary examination – A pilot study. *Applied Animal Behaviour Science, 250*, 105615. ********doi.org/10.1016/j.applanim.2022.105615

Winslow, T., Payne, S. W., & Massoudi, K. A. (2018). Functional analysis and treatment of problem behavior in 3 animal shelter dogs. *Journal of Veterinary Behavior, 26,* 27-37. ********doi.org/10.1016/j.jveb.2018.04.004

*Yin, S., Fernandez, E. J., Pagan, S., Richardson, S. L., & Snyder, G. (2008). Efficacy of a remote-controlled, positive-reinforcement, dog-training system for modifying problem behaviors exhibited when people arrive at the door. *Applied Animal Behaviour Science, 113*(1-3), 123-138. ********doi.org/10.1016/j.applanim.2007.11.001

Table 1 *Example search string for Scopus, Web of Science Core Collection, EBSCOhost (Psychology and Behavioral Sciences Collection), and OVID (APA PsycInfo) database search.*

Population		Behavior		Intervention		Field
foster* or carer* or caregiver* *or* shelter* *or* rescue* *or* volunteer* *or* owner* *or* adult* *or* participant* *or* trainer* *or* attendant* *or* student* *or* zookeeper* *or* handler* *or* staff	**AND**	"dog-training" *or* "dog training" *or* "teach* dogs" *or* "train* dogs" *or* "canine training" *or* "teach* canines" *or* "train* canines" *or* "animal training" *or* "teach* animals" *or* "train* animals" *or*	**AND**	procedure* *or* method* *or* teach* *or* train* *or* program* *or* intervention* *or* "behavior skills training" *or* "behavior skills training" *or* BST *or* "video model*" *or* "video-model*" *or* shaping *or* "differential reinforcement" *or* prompt*	**AND**	"behavio*r analysis" *or* "behavio*r analytic" *or* behavio*ral *or* behavio*r

Table 2 *Summary of Variables Extracted from the Studies. 'H' in a Column Denotes Human and 'A' Denotes Animal.*

Study	Journal	Participants	Study design	Intervention	Target behavior(s)	Gen	Main	PI	SV	IOA
Adams-Progar et al. (2019)	Journal of Extension	36 weaned heifers. 6 adult handlers.	Between-groups	Face-to-face lecture. Face-to-face lecture + hands-on workshop. Automated video-based lecture. *Animal: herding, holding.*	*Animal: walking, slipping, facing handler.*	-	-	-	-	-
Blackwell et al. (2006)	Veterinary Record	50 dogs. 50 dog owners.	Between-groups (pre and post)	Standardized consultation (3 programmes in separate visits). Control. *Animal: systematic desensitisation.*	*Animal: separation-related problem behavior (e.g., vocalization, destructiveness, urination/defecation).*	-	-	-	yes	-
Bloomsmith et al. (1998)	Zoo Biology	66 chimps. 6 caregiving staff.	Within-group (with 4 phases)	Modelling + rehearsal + feedback. *Animal: positive reinforcement (RFT).*	*Animal: cooperation with request to move.*	-	A	-	-	-
Butler et al. (2011)	Applied Animal Behavior Science	8 dogs. 8 dog owners.	Small-*N* (ABC)	Instructions (unspecified). *Animal: systematic desensitisation, counter-conditioning, punishment.*	*Animal: separation-related problem behavior (e.g., destructiveness, vocalisation, urination/defecation).*	-	A	-	-	-
Clark & Boyer (1993)	Applied Animal Behavior Science	30 dogs. 30 dog owners.	Between-groups (pre and post)	Obedience classes (8 weeks) with review outlines and lectures. Control. *Animal: positive RFT.*	*Animal: proximity, tactile behavior, separation anxiety, obedience exercises.*	-	-	-	-	-
Durgin (2013) [Experiment 1]	PhD Dissertation (Western Michigan University)	6-9 rats. 3 trainers. 3 supervisors.	Small-*N* (multiple baseline across subjects)	Corrective feedback (trainer). Informational session + job-aid + instructions + feedback (supervisor).	Completion of training items (trainer). Delivery of feedback (supervisor).	H	H	yes	yes	yes
Echterling-Savage et al. (2015)	Journal of Applied Animal Welfare Science	4 dogs. 4 dog owners.	Small-*N* (concurrent multiple baseline across participants)	Private instruction + generalization programming. *Animal: positive RFT.*	Aggression reduction procedure fidelity. *Animal: dog-to-dog aggression, precursors to aggression.*	-	H/A	yes	yes	yes
Feng et al. (2018)	Applied Animal Behavior Science	15 dogs. 15 dog owners.	Between-groups (pre- and post)	At-home training sessions with researchers (incl. instructions, rehearsal). *Animal: clicker + food training; food-only training; control.*	*Animal: task performance.*	-	-	-	yes	-
Feuerbacher & Muir (2020)	Animals	5 dogs. 5 dog owners.	Small-*N* (AB trial-by-trial)	Verbal instruction/ guidance. *Animal: DRO, DRA.*	*Animal: separation-related problem behavior (e.g., exploration, locomotion, oral* behavior*).*	-	-	-	-	yes
Hall et al. (2014)	Journal of Veterinary Behavior	3 dogs. 3 dog owners.	Small-*N* (multiple	Guidance through sessions (unspecified).	*Animal: stereotypy.*	-	-	-	-	-

			treatment reversal)	*Animal: tailored (incl. DRO, DRA, timeout).*						
Howard & DiGennaro Reed (2014)	Journal of Applied Behavior Analysis	3 dogs. 3 undergrad students.	Small-*N* (concurrent multiple baseline across subjects)	BST component analysis. *Animal: discrete trial obedience training (positive RFT).*	Discrete trial training fidelity. *Animal: compliance with 'sit' and 'wait' commands.*	H/A	-	-	yes	yes
Howard & DiGennaro Reed (2015)	Journal of Organizational Behavior Management	3 shelter volunteers.	Small-*N* (concurrent multiple baseline across subjects)	Training as usual (info packet, live training). Video-based training (video modelling). Coaching (feedback, 3-step prompting).	Implementation of dog walking and enrichment protocols. Knowledge assessment performance.	-	H	yes	yes	yes
Levine et al. (2007)	Applied Animal Behavior Science	54 dogs. 54 dog owners.	Between-groups (pre- and post)	Instruction booklet + telephone support. Control. *Animal: systematic desensitisation CD.*	*Animal: fear of fireworks (e.g., panting, shaking, cowering).*	-	-	-	yes	-
Lewon et al. (2019)	Journal of Applied Behavior Analysis	11 rats. 4 trainers.	Small-*N* (A/AB/ABC/ ABCD)	BST component analysis. *Animal: discrimination training.*	Response timing. Repeat evaluation. *Animal: indicating response to samples.*	-	H/A	-	-	yes
MacKellar et al. (2022)	Behavior Analysis in Practice	2 killer whales. 2 trainers.	Small-*N* (multiple baseline across subjects)	BST. *Animal: discrete trial training (positive RFT).*	Discrete trial training fidelity. *Animal: attending.*	H/A	H/A	-	-	yes
Marschark & Baenninger (2002)	Anthrozoös	6 dogs. 6 dog owners.	Within-group (group mean per session)	Modelling. *Animal: punishment (blocking, verbal reprimand), reinforcement (praise, access).*	Correct training techniques. *Animal: herding* behaviors *(outruns, slowing down, gripping sheep, etc.)*	-	-	-	-	yes
Pfaller-Sadovsky et al. (2019a) [Experiment 2]	Animals	4 dogs. 4 dog owners.	Small-*N* (ABCDFG)	BST component analysis. *Animal: non-contingent RFT.*	Owner procedural integrity. *Animal: jumping up.*	A	H/A	yes	yes	yes
Rutter et al. (2021a)	Journal of Veterinary Behavior	19 dogs. 19 dog owners.	Within-group (post)	Training classes and workshops (incl. demonstrations, roleplay, feedback). *Animal: positive RFT, shaping.*	*Animal: correct responses, false alerts.*	A	A	-	-	-
Rutter et al. (2021b)	Animals	14 dogs. 14 dog owners.	Within-group (pre- and post)	Training classes and workshops (unspecified). *Animal: positive RFT.*	*Animal: false alerts, sensitivity, precision.*	-	-	-	-	-
Rybova et al. (2022)	Learning and Motivation	4 horses. 3 horse owners.	Small-*N* (multiple baseline across subjects)	BST. *Animal: shaping, differential reinforcement.*	Owner procedural integrity. *Animal: separation-related problem* behaviors *(e.g., running, pacing, legs restlessness).*	A	H/A	-	yes	-
Stellato et al. (2019)	Animals	56 dogs. 56 dog owners.	Between-groups (pre- and post)	Written instructions + videos + independent practice. Control.	*Animal: fear behaviors (e.g., head position, tail position, ear position).*	-	-	-	-	-

				Animal: desensitisation, counter-conditioning.						
Waite & Kodak (2022) [Experiment 2]	Behavior Analysis in Practice	3 dogs. 3 dog owners.	Small-*N* (ABAB reversal)	Researcher guidance (unspecified). *Animal: tailored (incl. DRA, DRI, NCR multiple schedule).*	Owner procedural integrity. *Animal: mouthing, stay.*	-	-	-	-	-
Wess et al. (2022)	Applied Animal Behavior Science	47 dogs. 47 dog owners.	Between-groups (pre- and post)	Group training (unspecified) + independent practice. *Animal: positive RFT.*	*Animal: compliance with veterinary procedure.*	-	-	yes	-	-
Yin et al. (2008)	Applied Animal Behavior Science	15 dogs. 15 dog owners.	Within-group (pre- and post)	Written instructions + videos + sessions with researchers. *Animal: shaping.*	*Animal: barking, jumping, crowding door, contacting visitors.*	-	-	-	-	-

Gen = generalization. *Main = maintenance. PI = procedural integrity. SV = social validity. IOA = interobserver agreement*

Figure 1 *PRISMA Diagram of Literature Review Search Process*