Rat Lab for Fun and Profit

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Many applied behavior analysts have little or no personal exposure to the basic animal experimentation that provided the foundation for applied behavior analysis. However, personal experience in the animal laboratory provides many benefits to students of applied behavior analysis. Animal laboratory experience provides convincing, vivid illustrations of basic principles of learning and facilitates generalization and application of the basic principles. The laboratory experience also teaches interpersonal skills that may be important in future employment in applied fields. The animal laboratory can also provide public relations opportunities, especially with university-sponsored events such as the Rat Olympics. These points, as well as concerns about the resources needed for an animal laboratory and compliance with federal animal-use guidelines, are addressed. It is concluded that the animal laboratory offers many educational profits to students while making learning fun for a reasonable outlay of effort and resources.

Key words: teaching, instruction, rats, laboratory, applied research

Behavior analysis has traditionally used animal models to study learning principles (Domjan, 1987). Although rats or pigeons have often been used in teaching the experimental analysis of behavior and have even recruited many applied behavior analysts, Michael (1980) reported on arguments made as early as a 1977 Midwest Association for Behavior Analysis symposium indicating that some applied behavior analysts do not support the use of animals or even basic research in the training of applied behavior analysts. Branch and Malagodi (1980) point out that, although much of the behavioral research in the 1960s was done by analysts “who had begun their training as laboratory scientists” (p. 37), a majority of current applied behavior analysts have no laboratory experience.

Assuming that students have been exposed to animal laboratory work as undergraduates is risky. Textbooks for learning courses that focus on behavior

analysis typically describe the crucial animal experiments which demonstrate the basic principles of behavior (Chance, 1994; Domjan & Burkhard, 1986; Keller & Schoenfeld, 1950; Malott, Whaley, & Malott, 1993; Schwartz, 1984). Yet, for many students, the descriptions in the textbooks are the only exposure they get to basic animal experiments. Lattal, McFarland, and Joyce (1990) found that only 46% of the undergraduate learning courses they surveyed included a required laboratory component. Of those classes, only 52% were using animal models (47% rats, 4% pigeons, and <1% gerbils).

I find that training animals is one of the most valuable learning activities for my students in applied fields of psychology, behavior analysis, or human services. Despite all the jokes about those who study rats and apply that study to people, training a rat does teach basic concepts directly. When my students experience these concepts in action, they not only learn them, but they also believe in their validity. Rat training allows opportunities for practice in and generalization of training skills. Training rats also teaches important clinical and interpersonal skills, such as clinical observation, timely feedback, and patience. Rat Olympics, in which students train rats to compete

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in athletic events, can also provide opportunities for positive public relations for a program (Labounty, 1992). I have found that the rat laboratory and Rat Olympics experiences contribute immeasurably to my teaching. I consider my four-legged furry white teaching assistants to be invaluable members of my teaching team. The fun teaching forum they provide produces a great educational profit in terms of the skills students learn.

OVERVIEW

History

I teach at an upper-level university (juniors, seniors, and graduate students) that was founded in 1974. The designers of the new university viewed psychology as one of the liberal arts and saw no need for psychology laboratory space. In 1976 and 1977, the campus biopsychologist and I prepared proposals arguing for laboratory space and equipment to run simple rat experiments and demonstrations. By 1978 we were provided with two small adjoining classrooms with a small storage space between them and money to buy four small animal test environments with solid state control equipment. We charged the students a \$10 lab fee to cover rats, feed, bedding, and other consumables. On each day of the week, a different student was responsible for feeding, watering, and caring for the rats. Students met those responsibilities reliably, despite this being a commuter campus with no on-campus housing.

In 1981, after 3 years of using the rat laboratory as an essential part of my graduate course with demonstrated student satisfaction on course evaluations, I combined my needs with those of faculty in biopsychology and biology; we requested that the university provide more appropriate animal facilities as required by the National Institute of Health guidelines (see National Institute of Health, 1985, for more recent guidelines). In 1983 the university built a separate animal care facility and

hired a rat keeper. Since that time my rats have been bred and maintained in the university animal care facility and are brought into the learning laboratory in the classroom building once a week for class.

For 19 years I have taught a graduate-level basic course in basic learning principles under a number of different titles. As we developed curricula for our various programs, this course has become a required core course for all students in the Masters programs in general psychology, clinical psychology, and school psychology. Almost all of these students will work in the human services or applied psychology fields. Inclusion of the course in the school psychology program was the result of the national accreditation guidelines for that program. To argue for its inclusion in the core of general psychology and clinical psychology, I changed the name of my course from Behavior Analysis I to Learning Principles, to reflect more specifically what was taught in that course.

Since the fall of 1978, a portion of the required activities for this course has included working in a group to train a rat to press a lever, to press the lever only when the cage lights are on (discrimination), and to do a simple behavioral chain. Training for competition in the Rat Olympics events—the rope climb, the long jump, and the sprint—has been added for the last 2½ years. I will now upgrade to computer control of the equipment to allow for demonstration of additional behavioral principles as a result of a grant awarded to me in the fall of 1994.

Description of Rat Laboratory Use

Students spend 1 hr of class time each week in the rat laboratory. To reduce crowding in the laboratory, half of the students participate during the hour before the 3-hr scheduled class, and half of the students participate during the 3rd hour of the scheduled class time. Students are required to have

Figure 1. Equipment used in the rope climb, long jump, and sprint events in the Rat Olympics.

completed one of the computer-simulation shaping programs (Acker, Goldwater, & Agnew, 1990; Cunningham, 1990) before beginning work with the live rat.

The first laboratory session is spent in demonstrating laboratory rules and procedures, introducing the students to their rats, and allowing the students to adapt to the rats and the rats to adapt to the experimental environment and find the food hoppers. Starting with the second session, and progressing as determined by the behavior of the group's rat, students begin magazine training to establish the sound of the feeder as a discriminative stimulus (S^D) for approaching the food hopper, and then hand shape the rat to press the lever. Once the rat is lever pressing reliably, the students begin a trial-and-error discrimination training procedure in which the presence of the cuellights over the lever and the houselight is the S^D for lever pressing and the absence of the lights is the S^A (stimulus indicating lack of reinforcement) for lever pressing. Once the discrimination is es-

tablished to a criterion of three periods of S^A without a lever press with at least one lever press in the intervening S^D periods, students begin to train a simple behavior chain. Students establish any group-defined behavior for the first behavior in the chain that will lead to the lights being turned on so that the rat can then lever press and get a food pellet before the light is turned off to start the chain over.

Once students have completed the laboratory reports on these three procedures, they begin training their rats simultaneously on the three events of the Rat Olympics—the rope climb, the long jump, and the sprint. A framework to hang a rope for the rope climb was built out of scrap metal. The long jump uses two cut-down cardboard boxes attached by large rubber bands to chairs on wheels. The sprint box is a piece of an old discarded rat maze found in the bowels of the university. Rat Olympics equipment is shown in Figure 1. The Rat Olympics are held as a gala event following the last exam in the course, and guests are invited.

Figure 2. A student's responses to her rat's progress in the rope climb event in the Rat Olympics.

The rats compete in the three events: They are timed on the rope climb and the sprint, and their longest jump distance is measured. Rats who balk for more than a minute and half are disqualified from that event. In addition, during some of the Olympics, style judges (who are university administrators or colleagues) give style points and commentary that are included in the judging. The trainers of the Gold Medal rats for each event receive frog-clicker key chains with which to continue their illustrious training careers.

EDUCATIONAL PROFITS OF THE RAT LABORATORY

Teaching Basic Principles

In my experience, the rat laboratory brings basic principles to life and turns many students into behavior analysis converts. Students enter my class viewing learning principles as just one more body of information to be memorized for recitation on exams. However, from the moment that a student-trained rat

starts pressing the lever, the students really begin to see the validity of the principles they are learning. The excitement generated by training is illustrated by a student's response to the rope-climbing success of the rat she trained (see Figure 2). In addition, the rat training experience provides a shared example that I can refer to as an illustration of various aspects of the basic principles. For example, when talking about extinction bursts or spontaneous recovery, I can refer students to their own observations of the rat while training the discrimination. I conclude that these commonly experienced phenomena become easier for students to learn because very few of the experienced principles show up in the group of concepts most often missed on exams.

Teaching Application and Generalization

Moving from theoretical material to application is often difficult for stu-

dents. We commonly give them numerous opportunities to practice their verbal repertoires but reserve the applied practice to higher level courses and practica. Malott (1994) and Sharpe (1994) have both suggested that deliberate practice of essential behavior, especially with appropriate feedback, might be a necessary part of training expert behavior analysts. Although the discussion about what skills need intensive practice is just beginning, I suggest that practicing basic skills such as shaping, discrimination training, and chaining is analogous to a musician practicing scales. In addition, one of the advantages of animal training is the salutary feedback inherently provided by the animal's behavior. In other words, if the students are not shaping skillfully, the rat will not learn, and the struggle to shape the rat's behavior effectively nicely illustrates Skinner's principle of the subject always being right (Reese, 1966).

It is also not enough to practice in just one setting. To establish good performance, practice must be done in a variety of settings with all types of distractions (Mechner, 1992). As behavior analysts, we understand this principle in terms of generalization. As instructors, our course objectives typically extend beyond verbal fluency to application. I want my students to use what they are learning, not just talk about it. The importance of generalized outcomes is covered in virtually any applied textbook (e.g., Cooper, Heron, & Heward, 1987; Martin & Pear, 1983; Sulzer-Azaroff & Mayer, 1991). Generalization requires not just practice, but practice under a variety of circumstances. The rat laboratory provides a different setting for the practice of applying basic principles. To encourage generalization, I require both a rat laboratory experience and a home laboratory experience, which involves students applying behavioral principles to change their own behavior or the behavior of someone else. Thus, the rat laboratory is one of the two legs of generalization in my course, and in my

18 years of teaching this course students are continually coming back to tell me how they have successfully implemented these principles in their professional and personal lives.

Teaching Interpersonal and Clinical Skills

The value of a rat laboratory, however, is not limited to learning basic concepts. I frequently tell students who are preparing for the clinical and human services area that the most important thing they will learn in the university is to shape a rat's behavior. Training a rat strips the social situation down to the basics. In order to shape the rat, the students must first learn to observe the rat's behavior carefully and then to put their own behavior under the control of the rat by responding immediately to small changes in the rat's behavior. In other words, they must become contingency-shaped shapers, rather than rule-governed shapers. The students must learn patience, because the rat will learn at its own pace, and they cannot speed up this learning by pleading, threatening, or yelling at the rat. They must also pay attention to what, in fact, changes the rat's behavior, not what they expect or hope will change the rat's behavior. They must be careful not to superimpose their own expectations and assumptions (which usually involve mentalistic explanations of behavior) on the rat's behavior.

All of these skills are important for clinicians and other human service providers. In order to change behavior successfully, therapists, service providers, and teachers must learn to observe their clients and students carefully, to respond expeditiously to small changes in behavior, and to observe their effects on those with whom they are working. They must learn to observe and collect data, not to make assumptions about the causes of behavior or about what changes the behavior. Students who have graduated and are now working in the field of psychology often return

to tell me that shaping the rat's behavior was the most important skill they learned.

Teaching Team Skills

The paucity of laboratory equipment necessitates grouping students to work with the rats. Students train their rat in a group of four to six, but they write individual laboratory reports that require them to relate the laboratory experience to concepts in the course material. Although the group approach was adopted for practical reasons, it has beneficial side effects as well. Group work allows for the participation of students who do not wish to actually handle the rat. As many as 75% of the students have expressed apprehension about rat handling at the beginning of the class, but this number generally drops throughout the semester. The group approach also has advantages in that many of our local employers (such as IBM, Loral, the Johnson Space Center, and NASA contractors) are looking for employees who have had experience in working with a team (Olson, 1994). The complexity of much applied work today requires a team with a variety of skills to work together for a common goal. Rat laboratory groups give students opportunities to practice relevant skills in organizing, communicating, and sharing the work load.

Rats as Recruiters for Behavior Analysis

The Rat Olympics provides a number of public relations opportunities. Rats doing cute things like climbing ropes and jumping from one chair to another provide photo and video opportunities. Community and school groups have watched our Rat Olympics. I have invited students from an alternative high school to watch, hoping to motivate those students to attend college. I have invited the Psychology Club from a nearby junior college, hoping to recruit some of these students into our program. I regularly in-

vite administrators and colleagues to be style judges for the Rat Olympics. Our Associate Dean for Academic Affairs, who has a degree in literature, our university poet and teacher of creative writing, and a colleague who is a cognitive psychologist have all been style judges for this event. A video of the Rat Olympics is being made to show at school recruiting functions. It is often difficult for administrators to sell the abstract ideals of the university, but the concrete example of learning a skill represented by the Rat Olympics appeals to a wide audience. Perhaps activities such as the Rat Olympics could be used more broadly to bring positive attention to the field of behavior analysis as Schlinger (1994), as chair of the ABA Public Relations Committee, has requested.

STUDENT EVALUATIONS OF THE LABORATORY

Students themselves also appreciate the value of what they learn in the rat laboratory. In the spring and summer of 1994, to prepare for writing a grant to upgrade my laboratory equipment, I invited students in the graduate Learning Principles class and the graduate Applied Behavior Analysis class (for which the Learning Principles course is a prerequisite) to evaluate various elements of the course via a survey. The 45 students who chose to respond were given a list of elements of the course and asked to rate each element as very helpful, somewhat helpful, not at all helpful, or did not use/not available. Thirty-five students rated the rat laboratory as very helpful, nine students rated it as somewhat helpful, and only one student rated it as not at all helpful.

Most students rated the rat laboratory to be quite helpful in learning the concepts in the Learning Principles class. These ratings occurred in spite of the large number of ratings and commentaries indicating that the equipment was worn out and in need of replacement. The most frequent answers to the open-ended questions on the sur-

vey indicated the need for more, better, and more up-to-date equipment. Still, students noted the importance and impact of the rat laboratory portion of the course for learning basic concepts.

CONCERNS ABOUT USING ANIMAL LABORATORIES

Animal Care Guidelines

Despite the demonstrated advantages, many instructors may be reluctant to use animal laboratory experiences in their courses due to concerns about meeting the requirements concerning animal care of the National Institute of Health (1985) or of Institutional Animal Care and Use Committees (IACUCs). The recent guidelines issued by the National Institute of Health's Office of Protection from Research Risks (1994) legitimately suggest that highly distressing procedures be excluded from teaching and that food and water deprivation procedures be "strongly justified." As indicated in recent issues of the *ABA Newsletter* (Vol. 17, Nos. 2 and 3), the meaning of such guidelines is unclear, and the guidelines are in the process of being revised. Nevertheless, a large number of learning principles can be presented in the animal laboratory without using highly distressful procedures. Experience with reinforcement, shaping, discrimination training, chaining, and various schedules do not require anything more stressful than mild food deprivation. It can be argued that food deprivation is not as stressful as it might appear to people unfamiliar with animals (or to those who live with overweight dogs or cats). Himeline (1986) has pointed out that when we maintain animals at 80% to 85% of their free-feeding weights for food deprivation, the free-feeding weights themselves are probably artificially inflated in the laboratory where animals have ready access to food procured with no effort and few opportunities for exercise. Poling, Nickel, and Alling (1990) supported this premise with data on weight gains in feral pigeons maintained on a

typical free-feeding laboratory regimen. Deprivation to establish food or water as reinforcers can be readily justified in terms of the advantage for students to practice training procedures in an interaction with a living organism.

Alternative computer simulation programs such as "Sidney Slug and Friends" (Acker et al., 1990) or "Op. Rat" (Cunningham, 1990), although providing excellent learning and practice opportunities, are not adequate substitutes for the vagaries of interaction with live organisms. I always require my students to practice on the computer programs to prepare themselves for shaping a living being. However, the computer programs do not provide a sufficient range of learner behavior for mastery of the microskills of shaping. In addition, for humans raised in a world in which all kinds of impossibilities are regularly presented on computers in computer games, training a computer animal does not convince the student of the adequacy and practical reality of the training principles. This argument has been readily accepted by the IACUC at this university.

Resources

Many instructors who would like to add an animal laboratory experience to a course may be deterred by the resources needed to do so. Although it is possible to do very basic animal training with simple handmade environments with students turning stimuli on and off and delivering consequences by hand, more sophisticated automated control systems permit the demonstration of a greater variety of principles with more precision. Principles that I have found to be useful in garnering needed resources include joining with other faculty in making requests, shaping, and patience and persistence. Faculty in other departments may have similar needs for animal facilities; I found faculty with similar needs in biology and biopsychology. I also started the laboratory with very limited re-

sources, and used success in teaching with those resources to justify requests for further resources. Many requests and proposals have required repeated presentation and the passage of time for success. I have found that having well-trained graduates working in the community, which supports the mission of this university, to be a strong reinforcer for actions taken by administrators in regard to the availability of resources. It might be feasible to start with a Rat Olympics type of event that requires little equipment and provides much drama, and use this as a springboard to requesting further support.

CONCLUSION

The rat laboratory and associated Rat Olympics serve a variety of valuable functions in training students in applied fields. The rat laboratory illustrates the basic concepts of learning in a dramatic and convincing manner. Working with rats teaches students useful on-the-job skills needed to work with human clients and coworkers. The Olympics allow for positive public relations activities, reaching out both to colleagues on campus and to the broader community. The profits of the rat laboratory come from the benefits to the students in direct learning and practice of the basic principles of behavior analysis, and the joy and excitement of training make learning fun. These benefits can be gained for a fairly modest outlay for equipment and resources.

REFERENCES

- Acker, L. E., Goldwater, B. C., & Agnew, J. L. (1990). Sidney Slug: A computer simulation for teaching shaping without an animal laboratory. *Teaching of Psychology*, 17(2), 130-132.
- Branch, M. N., & Malagodi, E. F. (1980). Where have all the behaviorists gone? *The Behavior Analyst*, 3, 31-38.
- Chance, P. (1994). *Learning and behavior* (3rd ed.). Belmont, CA: Wadsworth.
- Cooper, J. O., Heron, T. E., & Heward, W. L. (1987). *Applied behavior analysis*. Columbus, OH: Merrill.
- Cunningham, M. (1990). *Op. Rat PC users' guide*. Orlando, FL: Psi & Eye.
- Domjan, M. (1987). Animal learning comes of age. *American Psychologist*, 42, 556-564.
- Domjan, M., & Burkhard, B. (1986). *The principles of learning and behavior*. Monterey, CA: Brooks/Cole.
- Hineline, P. N. (1986). The relationships between subject and experimenter. *Journal of the Experimental Analysis of Behavior*, 45, 123-127.
- Keller, F. S., & Schoenfeld, W. N. (1950). *The principles of psychology*. New York: Appleton-Century-Crofts.
- Labounty, L. (1992, May). Activities that support the teaching of behavior analysis. In H. J. Karp (Chair), *Activities that support the teaching of behavior analysis*. Panel discussion conducted at the meeting of the Association for Behavior Analysis, San Francisco.
- Lattal, K. A., McFarland, J. M., & Joyce, J. H. (1990). What is happening in psychology of learning courses? *The Behavior Analyst*, 13, 121-130.
- Malott, R. W. (1994). Notes from a radical behaviorist . . . Why we fail to train expert behavior analysts. *The ABA Newsletter*, 17(1), 48.
- Malott, R. W., Whaley, D. L., & Malott, M. E. (1993). *Elementary principles of behavior* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Martin, G., & Pear, J. (1983). *Behavior modification: What it is and how to do it* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Mechner, F. (1992, May). A technology for learning and practicing skilled performance. In A. M. Wylie (Chair), *Educational applications of behavior analysis*. Symposium conducted at the meeting of the Association for Behavior Analysis, San Francisco.
- Michael, J. (1980). Flight from behavior analysis. *The Behavior Analyst*, 3, 1-24.
- National Institute of Health. (1985). *Guide for the care and use of laboratory animals* (NIH Publication No. 86-23). Bethesda, MD: Author.
- National Institute of Health. Office for Protection from Research Risks. (1994). *Institutional animal care and use committee guidebook* (NIH Publication No. 92-3415). Boston: ARENA.
- Olson, K. M. (1994). *Writing a winning proposal*. A Symposium for writing Total Quality Management Grants presented at the University of Houston-Clear Lake, Houston.
- Poling, A., Nickel, M., & Alling, K. (1990). Free birds aren't fat: Weight gain in captured wild pigeons maintained under laboratory conditions. *Journal of the Experimental Analysis of Behavior*, 53, 423-424.
- Reese, E. P. (1966). *Human behavior: Analysis and application* (2nd ed.). Dubuque, IA: Wm. C. Brown.
- Schlinger, H. (1994). Public relations: Does ABA need it? *The ABA Newsletter*, 17(3), 4.
- Schwartz, B. (1984). *Psychology of learning and behavior* (2nd ed.). New York: Norton.
- Sharpe, T. (1994). Training recommendations for "expert" behavior analysts. *The ABA Newsletter*, 17(3), 13.
- Sulzer-Azaroff, B., & Mayer, G. R. (1991). *Behavior analysis for lasting change*. Fort Worth, TX: Holt, Rinehart and Winston.