Research at a Local Zoo

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Conducting research at a zoo is both a fantastic opportunity and a singular challenge. After all, you have a large, diverse collection of animals available, for which you are not responsible. You can conduct animal research without the difficulties and expense of an animal laboratory and laboratory staff. But you also lose the neat, precise controls of laboratory research, and all control over the animals. As a researcher you must be patient, persevering, flexible, and creative. But when you forge a good relationship with your local zoo, you have a wealth of opportunity for nurturing the undergraduate research experience in psychology.

Types of Behavioral Research

The zoo offers arenas for research on a wide range of species, including humans. There is a niche for visitor studies at the zoo. (For a review see Davey, 2006.) The zoo is a common site for a family outing and offers an ideal opportunity to investigate family relationships, sex role stereotypes, and social roles, through observational methods. Burns, Mitchell, and Obradovich (1989) observed mothers and fathers carrying toddlers and found fathers were more likely to carry daughters than sons while mothers did not discriminate among their children. Women were also more likely to be in charge of the strollers and bags carrying children's supplies than men. A study of children in a children's zoo also highlighted gender differences in kids and found that little girls were more likely to approach animals than the boys (Morgan, unpublished data).

Students can also look at the interaction between visitors and animals. Students can investigate how visitor density affects the behavior of the animals. Sellinger and Ha (2005) found visitor density and intensity increased unfavorable behaviors in zoo animals (pacing and reduced visibility) and Wells (2005) reported greater agitation among gorillas with higher visitor volume. However, one study we conducted found that gorillas actually sought the attention of visitors. Gorillas spent more time near viewing areas when people were present compared to when they were not present (Altman & Snyder, unpublished data). Thus, the dynamics of the exhibit and how animals respond to visitors is a viable avenue of research.

Likewise, how the visitor responds to the behavior of the animals is also a viable area of research. One of the major goals of a zoo is education (Conway, 1969; Hediger, 1950) with the hope that education leads to better attitudes toward conservation. Thus, the message visitors leave the zoo with is important to zoos and the future of endangered species. In a study which eavesdropped on conversations at the exhibits of three different species of bears, research found that visitors spoke about behaviors only when animals were present and active compared to when they were sleeping or pacing. Otherwise, conversations at the exhibits focused on anything but animal behavior (Altman, 1998).

Of course, the most popular research conducted at the zoo is that which focuses on non-humans; and there are a variety of approaches students can take when pursuing animal research at a zoo. One approach is to view the zoo collection as an auxiliary animal laboratory and find animal models for theoretical research. Thus, a student has a research project in mind and approaches the zoo for use of individuals in its collection as research subjects. For example, students interested in the animal cognition literature on numerical competencies in primates (Beran, 2001; Boysen, Berntson, & Mukobi, 1999) might be interested in determining whether this ability only shows up with extensive training in a laboratory context, or if animals demonstrate ordinal judgments in other environments. Cantlon and Brannon (2007) found that monkeys, even those untrained in numerical reasoning, do use numerical attributes for information even when other information is available. However, they still tested animals using a laboratory task-oriented format rather than naturalistic patterns of behavior. Therefore, the young researcher might try implementing a numerical reasoning task in a naturalistic zoo habitat, eliminating the constraints or demand characteristics of a laboratory setting. The limitation of using zoo animals for theoretical research is that one is not necessarily testing the best animal model for the question he is asking, but rather the most available animal model from among the collection one has access to.

The most common type of animal research

conducted at the zoo, which benefits both the researcher and the zoo, is enrichment studies. Enrichment studies focus on ways to improve the physical and psychological well-being of the captive animal. Enrichment focuses on changes to the style or structure of the habitat, objects in the habitat to interact with, or food manipulation. Burrell and Altman (2006) looked at changes in behaviors of cotton-top tamarins as they were switched across three different types of exhibits. Unsurprisingly, the tamarins were most active, even when least visible, when free ranging in a rain forest exhibit compared to two different caged environments. How active the tamarins are and their range of active behaviors in captivity have implications for reintroduction efforts to native habitats. The first author on this research was an undergraduate student when these data were collected.

Researchers, of course, have no control over creating exhibit changes, but plans for an exhibit change creates the perfect opportunity for student research. New habitats under construction, and animals being moved due to seasonal changes, are opportunities for comparisons across habitat types. Zoos are always developing and working towards improving their animal exhibits so opportunities often arise, even if exhibits are not new. In addition, individual animals living in social groups are often moved out of a group or are introduced to a new group, and such occasions also offer research opportunities. Of course, one needs to know about these changes with enough time to get baseline measures of behavior before changes are implemented. This suggests nurturing an on-going relationship with the zoo.

While the researcher has no control over the events of construction of new exhibits or the relocation or introduction of animals, activities such as adding toys and other enrichment devices are much more flexible for the researcher to study. These objects can be introduced at any time and are perceived to engage the animals and encourage a wide array of species-typical behaviors, while at the same time reducing the behaviors deemed indicative of psychological stress or distress. Altman (1999) used manipulatable objects with sloth, spectacled, and polar bears to reduce pacing and excessive inactivity. Large plastic floats reduced these behaviors in the polar bears and plastic balls halved pacing in the spectacled bear, but not the sloth bear. Thus, there are not universal answers for enrichment and enrichment projects at zoos should not be applied without being assessed. This opens a wealth of opportunity for students.

The most common form of enrichment is perhaps food enrichment. Food is a great motivator and the old, classic studies (Carder & Beckowitz, 1970; Neuringer, 1969) suggest that animals do prefer to work for food. In addition, a great portion of an animal's wild behavior is usually centered on food. Therefore, introducing food enrichment often encourages naturalistic patterns of behavior. In a study at the Topeka Zoo in Kansas, Altman, Gross, and Lowry (2005) switched lions from a conventional six day a week feeding schedule to a random "gorge and fast" feeding schedule that better models naturalistic patterns. Lions were slowly reduced to eating only 3 days a week but were fed the same amount of food per week. The lions showed increases in appetitive (goal oriented) behaviors while pacing halved. The lions also showed an increase in digestibility and a corresponding decrease in food intake and metabolized energy intake. Thus, changing the feeding pattern of the lions improved nutritional status and increased species-typical behaviors. Changes in feeding schedules of the lions, along with the daily fecal collection necessary to measure digestibility, involved fairly invasive and complex activity that required a good deal of effort and cooperation from the zoo. Other types of food enrichment do not necessarily involve as much effort on the part of the researcher. There are food logs where food is inserted into objects with limited access; peanut butter can be smeared across logs and rocks around the exhibit; orangutans are given long sticks to "fish" for sauces, like mustard, on a plank outside the exhibit. Students can assess the attention animals give to these activities and the animals' subsequent behaviors.

Another avenue for behavioral research at the zoo that requires no invasive techniques (like feeding regimes or fecal collection) and no cooperation of the keeper staff (implementing enrichment programs) is the study of the usage of exhibit space by individual members of an enclosure. Many physical and social factors contribute to how well an exhibit is used and it is a significant topic of study in the literature. Mallapur, Waran, and Sinha (2005) tied usage of space to the type of behaviors displayed. Renner and Lussier (2002) found limited use of cage space in two spectacled bears as an index, in part, of a limited behavioral repertoire, which they subsequently improved with a climbing apparatus. Hence, how well animals are using their enclosure may be an index of well-being and may point to opportunities for enrichment. The questions one asks can be experimentally and statistically tested by breaking an exhibit up into quadrants and comparing the amount of time spent in each quadrant or by investigating use of quadrants as a function of sex, age or status, or visitor presence.

This last avenue of research, evaluating use of captive habitats, is the easiest way to get started in zoo research. A trip to the zoo will familiarize the new zoo researcher with the types of animals and exhibits available, and the researcher can start generating questions about how the animals use their space, spend

their time, or interact together. Spending a lot of time observing a specific exhibit will increase the likelihood of meeting zoo keepers and obtaining additional information on the animals. The student should work to develop a rapport with zoo keepers; this relationship can lead to cooperative efforts with the zoo which can lead to greater access to the collection and the generation of other hypotheses.

Forging Relationships with a Zoo

None of this research at a zoo is possible without establishing a relationship with zoo staff. Even when doing strictly observational research, a researcher needs background information on the animals in the collection. For research that involves any manipulation of the environment, one needs the cooperation and good will of the keeper staff. The greatest source of information and day to day activity will come from keeper staff. However, for permission to conduct the research, one needs to approach the head administration of the zoo, usually a zoo Director. Thus, the zoo researcher must know the proper power structure of the zoo and respect it. The Director makes the decisions so his approval is required first. The budding zoo researcher should also be careful to communicate about the project with everyone. If the Director agrees but the keepers feel put upon, the researcher will have quite a struggle. If the zoo veterinarian plays a strong role in decisions made at the zoo than a researcher wants to be sure he has had a conversation with the veterinarian. The reason for this is that all the levels of the hierarchy do not communicate with each other and zoos often have their own internal power struggles. A zoo researcher needs to have buy-in from, and the good will of, all the important players without getting involved the local politics.

Establishing contact with a zoo sometimes takes more salesmanship than one might expect. While the relationship between a zoo and a university can be very mutually fruitful, it is often tenuous and the academic is met with suspicion. Part of the problem is that the zoo and the researcher have different priorities. The zoo's priority is husbandry and management while the researcher's priority is, of course, research and methodology. So, for the researcher it is imperative that the zoo not change anything until the experimental condition is over, while the zoo takes offense at being dictated to when it has more than just one animal to consider. There may also be some negative perception of outsiders coming in acting as experts to keeper staff who truly are experts with the animals they manage. Finally, the cost-benefit ratio of the relationship between the zoo and the university is not the same for both parties. The researcher has little to lose. However, the zoo has the risk that the researcher might find or report information that may create negative publicity for the zoo. It makes them cautious.

Thus, a researcher must always nurture her relationship with a zoo. She must educate herself on the political hierarchy and pay homage to the right people. But she must never forget that she will not succeed without the help of the keeper staff who work with the animals on a daily basis. A researcher and her students must show keeper staff and their knowledge of their animals respect, and recognize research is not a zoo keeper's top priority. Furthermore, the research must be valuable to the zoo. Therefore, researchers must follow through and share the results with the zoo. The best way to keep the relationship going is to make the relationship reciprocal. University research should feed back to the zoo and be helpful in its management choices. University researchers can also make their relationship valuable to the zoo by trading resources. The one thing professors are rich in is access to students. Students are often very interested in volunteering at the zoo and zoos have critical times when they need extra help observing a newborn to be sure there are no complications, or to observe a new exhibit for unexpected escapes. The more reciprocal the relationship is, the stronger it will be. Navigating the human social politics should be given as much attention as one's research protocols.

Pitfalls

Zoo research is only for the passionate student researcher because it takes longer and is harder to do than traditional laboratory or survey research. It requires long hours of observations across months and balanced across times of day and days of the week; which is fairly difficult for the student to manage. In the gorge and fast lion study (Altman et al., 2005), students observed lions 7 hours a day for 10 weeks. Burrell (Burrell & Altman, 2006) observed tamarins across exhibits several times a week in 10 min. intervals for 7 months. That means running back and forth to the zoo when the pre-established random schedule dictates, rather than by a schedule of convenience. Certainly a student chooses an easier path when he hands out a survey or runs subjects, or participants, at his convenience.

In addition, student researchers have no control over the animals they study or the conditions under which they are managed. The study of the tamarins across exhibits actually started out as a study of an unusual family structure of tamarins in the zoo's rainforest and an investigation of how the family utilized its space in the exhibit. Tamarins are pair-bonding monkeys and live in family groups of the mating pair and their newborn twins and twin yearlings. This group consisted of older siblings and no father and

the student was looking at the relationship among the offspring and the mother in the absence of the father. The mother died. So the project evolved to the relationship among the siblings in the rainforest without the parents. Then one day the tamarins disappeared from the rainforest. They had been moved to an open air cage outside of the rainforest. Thus, the project became a comparison between a caged vs. free ranging exhibit. As the weather cooled, the tamarins were moved again to a cage that had both indoor and outdoor access. The project was expanded to compare behavior across the three types of exhibits. It turned out to be a great project, but it was a result of being flexible rather than being brilliant.

There are limits to one's flexibility, however; and though things worked out for this next student, it may not always. One student had her heart set on documenting changes in two elephants as a function of enlarging their exhibit and switching them from being chained to free ranging in the exhibit. The construction of the exhibit took a year longer than projected. However, the student stayed with the project and continued to do observations during the intervening time and managed to complete her project and present her results at a regional student conference. She was fortunate that she started her research early in her college career, for it is the only reason her research did not take longer than her degree!

One final constraint of zoo research is a methodological one. Working with zoo animals almost always means working with small n's. In captivity there is a very finite subject pool. This leads to two choices. One option is to report single subject design data and descriptive statistics. The drawback is that most journals want to see inferential statistics. A second approach is to treat observations, and not animals, as statistically independent samples and thus use a mean proportion per observation in the analysis of variance which results in much larger sample sizes. While, using observations of a single animal as the sample size is not traditional, it is neither uncommon nor unacceptable. When working with single animals in captive zoo environments it is often unavoidable. Several notable papers in the early literature employ statistical tests on individual animals that assume observations as independent. Carlstead et al. (1991), Wechsler (1991; 1992), Markowitz et al. (1995), and Altman (1999) used Mann Whitney U and/or Kruskal-Wallis tests. Both of these tests assume independent samples (Siegel, 1985). Statisticians understand this. However, the method can be rejected by those who only tout conventional techniques.

Placing the pitfalls at the end of this chapter may make conducting zoo research sound daunting. However, perhaps the hardest part of conducting zoo research for students is staying on task when they are engaged by the animal. It is often hot, smelly, and loud from kids yelling, and yet student researchers love collecting data. They feel a connection with the subjects that one just does not get with introductory psychology students. Like keepers, they start to learn the nuances of the behavior of their subjects. The zoo is an opportunity to conduct behavioral, social, and cognitive research with animals in an academic environment often no longer supportive of the animal laboratory. Faculty members do not have to scrounge for grant money to keep laboratories open or compete with colleagues for their piece of a shrinking pie. The local zoo offers faculty an arena for guiding the student researcher through theoretical and applied research opportunities in a way that may be enriching for the zoo and transforming for the student.

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