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Animal Farm: Using Common Domestic Animals to Teach Comparative Psychology

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As money for animal facilities at colleges and universities has declined, so too has the accessibility of students to hands-on experiences with animals (Abramson, Wallisch, et al., 1999). However, we know that laboratory experiences with animals provide students with better ideas of the challenges and joys of animal research (Abramson et al., 1996). Faculty can be creative about using local resources or even their own pets to teach simple experiments in comparative psychology. This paper describes an animal laboratory utilizing locally available animals to test understanding of the human communicative gesture of pointing. Outcomes of the laboratory provide interesting discussion for students, and students enjoy the experiences of using live animals to learn about comparative psychology.

Keywords: comparative psychology, domestic animals, laboratory exercises

Unfortunately, comparative psychology is a shrinking field of psychology (Abramson, 2015a, 2018). While student interest in the course materials remain high (see, e.g., Furlong et al., 2015), relatively few departments now offer coursework in comparative psychology at either the undergraduate or graduate level (Abramson, 2015a, 2015b; Krachun, 2015). One barrier to animal focused research and coursework is the perceived or actual need for expensive animal facilities on campus, particularly with reduced grant money opportunities (Abramson, Wallisch, et al., 1999; Gallup & Eddy, 1990; Ireland et al., 2008) and with increasing pressure from government groups to reduce animal research (Grimm, 2019). However, the great aspect of comparative psychology is that it can take advantage of whatever animal species happen to be available in an area, including humans. In fact, comparative psychology has shown a shift from a focus solely on traditional laboratory animals to a wider diversity of species being researched (Beran & Parrish, 2014; Shettleworth, 2009).

Working directly with animals in courses provides a number of benefits to students. Physical contact with animals has been found to have both positive physiological and psychological effects from pets (Beetz et al., 2012; for review, see Wells, 2009) and farm animals alike (Hassink & van Dijk, 2006; Pedersen et al., 2011). Even just passively observing animals can produce health benefits (e.g., DeSchriver & Riddick, 1990). While not many studies have been done to assess the influence of animals on learning within classes, the few that have been done suggest either no difference (Hummel & Randler, 2010) or some improvements in learning compared to nonanimal controls (Abramson et al., 1996; Gonzalez-Redondo et al., 2010; Sherwood et al., 1989). Additionally, emotional ratings of the experience suggest that students are more interested and have more positive attitudes following animal interactions (Hummel & Randler, 2010; Sherwood et al., 1989; Tomažič, 2011). This paper describes a laboratory exercise, testing the capacity to understand a pointing gesture, that can easily be adapted to most environments with a variety of domestic animals and, potentially, some zoo animals.

When teaching an undergraduate course with students who are relatively new to working with animals or are new to data collection, it is important to consider experiments that are relatively easy to perform with minimal training involved for either humans or the animals. The present laboratory assignment gave the

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students exposure to live animals and allowed students to collect comparative data using multiple animal species. Many tests with animals require extensive training or a number of repeated trials to get reliable data; for example, tests of learning and memory may require dozens to hundreds of trials for an animal to express its learning (e.g., see Washburn et al., 1989). For courses in which instructors would like to cover multiple topics and demonstrations of comparative research, spending weeks training on one topic (e.g., memory) may not be feasible. Instead, the current laboratory exercise involved one to two class periods (depending on the number of animals tested that year) of approximately 1-2 hr each. The pointing task used here allows for minimal training on the part of animals and researchers and can be deployed with little in the way of materials.

Pointing is a gesture used primarily in humans to communicate location and intentions (as reviewed in Miklósi & Soproni, 2006). Examining how animals perceive and understand this communicative gesture may allow better understanding of interspecies communication and perhaps even an understanding of another's intention (Miklósi & Soproni, 2006; Povinelli et al., 1992; but see Elgier et al., 2012; Heyes, 1998, for other explanations). Pointing tasks typically involve the animal choosing between two objects containing food. A human experimenter indicates one of those objects through a pointing gesture, and the animal is allowed to make a choice, receiving rewards for choosing the indicated object (for review, see Miklósi & Soproni, 2006).

While a number of domestic animals have been tested on this pointing procedure, including dogs (D'Aniello et al., 2017a; Miklósi et al., 2003; Udell et al., 2008), cats (Miklósi et al., 2005), horses (Proops et al., 2010), and goats (Kaminski et al., 2005), it provides a good test because other species have not been tested (e.g., pigs, chickens, alpaca), and there are still a number of theories about why animals follow pointing. The pointing task can also include a number of experimental variations to see the impact that its different aspects have on responding. For example, in the present exercise, students compared pointing alone to alternating gaze between the animal and the direction of an object without a point to pointing and gazing combined; these were a combination of the methods used in Proops et al. (2010) and Kaminski et al. (2005) in horses and goats respectively. Additionally, control trials can be used in which no pointing or gazing occurs (e.g., D'Aniello et al., 2017b; Hare & Tomasello, 1999; Kaminski et al., 2005), or trial types can be compared to chance levels alone (e.g., Elgier et al., 2012; Proops et al., 2010) based on time available and the learning goals of the assignment. A variety of other test trials can be used and may affect outcomes for the animals (see Miklósi & Soproni, 2006, for a number of variations that can be done). Typical dependent variable measures for this experiment are correct choice counts or percentages (compared to chance levels) and latency to choice (Miklósi & Soproni, 2006).

One theory that can be tested among farm animals is the degree of domestication (Hare et al., 2002; Miklósi & Soproni, 2006). This theory posits that animals follow human pointing gestures based on the degree that they have been domesticated by humans. Thus animals with a long history of domestication (e.g., dogs, cats, goats) appear to perform better than animals with a shorter history of domestication or none at all (e.g., chimpanzees and wolves; as reviewed in Kaminski et al., 2005). This test allows for maximal flexibility in testing a variety of species that might be available to the class while allowing students to test a theoretical question. Although dogs have been tested extensively, they do provide a nice demonstration for the students of an extremely successful animal in this pointing task and are typically easily accessible to a class.

The Assignment

The full assignment that is given to students is attached in the Appendix. In order to practice finding and integrating literature into a manuscript, students were required to read three articles (Kaminski et al., 2005; Miklósi & Soproni, 2006; Proops et al., 2010) and then to find a fourth article on their own. These three articles were chosen as they provide a good overview of the task and methods used to study pointing and the theory of domestication in explaining responses to pointing. There are, however, gaps, and students are expected to find at least one article that will help answer questions about the species tested in that class. For many students in this course, it is their first exposure to reading scientific articles, so I keep the number of articles to read smaller, but this could certainly be scaled up to meet the needs of more advanced coursework in comparative psychology. Students must write a full American Psychological Association (APA) manuscript including graphs. Below, I will describe some of the variations that we have completed or that could be done with this laboratory exercise.

Animals

As described above, this assignment allows for incredible flexibility for students to test animals that might be present in nearby facilities or that might be brought into the classroom. Instructors might consider using their own personal animals or animals from nature centers, pet stores, shelters, or zoos (Abramson, Huss, et al., 1999; Highfill & Yeater, 2018). In order to create opportunities for students to work with local animal facilities, it is important to create a relationship with those facilities. Contacting local shelters and nature centers by phone or email can create a long lasting relationship for student research and internships (Abramson, Huss, et al., 1999). Many facilities appreciate the connection to local students whom they rely on for volunteer positions. However, if no facilities are present in nearby communities, courses can still utilize domestic animals owned by faculty or staff (e.g., dogs, cats, rodents, etc.).

After establishing the location and species to be used, Institutional Animal Care and Use Committee (IACUC) approval is necessary. Typically, this can be done with expedited review because the experiment is low stress and the animals do not require on-campus housing, but check with local IACUC committees for their own regulations in this regard.

The first time this laboratory was completed, we worked with a local nature center to test two goats and two pigs, all of which had been used for programs with large groups of people. The second time this laboratory was completed, we used my own two pet dogs (a Collie and a Labrador mix), a pet cat (domestic shorthair), a neighbor's three fainting goats, and a local rescue's three alpaca. This experience highlighted the importance of making sure that animals are comfortable around larger groups of people before testing in a situation with a large group of students. While the dogs, cat, and alpaca were fairly comfortable around people, the fainting goats became extremely stressed and predictably fainted during the experiments. The alpacas were not the most cooperative during the experiment, and only pointing trials were completed on a single animal. This past year, we again tested two dogs and a cat, but we also added to the test two chickens. Once again, however, the stress of the chickens around so many people prevented accurate testing. While not ideal, the failure of an animal to complete a task can also be a good teaching moment to discuss stress and comfort with people and the role that it plays in animal studies (e.g., the dolphin and seal who successfully completed the pointing task were exposed to people extensively, as reviewed in Miklósi et al., 2005).

Materials

Few materials are used for this experiment. We used two rubber or metal dog bowls approximately 21 cm in diameter and 10 cm deep. These can be substituted as needed with whatever bowls might be available. We also used a flattened cardboard box (approximately 1.0 x 0.5 m) to block the animals' view during baiting. Food for baiting was selected to be a highly preferred treat for that animal. Additionally, it is best to conduct the experiment in an enclosed environment when possible. When working with farm animals, this can be a stall or fenced yard. Dogs and cats may be placed on a long leash or in a fenced area.

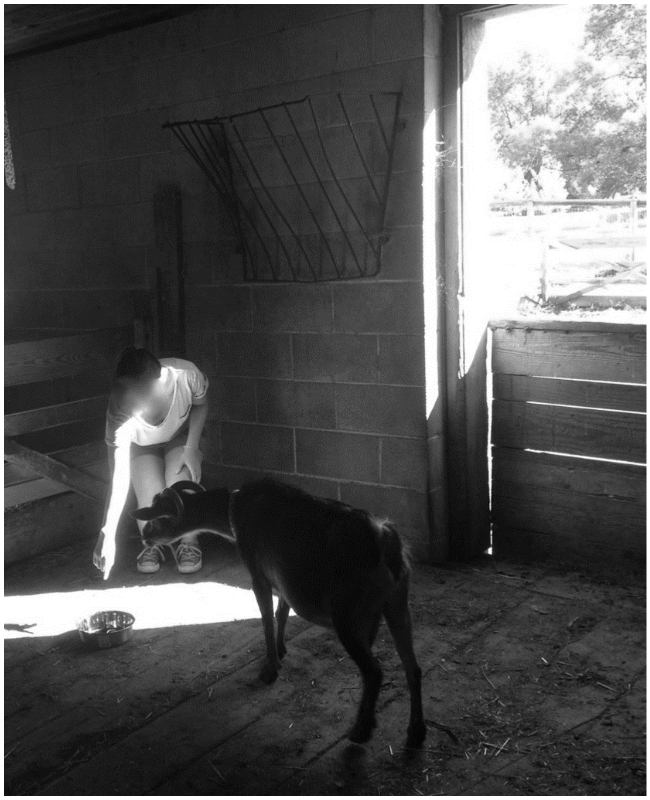
Procedure

This experiment works best when each animal can be isolated in a holding pen (see Figure 1), but we have done this even when there was more than one animal around. When multiple animals were present, we just used body blocking to only allow one animal to engage with the testing at a time. Bowls were placed approximately 1 m apart from each other and approximately 2.5 m from the animal (see Figure 2; set up similar to Kaminski et al., 2005). Initially, both bowls were baited with a small amount of treat, and the animals were allowed to freely eat from each bowl, which allowed for association between the bowls and food to be created (Miklósi & Soproni, 2006; Proops et al., 2010). If the animals were reluctant to eat from the bowls, attention was drawn to the bowls by shaking the food inside or leading the animal to the food bowls.

The class for this project was typically 15-30 students taking an intermediate (200 or 300 level) course in animal cognition. All students were transported to the location of the testing using college vehicles. Students were divided into groups to test different animals at the same time. Students were assigned different roles in the experiment. One student acted (sometimes with help from the animal caretaker) as a *wrangler* who would direct the animal to the starting position after each trial. This was done mostly using body pressure with spread out arms in the farm animals but with leashes or carrying in the pets. Another student was assigned the role of the *indicator*. The indicator stood approximately 1 m behind the bowls (see Figure 2) and pointed to the correct bowl on each trial to produce a distal point (~0.6m between the fingertip and the bowl), which has been tested across several species (see review in Miklósi & Soproni, 2006). Students were also in the role of the *blocker*, who held the cardboard up to block the view of the animal during baiting, and the *baiter*, who placed the food in the bowls each trial. Finally, any remaining students were given roles in assigning random trial types, timing latency to choice, and data recording.

Figure 1

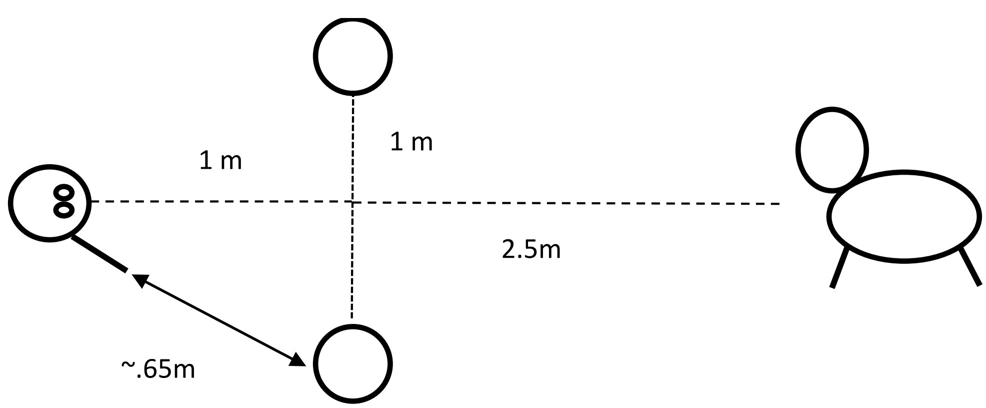
Testing Environment Used for One of the Goats



Note. The image shows the indicator, following a correct choice by the goat, encouraging the goat to eat the food by the bowl.

Figure 2

Experimental Set-up



With the animal in the starting position for the trial, the bowls were placed upside down and baited with the blocker in place to prevent visual cues. Both bowls were baited to control for odor, but the animal was only allowed to eat from the indicated bowl. Once the bowls were baited, the indicator pointed and/or gazed at the correct bowl according to the trial type for the duration of the trial (maximum of 2 min). The trial types were adapted from Kaminski et al. (2005):

1) Pointing + Gaze: The experimenter, standing approximately 1 m from the bowls, pointed by extending their arm and extending their first finger and directed their head and eyes first at the animal and then in the direction of the correct bowl (randomly assigned). The gaze continued to alternate between the animal and the bowl until the choice was made.

2) Pointing: The experimenter pointed by extending their arm and extending their first finger in the direction of the correct bowl. The eyes and head of the experimenter remained straight forward.

3) Gaze: The experimenter directed their head and eyes first in the direction of the animal and then in the direction of the correct bowl. The arms of the experimenter remained at their side. The gaze continued to alternate between the animal and the bowl until the choice was made.

An answer was recorded as a choice when the animal approached within 30 cm of the bowl within 2 min of the gesture. If the animal chose correctly, the bowl was turned over by the indicator, and the animal was allowed to eat the food (see Figure 1). If the animal chose incorrectly or after the animal finished eating, they were moved by the wrangler back to the starting point to begin another trial.

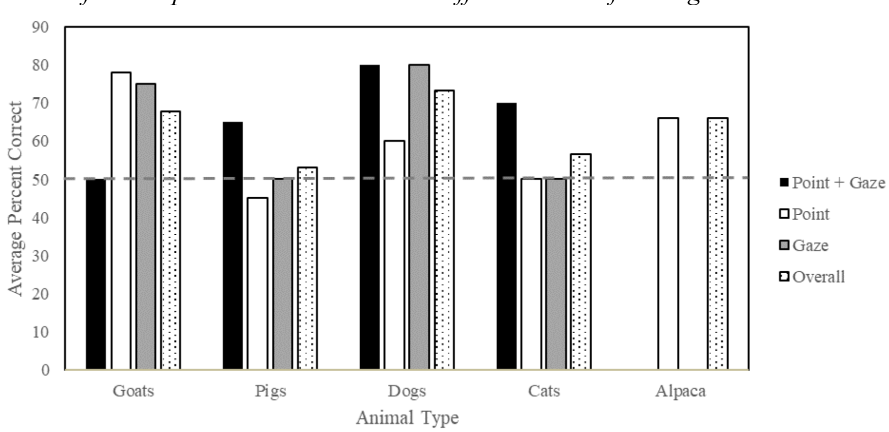
Students were asked to randomly present the trials in a counterbalanced order to the animals with the stipulation that no more than two trials in a row should be done with the same bowl. Based on time available, students completed between 5 and 10 trials of each type. The more trials, obviously, the better, but the results are interesting to observe even with fewer trials. In approximately one hour, students can test two animals with 15-30 total trials per animal. Thus, breaking students into groups allows for more animals to be tested and more animal contact for the students.

Outcomes

While the data collected in this laboratory exercise are certainly not of the quality necessary to publish research findings, the exercise does what it was intended to do, which is to expose students to methods of data collection in a comparative cognition course. Students see firsthand the challenges that are present when working with animals. When testing different species, they get to see how innate behaviors might set some animals up to be easier test subjects than others. Using this lens, students write up their reports discussing why some animals did or did not succeed in the pointing test. As an example of performance, the data in Figure 3 show the average percent correct of different species that have been tested over the three years that I have run this experiment with my class.

Figure 3

Average Percent Correct of Each Species Across the Three Different Years of Testing



Note. The dotted line indicates chance performance.

Students can accurately discuss the theories of domestication and what role it might play in this test. Additionally, students can report on the comfort of different species and individuals with humans. Our failure to test chickens and fainting goats, as well as two out of the three alpacas, demonstrate typical challenges of animal research. This leads to good discussions of habituation and practice trials in animal research. Additionally, these experiences provide great examples for students to practice interpreting behavioral observations, such as stress behaviors. Students wrote in their papers about how stress may have contributed to the performance of different animals. They noted that the cats tended to bury their heads into the wranglers arms, which caused them to miss some of the pointing signals. In contrast, students observing the pigs did not report stress but instead noticed the impulsiveness of the animals, noting that the pigs ran immediately to a bowl without really attending to the gestures, while the goats seemed to "pause and observe the gestures" before deciding. This then can provide another opportunity to discuss anthropomorphism and being careful and accurate in our descriptions of behavior.

Besides animals that refused to take part in the study, we have had very few challenges come up in working with the animals. Sometimes the animals have not liked our first treat choice, so doing a little piloting of preferred food for each individual animal may help trials go more smoothly.

Students generally enjoy the farm laboratory and view it as a highlight of the course. They frequently comment on end of semester course evaluations about taking the field trip to work with animals as one of their favorite experiences in the class. One student wrote: "I really liked the farm trip and the content of the course. I find myself thinking about the topics often outside of class and feel better able to critically analyze articles." Another wrote that the thing they would remember most was "the farm lab field trip (so much fun)" and asked for more field trips.

Overall, this is an easy and fun laboratory that can be implemented virtually anywhere. This laboratory provides an excellent opportunity for data collection and hands-on animal experience. Given the positive effects of being around animals and the increase in learning that often happens when using animals, it is a good way to teach comparative psychology to the next generation of students.

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