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A Two-Choice Preference Assessment With Five Cotton-Top Tamarins (*Saguinus oedipus*)

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A study selected 5 cotton-top tamarins (*Saguinus oedipus*) located at the Frank Buck Zoo in Gainesville, Texas, for a food preference assessment. The study used a paired-choice procedure across 7 different food items for all 5 tamarins. Preferences for the food items across all the tamarins varied, although general trends were noted as well. This article discusses the benefits of using paired-choice preference assessments in zoo settings.

During the past several decades, a number of researchers have attempted to quantify food preferences, (Thompson & Grant, 1971; Young & Chaplin, 1945; Young & Kappauf, 1962). However, only recently have researchers in applied settings focused on systematic preference assessments. Much of this research has focused on choosing one stimulus more frequently than another (Pierce & Epling, 1999). Several of the preference assessments developed include single-, paired-, and multiple-stimulus methods.

Fisher et al. (1992) developed a systematic approach to differentiate between preferred and nonpreferred stimuli. They described a method in which stimuli were presented in concurrent pairs to an individual who then would select one of the stimuli (paired choice).

When every combination was presented, the researchers then ranked the stimuli on the percentage of times an individual selected that stimulus. Fisher et al. (1992) compared this method to the Pace, Ivancic, Edwards, Iwata, and Page (1985) method, in which stimuli were presented individually to the subject and ranked on

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the approach and nonoccurrence of the item. Approach was defined as the subject moving toward the item with any part of its body within 5 sec. Nonoccurrence was defined as absence of a response within 5 sec. The results of Fisher et al. were that both methods identified potential reinforcers for all of the individuals. However, the paired-stimulus method was found to be more accurate in identifying highly preferred stimuli. One problem with the single-stimulus preference assessment method is that it may be limited because of a tendency for the individual to approach an available stimulus, regardless of whether that stimulus would function as a reinforcer for a response other than the approach (Roscoe, Iwata, & Kahng, 1999).

Although this technique has been used in applied settings for the past decade, most of the published research applies to nonapplied purposes or uses humans as subjects. Recently, however, zoos and aquariums have focused more on training through operant conditioning techniques and increasing nonhuman animal welfare through food and other enrichment items. Coinciding with this increase in training techniques and the use of environmental enrichment is the need to answer questions such as which training methods work better, which items produce increases or decreases in desired or undesired responses, which reinforcers will be the most effective in a training program, and how to measure changes in the welfare of captive animals.

Reinforcement is a central mechanism in the development of operant behavior, and the process of choosing a reinforcer often is taken for granted (Pace et al., 1985). Choosing an effective reinforcer is an important step in any training procedure. It is likely that at least some of the failures to effect behavior change can be attributed to defective stimulus selection rather than to contingency mismanagement (Pace et al., 1985; Repp, Barton, & Brulle, 1983).

In this experiment, we examined the use of a paired-choice assessment across seven food items with five cotton-top tamarins (*Saguinus oedipus*). Initially the project was intended to train all five tamarins to touch and hold to a target; however, the experimenters found it hard to keep the subject around for training and thought that a food preference assessment might determine potential rewards more accurately.

METHOD

Subjects, Setting, and Materials

Five cotton-top tamarins (*Saguinus oedipus)* located at the Frank Buck Zoo in Gainesville, Texas, were used in this study. Vania was a 14-year-old female tamarin and was the mother of Vicuna, Moth, and Hawk. Dida was an 11-year-old male tamarin and was the father of Vicuna, Moth, and Hawk. Vi-

cuna was a 6-year-old female tamarin. Moth was a 4-year-old male tamarin. Hawk was a 3-year-old male tamarin. All five resided in a 12 × 12 m (total width and height) octagon cage enclosure located in the middle of the zoo and were accessible for view by the public from all sides of the enclosure. All five tamarins were born in captivity, with Vania, Dida, Vicuna, and Moth coming from the University of Wisconsin's Snowden lab in June of 1999, and Hawk born at the zoo. All research was conducted with the tamarins in their housing enclosure.

Seven different food items were used during the study: raisins, grapes, bananas, Fig Newtons, graham crackers, Apple Jacks, and mealworms. Raisins, grapes, bananas, Fig Newtons, graham crackers, and Apple Jacks were presented in .5 – 1.25 × .5 – 1.25 cm pieces, whereas mealworms were fed live and whole. All food items were presented using a pair of 2 × 12 cm yellow plastic tweezers. Each of the food items used was part of all the tamarins' normal diet or enrichment schedule. All food selections made during the study were recorded on data sheets, listing the predetermined orders for all tamarins and trials.

Data Collection and Procedures

Methods were similar to those used by Fisher et al. (1992) for presenting stimuli in concurrent pairs. All five tamarins initially were allowed to approach and sample each of the seven food items presented individually with the tweezers (sample condition). A list of pairs for all seven items was then produced, presenting each food item on the left against all six other food items, also on the right side, thus having each food item presented in every possible combination: 12 presentations for each food item and 42 total food presentation trials for each tamarin. To minimize potential order effects, the list of pairs was randomized for each tamarin individually and then listed on the data recording sheets. Paired choices were presented several inches apart from each other, using tweezers, both several inches away from the cage and directly in front of the tamarin. Which tamarin selected to be run for a given trial was based on observing who was either present in front of the experimenter or who was likely to approach when presented with a paired-food trial. During a trial, only the tamarin selected for that trial was allowed to choose a food item—only one of the two food items presented. Having other tamarins interfere with a trial was avoided by having another researcher distract the other tamarins or by repositioning the food items where only the desired tamarin successfully could approach the items.

A food selection was determined when the tamarin run in the trial grasped and removed one of the two food items from one of the tweezers. During the initial sample condition (when food items initially were presented individually to each tamarin), the same criteria were used for determining a successful selection. During the sample condition, two tamarins refused to sample one of the food

items—although not the same food item for both. Three separate attempts were made to present that food item but with no success. During choice conditions, all five tamarins always met the previous definition for selecting one of the seven food items.

Data were collected by recording both the food item selected and the position of that item for any given trial. Each preference assessment took 1 to 4 days for each tamarin. The entire study took 10 days to complete.

RESULTS AND DISCUSSION

All five tamarins varied greatly in their total food preferences. Figure 1 shows each tamarin's number of selections for each of the seven food items. Dida selected graham crackers 12/12 times; raisins 9/12 times; Fig Newtons 7/12 times; grapes 6/12 times; Apple Jacks 5/12 times; mealworms 2/12 times; and bananas 1/12 times. Moth selected both Fig Newtons and graham crackers 10/12 times; both grapes and mealworms 8/12 times; raisins 4/12 times; Apple Jacks 2/12 times. He never selected bananas during the choice conditions. Hawk selected mealworms 11/12 times; Fig Newtons 8/12 times; raisins, grapes, and graham crackers 6/12 times; Apple Jacks 5/12 times. He never selected bananas during the choice conditions. Vainya selected raisins 11/12 times; both grapes and graham crackers 8/12 times; Fig Newtons 7/12 times; mealworms 6/12 times; and bananas 2/12 times. She never selected Apple Jacks during the choice condi-

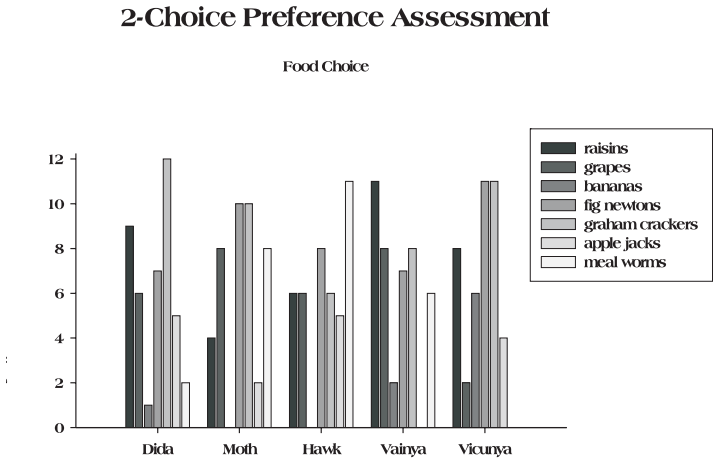

FIGURE 1 Number of selections (out of 12) for each food item and each tamarin during the paired-choice preference assessment.

tions. Vicunya selected both Fig Newtons and graham crackers 11/12 times; raisins 8/12 times; bananas 6/12 times; Apple Jacks 4/12 times; and grapes 2/12 times. She never selected mealworms during the choice conditions.

Although there was great variance between tamarins in terms of food preferences, there also was a general trend for the overall selection of food items among all five tamarins. Graham crackers were selected 47/60 times; Fig Newtons 43/60 times; raisins 38/60 times; grapes 30/60 times; mealworms 27/60 times; Apple Jacks 16/60 times; and bananas 9/60 times. Thus, it appears that certain foods, such as graham crackers or bananas, either were generally favored or not favored by all five tamarins. However, there also was considerable variance in selections between the tamarins (see Figure 1).

Therefore, preference assessments may play an important part in determining individual preferences within a species. Although ranges in food selections are likely to have important phylogenetic components, the following study demonstrates that individual differences can be considerable and should be taken into account when determining potential enrichment items, diets, and rewards for operant training procedures.

The position of the food item appeared to have little effect on actual food choice. Dida chose food on the left side on 20/42 trials, Moth chose food on the left side on 22/42 trials, Hawk chose food on the left side on 20/42 trials, Vainya chose food on the left side 23/42 trials, and Vicunya chose food on the left side on 20/42 trials. Overall, a food item on the left side was chosen 105/210 trials, or 50% of the time.

For two of the tamarins, one of the food items was not selected during the initial sampling condition. That food item was Apple Jacks for Vainya and mealworms for Vicunya. Also, during the actual preference assessment, neither of the two tamarins selected those food items during any of the paired presentations.

During the past decade, the use of operant principles and procedures for applied purposes has dramatically increased in zoo and similar captive animal facilities. Many examples include using reinforcement techniques for behavior management and husbandry purposes. Animals might be trained to move or "shift" from their enclosures to a holding area; present a limb or other body part for medical examination; interact with other animals in the enclosure; provide blood, urine, or semen collections; or to reduce aggression or other aberrant behaviors. In many of these procedures, finding adequate potential reinforcers is an integral part of a successful training protocol. Often, however, little is known about what would work as a reinforcer for some particular response; instead, what might work as a reward is assumed. In this context, several of the zoo staff suggested that grapes would be good potential reinforcers. After several unsuccessful attempts to use grapes for the previous training project, the following preference assessment study was conducted. In our study, one can see that grapes were the fourth most selected item overall, suggesting that several other food items would serve as more adequate potential reinforcers.

Similarly, the use of environmental enrichment for captive animals has increased during the past several decades. Often, environmental enrichment is implemented by introducing different food and nonedible items into an animal's enclosure. Often, as with the selection of reinforcers, little is known about how an animal will interact with an enrichment item before its introduction. Numerous items might be presented individually before finding an item or set of items that produce the desired behaviors in the captive animals. Using preference assessments for identifying preferred enrichment items also might prove beneficial, where zoo personnel systematically could compare different enrichment items, thereby more accurately assessing with which items the animals are more likely to interact or to eat.

It is likely that the use of operant procedures and environmental enrichment will continue to grow as a means for improving animal welfare in captive settings. Therefore, the need for systematically identifying potential reinforcers and enrichment items will become more evident. Individual differences can be considerable within a species, thereby making the selection of potential rewards and enrichment items an individual process. In addition, assuming what animals prefer, instead of systematically assessing their preferences, can lead to less adequate rewards and enrichment items used. Two-choice preference assessments make an ideal procedure for quickly, easily, and accurately identifying preferences in zoo and other captive animal settings.

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