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Functional Analysis of Aggression in a Black-and-White Ruffed Lemur (Varecia variegata variegata)

Valeri Farmer-Dougan

Department of Psychology, Illinois State University

A functional analysis was conducted to assess the antecedent and reinforcing conditions underlying aggressive behavior in a female lemur in captivity. Results showed that her aggression was primarily the result of human attention. A replacement behavior-training program was introduced, and the lemur's aggression was successfully eliminated. These results demonstrate the utility of using functional assessment and analyses in zoos with captive wild nonhuman animals.

Keywords: functional analysis, aggression, lemur

Using functional analysis to identify the antecedents and consequences of behavior is well-established in human settings (Crosland et al., 2003; Dunlap, Carr, Horner, Zarcone, & Schwartz, 2008; Freeman et al., 2002; Hanley, Iwata, & McCord, 2003; Najdowski, Wallace, Ellsworth, MacAleese, & Cleveland, 2008; Perrin, Perrin, Hill, & DiNovi, 2008). The term functional analysis typically is used to describe a procedure used to identify potential consequences that maintain problem behaviors in humans (Iwata, 1995; Iwata, Dorsey, Slifer, Bauman, & Richman, 1994; Iwata, Pace, et al., 1994; Phillips & Muciford, 2008). The procedure includes both direct observation and measurement of behavior across a variety of setting conditions. Each setting condition could be used to assess the role of different reinforcement contingencies in the maintenance of problem behavior. (For a review of the literature on functional analyses in humans, see Hanley et al., 2003.)

Data from the functional analysis may then be used to develop a treatment plan. The treatment plan addresses how to alter reinforcement contingencies to produce a reduction in problem behavior. For example, the use of differential reinforcement of alternative behavior schedules has been shown to be one highly effective method for changing the relationship between an inappropriate reinforcer and the problematic behavior (Piazza et al., 1997).

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Given the robust effectiveness of this approach with humans, it would be logical to extend its application to nonhumans, particularly wild nonhuman animals in captivity. However, it appears that only a small number of papers have specifically attempted to use functional analysis in captive wild animals (Bloomsmith, Marr, & Maple, 2007; Dorey, Rosales-Ruiz, & Lovelace, 2009; Dorey, Tobias, Udell, & Wynne, 2012; Martin, Bloomsmith, Kelley, Marr, & Maple, 2011; Vollmer, Borrero, Wright, Van Camp, & Lalli, 2001).

One difficulty in using functional assessments to determine the function of problematic behavior in captive wild animals is the need to include factors not readily applicable to typical human or laboratory animal settings. For example, housing may play a strong role in the development of self-injury or aggression (Bellanca & Crockett, 2002; Kinsey, Jorgensen, & Novak, 1997; Lutz, Well, & Novak, 2003; Reinhardt & Rossell, 2001; Watson, 1992). Dysfunctional behavior may emerge due to inappropriate social conditions such as separation from sexual partners or social companions (Chamove, Anderson, & Nash, 1984; Erwin, Mitchell, & Maple, 1973; Redican & Mitchell, 1973). Finally, the environmental consequences of humans, particularly keepers, must not be overlooked.

As with humans, rewarding aggression is likely to increase these behaviors in captive nonhuman animals. For example, Schaefer (1970) demonstrated shaping of head banging through contingent delivery of food reinforcement in two rhesus monkeys (Macaca mulatta) within a laboratory setting. Similarly, Dorey et al. (2009) demonstrated how keeper behavior maintained self-injury in a captive olive baboon. Primates in particular appear to show aggression in the presence of an audience, be it a zookeeper or visitors to the zoo.

Hosey (2005) noted that the aggression observed in primates primarily occurred when at least one person attempted an interaction with the animal. Aggression was much less likely to occur if the audience was passive—that is, ignoring the animal. Both Hosey and Druck (1987) and Mitchell et al. (1992) found that intragroup interactions were more likely to be aggressive in the presence of an audience than when the animals were alone. Interestingly, Mitchell et al. found that, at least for golden-bellied mangabeys, audience-directed aggression differed between the male and female mangabeys. The authors interpreted this as the animals differentially perceiving humans as agonistic competitors.

Given the work on aggression in the presence of an audience, one potentially potent, but also potentially forgotten, maintaining stimulus that appears to elicit aggression in captive animals may be the behavior of the caregiver with respect to the animals. Keepers might accidentally reinforce aggression by providing contingent attention, food, or toys any time the animal emits an aggressive response. Alternatively, the animal may use aggression to avoid or escape unpleasant events such as the presence of humans in the enclosure, demands made upon the animal for health inspections, or forced movement as an area is cleaned. All of these reactions would be consistent with Mitchell et al.’s (1992) suggestion that primates may potentially view the zookeeper as a competitor.

The present investigation was used to assess aggression toward a male zookeeper by a female lemur. A functional analysis and functional analysis checklist were used to determine the maintaining reinforcers for aggression by this female lemur. The lemur, W., was referred to the author by local zookeepers due to her high levels of aggression (e.g., biting and clawing). She had been scheduled for euthanasia, as her keepers felt they could no longer safely complete her daily care. Assessment of her behavior was twofold: (a) A functional analysis was conducted...
to determine the antecedents for and consequences of the aggression, and (b) a program for reducing the aggression was implemented.

MATERIALS AND METHODS

Subject

The subject for the study was a 10-year-old, spayed, female black-and-white ruffed lemur (*Varecia variegata variegata*) named W. Two 10-year-old, neutered male lemurs resided in the enclosure with W. All three lemurs were born and reared in captivity. The three animals had been housed together for approximately 3 years. The project was approved by the Illinois State University and Miller Park Zoo Institutional Animal Care and Use Committees, and all observations and interventions were conducted in compliance with U.S. Department of Agriculture and National Institutes of Health guidelines.

Housing and Training Setting

The lemurs were housed at Miller Park Zoo in, Bloomington, IL, a small Association of Zoos and Aquariums-accredited zoo. There were two interconnected enclosures: The indoor enclosure (approximately 3.05 m \(\times\) 2.4 m \(\times\) 3.7 m) was concrete with a glass front. The outdoor enclosure (approximately 9.14 m \(\times\) 6.10 m \(\times\) 3.7 m) was completely enclosed with 2.25-cm metal fencing. The animals could move freely between the two enclosures during daylight hours. Both areas contained tree limbs, housing huts, feeding stations, and a child’s climbing rope. The lemurs were fed once daily with a diet consisting of lemur chow, fresh fruits, vegetables, and cereal (e.g., Cheerios, Fruit Loops). The lemurs had continuous access to water. Red-footed tortoises also resided in the outdoor enclosure and shared the food that fell to the ground.

Referring Behavior

The female lemur was referred because of increasing aggression and inappropriate behavior toward keepers, including scratching, biting, clawing, and jumping on keepers’ backs. Aggression occurred on a daily basis and was sufficiently severe that keepers entered the enclosure armed with brooms to push her away. Paperwork accompanying W. upon her arrival at the zoo 3 years earlier suggested she had previously been punished by being hit and/or chased with sticks or brooms as a means of reducing her aggression. Further, she had been kept in an isolation cage away from other lemurs and humans at her prior residence, and was only recently housed in a group situation at this small zoo.

Data Collection Procedures

Data were collected first during a functional analysis and then during a training condition. Functional analysis sessions were 10 min long; training sessions were 30 min long. The functional analysis sessions were conducted during six separate daily observations during an
8-day period. Intervention began the Monday after the last functional analysis session, with training sessions conducted 3 to 5 days per week.

**Functional assessment and functional analysis.** Two forms of data were collected. First, the Captive Animal Functional Analysis Checklist (CAFAC) was completed by two keepers and a keeper-trainee prior to the functional analysis. This checklist is shown in Table 1 and results are shown in Table 2. The checklist answers were tallied, and the checklist results were used to determine the possible antecedents and consequences of W.'s aggression.

Second, a functional analysis was conducted and compared to the CAFAC results. The conditions used during the functional analysis were based on traditional categories and settings used in the literature (e.g., ignore, demand, alone, and contingent used by Dorey et al., 2009). Although the use of more settings in the functional analysis would have been useful, it was critical to minimize the number of observational sessions for the functional analysis: The decision had been made to euthanize W., and there was limited time to demonstrate that her behavior could be changed.

Observational data included counts of the number of interactions, approaches, or aggressions (defined as attempting to, or successfully, scratching, biting, clawing, and jumping on keepers’ backs) by W. and zookeeper touches toward W., as well as attention or food given by the zookeepers. Separate data were collected for aggressions toward the male keeper and the female keeper. Data were recorded under three conditions. First, there was an ignore condition in which the keepers entered without food or the broom and ignored W. (two sessions). In this condition, food items were freely available on perch and access was noncontingent. Zookeepers talked to W. in a nonaggressive manner and would leave a piece of food near her, but they did not require any behavior from her.

Second, there was an attention condition in which keepers entered the enclosure without food or the broom and interacted with W., including talking to her, touching or rubbing her back, or giving her treats, when she approached them (two sessions). Third, there was a demand condition in which keepers entered the enclosure with food and provided food items or attention to W. only when she sat on her perch or sat on her perch while holding her hand out for food (two sessions).

For safety reasons, during all six functional analysis sessions, the keepers carried a water bottle to spray W., contingent upon an aggression (defined as attempting to, or successfully, scratching, biting, clawing, and jumping on keepers’ backs). Although the use of a punisher (spraying water) is generally not part of a traditional functional analysis, this was the only way the superintendent of the zoo would allow the study to be conducted, given that W. had previously bitten zookeepers quite severely, resulting in trips to the emergency room. A squirt punishment was defined as three trigger pulls/squirts from the bottle directly to the face/head of W. Her typical reaction when squirted was to back away to the corner of the enclosure or go to her nest box.

**Behavior training intervention.** Following the completion of the functional analysis and the CAFAC, the data were analyzed and a behavior training program was developed to shape more appropriate social interactions. Two behaviors were shaped using a multiple baseline: (a) sit on a target station that was introduced into the enclosure (small carpet squares mounted
TABLE 1
Captive Animal Functional Assessment Checklist

<table>
<thead>
<tr>
<th>CAFAC</th>
<th>Captive Animal Functional Analysis Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(An adaptation of the FAST: Functional Analysis Screening Tool)</td>
</tr>
</tbody>
</table>

The CAFAC identifies factors that may influence the occurrence of behavior problems in an animal. It is one component to a functional analysis of behavior for a specified behavior problem. Keepers or trainers who interact with the animal or who have had recent contact with the animal should complete the CAFAC by answering the relevant information and then circling Y (yes) or N (no) for each behavior listed. A scoring rubric is included at the end. The results can then be used to determine the antecedents and maintainers of the ongoing behavior.

Animal: ______________ Date: ______________
Species ______________ Sex: M F
Spayed or Neutered? Y N Age: ______________
Location: ___________________________
Informant: ___________________________

Information-animal relationship: The person completing this checklist is (circle most appropriate):
Main keeper with contact:
- Daily 2–3× weekly weekly weekends only
- 2–3× month Other: ___________________________
Occasional keeper with contact:
- Daily 2–3× weekly weekly weekends only
- 2–3× month Other: ___________________________
Trainer with contact:
- Daily 2–3× weekly weekly weekends only
- 2–3× month Other: ___________________________

In what situations do you usually interact with the animal (Check all that apply)
Cage cleaning:
- Daily ______________ 2–3× weekly weekly weekends
- Other: ___________________________
Feeding:
- Daily ______________ 2–3× weekly weekly weekends
- Other: ___________________________
Grooming:
- Daily ______________ 2–3× weekly weekly weekends
- Other: ___________________________
Training:
- Daily ______________ 2–3× weekly weekly weekends
- Other: ___________________________

Y N 1. The behavior occurs most often in the presence of other animals.
Y N 2. The behavior occurs most often in the presence of keepers or trainers.
Y N 3. The behavior occurs often in the presence of visitors, keepers/trainers, and other animals.
Y N 4. When the behavior occurs, you usually try to calm the animal down or distract the animal with preferred food, toys, or activities.
Y N 5. The behavior usually does not occur while the animal is getting lots of attention or when the animal has its favorite items or food.
Y N 6. When the behavior occurs, you usually let the animal leave you or stop requiring the animal to perform a task such as:
   a. During moves from one cage to another
   b. During daily care routines
   c. During training sessions
Y N 7. When the behavior occurs, you usually give the animal a break from the ongoing situation.
Y N 8. The animal usually resists complying when required to move from one area to another.
Y N 9. The animal usually resists complying during daily care routines.
Y N 10. The behavior does NOT occur when the animal has had access to new items or food.
Y N 11. The behavior usually occurs when the animal is alone.
Y N 12. The behavior usually occurs when the animal is with other animals, but not with a human.
Y N 13. The behavior usually occurs when food is introduced into the cage even if the animal is alone.
Y N 14. The animal moves away from food/preferred items when another animal approaches the food or preferred item.
Y N 15. When the animal is near food/preferred item it will chase off or aggress to another animal who approaches the food or preferred item.
Y N 16. The animal does NOT engage in appropriate forms of play, social interaction, or group behavior.
Y N 17. The animal engages in repetitive “self-stimulatory” behaviors such as pacing, rocking, turning, or repetitive manipulation of an object.

(continued)
TABLE 1 (Continued)

<table>
<thead>
<tr>
<th>Y</th>
<th>N</th>
<th>18. The behavior occurs at high rates regardless of who or what is going on around the animal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>N</td>
<td>19. The behavior occurs in cycles that last several hours or days.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>20. The animal has a history of or recurrent illness.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>21. The behavior occurs more often when the animal is sick.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>22. The behavior occurs in the presence of a dominant animal.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>23. The behavior occurs in the presence of a less dominant animal.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>24. The animal is the most dominant of the group.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>25. The animal is the least dominant of the group.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>26. The animal assumes a submissive posture when around humans.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>27. The animal vocalizes or engages in search behaviors when other animals are removed from its cage.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>28. The animal vocalizes or engages in social behaviors toward humans when humans enter or leave its cage.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>29. The animal is more often with another animal or group than alone.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>30. The animal watches and follows human activities in an active, but not submissive, posture.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>31. The animal watches or interacts with other animals in its group in an active, but not submissive, posture.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>32. When separated from other animals, the animal shows signs of distress such as withdrawal, vocalizations, or escape behavior.</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>33. The animal seems to anticipate the delivery of food items or preferred items/activities.</td>
</tr>
</tbody>
</table>

Scoring Summary

For each statement that was answered “yes,” circle the corresponding number below.

Social reinforcement to humans

\[
\begin{array}{ccccccc}
2 & 4 & 5 & 10 & 28 & 30 & = \text{__/6} \\
\end{array}
\]

Social reinforcement to other animal(s)

\[
\begin{array}{cccc}
1 & 12 & 27 & 29 & 31 & 32 & = \text{__/6} \\
\end{array}
\]

Social reinforcement for food/preferred item

\[
\begin{array}{cccc}
1 & 2 & 4 & 5 & 13 & 33 & = \text{__/6} \\
\end{array}
\]

Social reinforcement-ESCAPE from human

\[
\begin{array}{cccc}
2 & 6 & 7 & 8 & 9 & 26 & = \text{__/6} \\
\end{array}
\]

Social reinforcement-ESCAPE from other animal

\[
\begin{array}{cccc}
1 & 7 & 12 & 14 & 22 & 25 & = \text{__/6} \\
\end{array}
\]

Social dominance

\[
\begin{array}{cccc}
1 & 8 & 9 & 15 & 23 & 24 & = \text{__/6} \\
\end{array}
\]

Automatic reinforcement-self-stimulation

\[
\begin{array}{cccc}
3 & 10 & 11 & 16 & 17 & 19 & = \text{__/6} \\
\end{array}
\]

Automatic reinforcement-pain

\[
\begin{array}{cccc}
16 & 17 & 18 & 19 & 20 & 21 & = \text{__/6} \\
\end{array}
\]

Notes:

on a flat shelf; sit), and (c) sit while holding out a paw for inspection/reward (paw). During the first noncontingent baseline sessions, sit and paw commands were requested by the zookeepers, and the number of times W. complied was recorded. Food and attention were delivered noncontingently—that is, regardless of whether or not W. complied. Training sessions then began in which food treats and attention were only given when a command was followed.

Training sessions were 30 min in length and were conducted by the zookeepers 3 to 5 days per week. Highly preferred foods (Fruit Loops, grapes, raisins, and cocoa puff cereal) were taken from the daily diet and used as potential reinforcers. Initially, food and verbal praise (zookeeper attention) were given for any attempt to sit, then for sitting for 10 s, and finally for sitting on the station while extending a paw. When the behavior reached mastery criterion (90% correct for 3 consecutive days), the next behavior was introduced. All three lemurs participated.
in each training session, but only the data from W. are included in the present study, as it was her aggression that was the focus of the intervention.

A short vacation break was taken by the male zookeeper after 22 training sessions, allowing for a 5-day break. This allowed an opportunity for a third phase, that of maintenance, because both *sit* and *paw* were at mastery prior to this interruption.

Data for *sit* and *paw* were recorded as the percentage of correct responses (number of correct responses/number of requests for that behavior). Data for *spray* and *leave station* were collected as the number of 1-min intervals that W. left her station or received a spray for aggression. Intervals were used rather than the number of episodes, so that the number and duration of an aggression or *leave station*, not just the number of aggressions or *leave stations*, could be estimated.

Prior to the onset of formal data collection, two graduate student observers were trained to use the behavior-recording systems at the zoo. Interobserver agreement (IOA) was obtained for two of the functional analysis sessions and six of the training sessions. During reliability checks, the reliability observer was seated at least 0.6 m away from the primary observer and was positioned so as to have a clear view of both the zookeeper and the lemur behaviors. IOA was obtained using the number of interval agreements/total number of observations. The mean percentage agreement was 92%, with a range of 84% to 100%.

**RESULTS**

**Functional Analysis and CAFAC**

To determine which of the potential conditions elicited the greatest degree of appropriate and inappropriate behaviors, CAFAC results were put into a table. The data from the observations were graphed. Results of the CAFAC (see Table 2) showed that aggression was primarily maintained by dominance (4.0/6), then social interactions with humans (3.2/6). A high score on the CAFAC Dominance subscale resulted when zookeepers reported that W. engaged in her inappropriate behavior in the presence of the other lemurs, she was the dominant animal in the group, she would aggress toward other lemurs around food or preferred items, and she resisted

<table>
<thead>
<tr>
<th>CAFAC Category</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Social</td>
<td>3.2/6</td>
</tr>
<tr>
<td>Animal Social</td>
<td>2.4/6</td>
</tr>
<tr>
<td>Reinforcement, Food</td>
<td>2.25/6</td>
</tr>
<tr>
<td>Escape, Human</td>
<td>1.4/6</td>
</tr>
<tr>
<td>Escape, Animal</td>
<td>1.0/6</td>
</tr>
<tr>
<td>Dominance</td>
<td>4.0/6</td>
</tr>
<tr>
<td>Self-Stimulation</td>
<td>0.6/6</td>
</tr>
</tbody>
</table>

*Note.* The mean ratings for the three keepers are included for each category. Bold indicates the top two categories.

Downloaded by [Dr Kenneth Shapiro] at 11:57 09 June 2015
complying with zookeeper requests during both daily care and when she was moved from the inside to outside enclosure, or vice versa.

Results of the direct observations from the functional analysis supported the CAFAC results. As shown in Figure 1, W.’s approach toward the keepers was greatest during the ignore condition, with the male keeper approached more often than the female keeper. Most of the aggression also occurred during the ignore condition, although slight aggression was observed during the interactive condition of attention (noncontingent reward was provided) and somewhat more aggression was exhibited during the demand condition (contingent attention). The majority of approach and aggression episodes were targeted toward the male keeper; that is, W. actively but inappropriately sought out attention from the male zookeeper.

One other behavioral observation suggested that W. preferred to dominate, or control, the interactions with zookeepers. During the period in which the direct observations were collected, a curious but related behavior was noted: Small red-footed tortoises were kept in the outdoor enclosure to eat the dropped food and help maintain the cleanliness of the cage, and W. was observed overturning the tortoises such that they could not right themselves. Zoo visitors would report this, and the keepers would be forced to enter the cage to right the tortoises.

The result was an increase in keeper contact for W., albeit she was typically aggressive toward the keeper when he or she attempted to leave. This informal observation added additional confirmation to the results obtained by the functional analysis: Social interactions in which W. could dominate or control interactions appeared to be maintaining the aggression. She was

![FIGURE 1](image)

**FIGURE 1** The total number of approaches and aggressions toward the male and female zookeepers during the three conditions of the functional analysis. NC = noncontingent.
using aggression as a means of gaining attention and interacting with the zookeepers, and in particular, the male zookeeper.

**Intervention**

As shown in Figure 2, W. received a spray for aggression during 100% of the intervals during the 3 baseline sessions prior to the onset of training. She showed no paw presentation behavior and only sat on command for 5% to 10% of requests during baseline. The number of aggressive episodes and spray deliveries decreased to zero almost immediately once training

![Figure 2](image-url)

**Figure 2** Changes in the percentage of intervals in which the lemur exhibits the appropriate behaviors (sit and paw; upper two panels), and the percentage of intervals in which an inappropriate aggressive behavior occurred (aggression receiving a spray or leave station; lower panel) during the baseline and intervention phases.
began. Similarly, leave station showed a steady decrease across training trials. During the initial training for sit, W. left her station during as many as 50% of the intervals. After the sit training, and within approximately 10 paw training sessions, W. left her station during 0% of the intervals. Further, when attention and food were contingent on the appropriate sit and show paw, compliance quickly increased to 90% of requests or higher across most of the training sessions.

Data taken after the zookeeper’s vacation showed that even after a week of no training, appropriate behavior continued. Informal follow-ups with zookeepers after the conclusion of the study indicated no reoccurrence of biting or aggression. W. continued to have a strong preference for the male zookeeper. However, as long as the zookeeper made both his attention and/or favored food items contingent on W. exhibiting appropriate behavior (sitting, paw out), W. continued to show no aggression.

**DISCUSSION**

While functional analysis has become a well-established technique for identifying antecedents and consequences of problem human behaviors (Crosland et al., 2003; Dunlap et al., 2008; Freeman et al., 2002; Hanley et al., 2003; Najdowski et al., 2008; Perrin et al., 2008), it has only recently been used with both companion animals and captive wild animals (Bloomsmith et al., 2007; Dorey et al., 2009; Dorey et al., 2012; Martin et al., 2011; Vollmer et al., 2001).

As noted earlier, a major obstacle in using functional assessments to determine the function of problematic behavior in captive wild animals is the need to include factors not readily applicable to typical human or laboratory animal settings. For example, researchers have shown that self-injury and aggression may be elicited by certain housing conditions (Bellanca & Crockett, 2002; Lutz et al., 2003; Reinhardt & Rossell, 2001; Watson, 1992), social conditions including separation from sexual partners or social companions (Chamove et al., 1984; Erwin et al., 1973; Redican & Mitchell, 1973), and interactions with humans, particularly keepers. Further, as with humans, aggression may be accidently reinforced by various environmental conditions, resulting in an increasing cycle of self-injury, injuries to other animals in the enclosure, and even injuries to keepers (Dorey et al., 2009; Hosey, 2005; Hosey & Druck, 1987; Mitchell et al., 1992; Schaefker, 1970).

As with the human literature, functional analysis approaches with animals utilizes both direct observation of behavior across a variety of setting conditions and interviews or surveys of caretakers. Both the observational approaches and survey approaches can be used to evaluate potential setting conditions that reinforce problem behaviors. Most importantly, however, functional analyses allow the development of directed treatment plans based on the identification of consequences that maintain the appropriate and inappropriate responses. The efficacy of such an approach is demonstrated in the current investigation.

The data from the current investigation highlight how keeper interactions may inadvertently shape and reinforce aggression. The lemur, W., exhibited aggression toward the male zookeeper under what initially appeared to be confusing conditions. A functional analysis and functional analysis checklist were used to determine the reinforcers maintaining the aggression by this female lemur, and an intervention plan was developed based on the outcome of the functional analysis. Data showed clear decreases in the lemur’s aggression as a result of implementing a
new set of contingencies targeted to eliminate reinforcers of aggression. It is important to note
that the results highlight the importance of zookeeper interactions as sources of both aggression and appropriate responses from primates such as lemurs.

Keepers may accidentally reinforce aggression by providing contingent attention, food, or toys any time the animal has an aggressive response. Alternatively, the animal may use aggression to avoid or escape unpleasant events such as the presence of humans in the enclosure, demands made upon the animal for health inspections, or forced movement as an area is cleaned. In the present investigation, the lemur was using aggression both as a means to gain attention and to escape unwanted demands. The keeper’s attempts at punishment (e.g., chasing the lemur) were actually serving as reinforcers for the inappropriate attempts to gain attention.

Rearranging contingencies such that attention from the keeper was given only for appropriate responses resulted in a significant decrease in aggression and an increase in appropriate behavior. Adding the training component provided additional positive behaviors in which the lemur could engage to gain access to the reinforcer of positive keeper attention. The results were removal of the lemur from a potential euthanasia list, a lemur who is now approachable and manageable, and freeing the keeper from danger when he entered the enclosure. The results clearly demonstrate the effectiveness of using functional analysis to identify and treat behavioral issues in captive wild animals.

CONCLUSION

In the present study, the results of the CAFAC, a functional assessment instrument, and an observation-based functional analysis provided the basis for an intervention program designed to reduce a female lemur’s aggressive behavior. The investigation showed that the use of the CAFAC in conjunction with direct observation was effective for determining the antecedents and reinforcers for inappropriate behavior. A replacement behavior training program was introduced, and the lemur’s aggression was eliminated successfully. These results demonstrate the utility of using functional assessment and analyses in zoos with captive wild animals.

REFERENCES


