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FUNCTIONAL ANALYSIS AND TREATMENT OF HUMAN-DIRECTED UNDESIRABLE BEHAVIOR EXHIBITED BY A CAPTIVE CHIMPANZEE

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A functional analysis identified the reinforcer maintaining feces throwing and spitting exhibited by a captive adult chimpanzee (*Pan troglodytes*). The implementation of a function-based treatment combining extinction with differential reinforcement of an alternate behavior decreased levels of inappropriate behavior. These findings further demonstrate the utility of function-based approaches to assess and treat behavior problems exhibited by captive animals.

Key words: behavioral management, chimpanzee, differential reinforcement, extinction, functional analysis

Captive chimpanzees housed in zoological parks and research facilities sometimes exhibit undesirable behavior toward caregivers or visitors, such as spitting, throwing feces or other objects, engaging in aggressive displays, and screaming. These behaviors can pose health risks to humans, erode relationships between chimpanzees and their caregivers, and lead visitors to develop a negative opinion of chimpanzees or the animal facilities. The responses of humans to these undesirable behaviors may inadvertently maintain these behaviors, similar to the maintenance of problem behavior in humans (Carr, 1977). Through informal observations and interviews with chimpanzee caregivers, we identified two general patterns of responding to these inappropriate behaviors: (a) delivering putative positive reinforcement in the form of attention (e.g., verbal reprimands) or tangible items (e.g., food) in an attempt to scold, distract, or calm the animal; or (b) quickly leaving the area, which might function as negative reinforcement.

Although it is well established in human clinical settings (Hanley, Iwata, & McCord, 2003), those who work with captive animals are just beginning to explore the utility of func-

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tional analyses in that population (see Bloomsmith, Marr, & Maple, 2007; Forthman & Ogden, 1992). Dorey, Rosales-Ruiz, Smith, and Lovelace (2009) used functional analysis techniques to identify attention from humans as a reinforcer for self-injurious behavior exhibited by an olive baboon (*Papio hamadryas anubis*). They successfully reduced the self-injurious behavior by implementing a function-based treatment that combined extinction with differential reinforcement of the alternative behavior (DRA) of lip smacking.

Using a similar approach, we conducted a functional analysis to determine which contingencies maintained our subject's feces throwing and spitting. When a function was identified, we implemented a treatment that combined extinction and DRA. Finally, we assessed whether the treatment would reduce inappropriate behavior in the presence of unfamiliar humans, a situation that often increases problem behavior exhibited by captive chimpanzees (Maki, Alford, & Bramblett, 1987; Rumbaugh, 1988).

METHOD

Subject and Setting

The subject was a 27-year-old male chimpanzee housed by himself (due to health status) in an indoor-outdoor enclosure (2.3 m by 6.9 m by 2.4 m). He was chosen based on his history of engaging in a variety of problematic behaviors. The subject had routine access to food, water, and environmental enrichment and a history of exposure to positive reinforcement during training for various husbandry and health-related behaviors. During all sessions, the experimenter was separated from the subject by metal caging in a corridor that adjoined the indoor portion of the enclosure where the subject was housed for the experimental sessions.

Response Measurement and Interobserver Agreement

Inappropriate behavior included feces throwing, object throwing, spitting, screaming, and cage shaking. *Throwing* was scored when the subject picked up fecal matter or another item and threw it at least 30 cm from his body. *Spitting* was scored when liquid expelled from the chimpanzee's mouth traveled at least 15 cm. *Screaming* was defined as a high-pitched, loud vocalization. *Cage shaking* was defined as pounding or pushing on the cage with enough force to make an audible sound. During the treatment evaluation, the alternate response consisted of the subject grasping a plastic ring with at least two fingers and holding it for at least 2 s.

All sessions were videotaped for subsequent scoring. During the functional analysis, pencil-and-paper data were collected on the frequency of each target behavior. Treatment sessions and generality probes were scored on a handheld computer using the Observer software. For the purpose of data analysis, the frequency of inappropriate and alternate behavior was converted to a response rate (responses per minute). All sessions were 10 min in duration, with the exception of the generality probes, which were 5 min in duration.

A second observer who had been previously trained to criterion independently scored 43% of the videotaped sessions. Interobserver agreement was calculated by dividing the number of agreements by the sum of the agreements and disagreements and multiplying that result by 100%. During the functional analysis, agreements were defined as 30-s intervals in which the observers agreed on the nonoccurrence or the exact number of occurrences of all behaviors. For all other assessments, an agreement was defined as each second of the observation in which the same behaviors were scored by the two observers (these data were compared by the computer program). Percentage agreement averaged 93% (range 70% to 100%) across all sessions.

Functional Analysis

The functional analysis was conducted in a reversal design. During the control condition, the experimenter provided the subject with

continual interaction by talking, playing, imitating, touching, or grooming him. In addition, sugar-free fruit juice was delivered via a squeeze bottle on a fixed-time (FT) 20-s schedule. During the positive reinforcement condition, the experimenter sat in front of the subject's enclosure and faced away from him. When the subject exhibited a target behavior, the experimenter approached him and provided 20 s of attention in the form of verbal reprimands and coaxing and 20-s access to fruit juice. No programmed contingencies were in place for any other behaviors. During the negative reinforcement condition, the experimenter stood in front of the subject wearing a white Tyvek suit and held a capped syringe while giving the cue to present for injection every 20 s. If the subject complied with the cue by pressing his thigh up to the cage mesh and allowing the experimenter to place the capped syringe against his skin for 2 s, the experimenter delivered brief verbal praise and stepped back a few steps from the enclosure. When the subject engaged in a target behavior, the experimenter provided escape by removing the syringe and walking out of sight, approximately 8 m away, for 20 s.

Treatment Evaluation

Three conditions were compared in a reversal design during the treatment evaluation. In all conditions, a plastic ring (17 cm in diameter and 2.5 cm wide) was hung outside of the subject's cage. The contingencies for the baseline condition were identical to the positive reinforcement condition of the functional analysis. The ring was present during baseline, but the experimenter did not reinforce interaction with the ring. During the extinction phase, the experimenter stood in front of the subject's cage, faced away from the subject, delivered no reinforcement following the occurrence of inappropriate behavior, and ignored any interaction with the ring. Prior to the initiation of DRA plus extinction, the experimenter used a shaping procedure to teach the subject the alternative behavior (Pryor, 1985). After 21 min of training across five sessions, the subject met the training criteria by exhibiting the ring-holding behavior three times in a row for three consecutive training sessions. During DRA plus extinction, inappropriate behavior was placed on extinction; however, if the subject displayed the alternative behavior, 20-s access to attention and fruit juice was provided.

Generality Probes

An unfamiliar human stood with the experimenter in front of the subject's cage. Eight facility staff who were unfamiliar to the subject were recruited as confederates and were randomly assigned to the baseline or treatment condition. Confederates were instructed to ignore the subject. The confederate and experimenter engaged in conversation as if the experimenter was giving a tour of the facility. The experimenter delivered all programmed contingencies, and the contingencies in place for appropriate and alternative behavior were identical to those in the baseline and the DRA plus extinction conditions of the treatment evaluation.

RESULTS AND DISCUSSION

Figure 1 (top) depicts the results of the functional analysis, in which the highest rates of inappropriate behavior occurred in the positive reinforcement condition ($M = 0.7$ responses per minute), and the lowest rates occurred in the control condition ($M = 0.1$). Rates of inappropriate behavior in the negative reinforcement condition fell between these two values ($M = 0.4$). These data suggest that the subject's inappropriate behavior was sensitive to both positive and negative reinforcement.

Given the higher rates of inappropriate behavior observed in the positive reinforcement condition, treatment was implemented in this context (Figure 1, bottom). During the treatment evaluation, high rates of inappropriate behavior were observed during baseline ($M =$ 1.4 responses per minute). Rates of inappropriate behavior during extinction were variable but

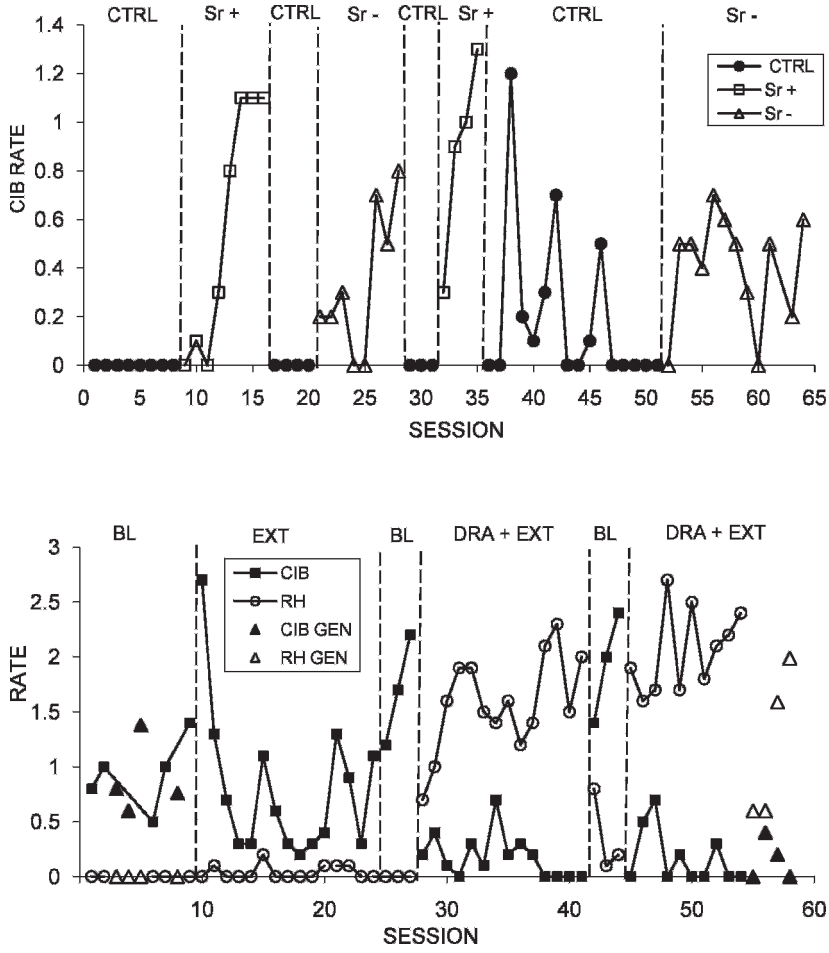

Figure 1. Rate of combined inappropriate behaviors (CIB) in control (CTRL), positive reinforcement (Sr+), and negative reinforcement (Sr−) conditions during the functional analysis (top). Rate of combined inappropriate behaviors (CIB) and ring holding (RH) in baseline (BL), extinction (EXT), and differential reinforcement of an alternate behavior with extinction (DRA + EXT) during the treatment assessment and generality (GEN) probes (bottom).

relatively high (M = 0.8). Under DRA plus extinction, inappropriate behavior decreased by 90% (M = 0.2) and ring holding increased to an average of 1.8 responses per minute. These results indicate that DRA plus extinction was successful in reducing inappropriate behavior and increasing the occurrence of the alternative behavior. In addition, our results suggest that the implementation of extinction alone, a treatment plan often recommended to those who work to reduce these problem behaviors in chimpanzees, may result in an extinction burst and that these behaviors are resistant to extinction.

Finally, during the baseline generality probes, rates of inappropriate behavior were relatively high (M = 0.9 responses per minute), and the subject did not engage in ring holding. With DRA plus extinction, the subject exhibited decreased rates of inappropriate behavior (M = 0.2) and increased rates of ring holding (M = 1.2). The function-based treatment reduced rates of problem behavior by 83% across probes, which underscores the efficacy of the intervention given that the presence of unfamiliar humans has been noted as a source of stressful excitement for chimpanzees (Maki et al., 1987).

The current approach led to two constraints on the interpretation of our functional analysis results. We did not assess the role of automatic reinforcement in the maintenance of these behaviors because we were specifically interested in the occurrence of human-directed problem behavior and because the subject's most prevalent problem behaviors (feces throwing and spitting) were directed at humans and therefore were not likely to occur in the absence of humans. Therefore, we are not able to exclude automatic reinforcement as a possible maintaining variable. Second, each topography of problem behavior may have its own function (Derby et al., 1994). Because feces throwing and spitting were combined into one measure, we were unable to determine the function of any individual topography. However, the subsequent reduction of all inappropriate behavior in the treatment evaluation suggests that the behaviors were sensitive to the same class of reinforcers. Finally, the intervention targeted only the positive reinforcement function of the subject's inappropriate behavior. Possibly an additional treatment was warranted for the negative reinforcement function; however, previous research has suggested that, in cases of multiply controlled behavior, the treatment of one function could exacerbate the other function, especially in the case of a behavior maintained by both escape and attention (Smith, Iwata, Vollmer, & Zarcone, 1993). In spite of these limitations, the present results, combined with those of Dorey et al. (2009), suggest that nonhuman primates may benefit from function-based treatments.

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