*DISRUPTIVE EFFECTS OF CONTINGENT FOOD ON
HIGH-PROBABILITY BEHAVIOR*

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The delivery of food contingent on 10 s of consecutive toy engagement resulted in a decrease in engagement and a corresponding increase in other responses that had been previously reinforced with food. Similar effects were not observed when tokens exchangeable for the same food were delivered, suggesting that engagement was disrupted by the contingent provision of the food, which may have functioned as a discriminative stimulus that occasioned competing responses.

Key words: discriminative stimulus, engagement, response reallocation

Reinforcement may be associated with a number of unintended, sometimes disruptive, effects. Balsam and Bondy (1983) suggested that reinforcement might lead to increases in responses that are incompatible with the reinforced target behavior. For example, reaching for a reinforcer might interfere with

response acquisition when another person delivers reinforcers after a response (Thompson & Iwata, 2000). Reinforcement might also decrease an individual's motivation to engage in the reinforced behavior after the termination of reinforcement, a phenomenon known as the overjustification effect (Balsam & Bondy; Deci, 1971).

The current study began as a programmatic investigation of the overjustification effect. Specifically, we set out to evaluate whether the removal of the contingent provision of food would differentially affect stimulus engagement with toys of varying preference. However, similar to results obtained by Roane, Fisher, and McDonough (2003), contingent delivery of a known reinforcer *decreased* engagement with

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one stimulus. These findings generated alternative hypotheses regarding ways in which reinforcer delivery could disrupt ongoing responding. Specifically, food might have functioned as a discriminative stimulus, evoking requests and grabs at the food previously reinforced in the presence of food. Thus, we initiated an investigation of variables that were hypothesized to be responsible for the decrease in engagement and corresponding increases in other responses.

METHOD

Participant and Setting

Glenn was a 12-year-old boy who had been admitted to an inpatient hospital for assessment and treatment of problem behavior. His diagnoses included severe mental retardation, autistic disorder, and stereotypic movement disorder with self-injury. Glenn communicated for preferred items vocally and using manual signs. All sessions were conducted in one of two rooms (2.4 m by 3 m) located across the hall from one another. Each room contained a one-way observation window, chairs, a table, and supplies necessary for the session. Baseline and reinforcement sessions were conducted in one room. Token exchange occurred in the second room.

Response Measurement and Interobserver Agreement

Observers used paper and pencil to collect data on stimulus selection (reaching for a stimulus within 5 s of stimulus presentation) during preference assessments and used laptop computers to collect data for the remainder of the study. Observers collected frequency data on reinforcer delivery, requests for food, and grabs at the food. *Reinforcer delivery* involved the experimenter placing the food in Glenn's mouth such that it passed the plane of his lips or placing a token on the token board. *Requests* (scored during all conditions) included Glenn vocally saying or signing "more," "please," or

"cheese." *Grabs* (scored only during contingent reinforcement conditions) were defined as Glenn reaching for or moving the experimenter's arm in the direction of the food or token. Duration data were collected on *engagement*, defined as Glenn's eyes being oriented toward the screen of the DVD player. During the reinforcer assessment, *task completion* consisted of Glenn placing a piece of paper in the bin and letting it go.

A second observer collected data during 100% of preference assessments, 41% of discriminative stimulus analysis sessions, and 50% of reinforcer assessment sessions. Agreement during preference assessments included both observers recording the same selection during each trial; agreement was 100%. Interobserver agreement data for the remaining analyses were calculated using the block-by-block agreement method (Mudford, Martin, Hui, & Taylor, 2009). During the discriminative stimulus analysis, mean agreement coefficients for reinforcer delivery, requests, and grabs were 94% (range, 73% to 100%), 98% (range, 93% to 100%), and 99% (range, 97% to 100%), respectively. Mean agreement for engagement was 92% (range, 76% to 100%). Mean agreement coefficients during the reinforcer assessment were 100%, 97% (range, 96% to 100%), 99% (range, 92% to 100%), and 97% (range, 75% to 100%) for reinforcer delivery, requests, grabs, and task completion, respectively.

Procedure

Discriminative stimulus analysis. Separate paired-stimulus preference assessments (Fisher et al., 1992) identified cheese puffs and a movie as the highest ranked stimuli. Engagement with the movie during baseline and reinforcement conditions was then compared using a reversal design. All sessions lasted 5 min.

Baseline. During baseline, Glenn sat with the portable DVD player placed on the table in front of him. Neither the food nor any stimuli associated with the food (e.g., tokens) were present. Engagement was ignored.

Contingent edible stimulus. This condition was identical to baseline, with the following exceptions. The experimenter (seated next to Glenn and diagonal to the DVD player) held the cheese puffs in Glenn's view and used a timer to keep track of engagement. The experimenter delivered a small piece of cheese puff (by placing the food directly in Glenn's mouth to avoid disrupting engagement) contingent on 10 s of continuous engagement with the movie. Any interruption of engagement reset the 10-s interval to 0.

Contingent token. Functional analysis results from Glenn's hospital admission indicated that his aggression was reinforced in part by access to food. Prior to his participation in the current study, his treatment team developed an intervention that included reinforcing appropriate requests for food. Given this history, we hypothesized that food delivery in the contingent edible stimulus condition may have disrupted engagement not because it functioned to decrease motivation to engage with the movie, but rather because the food functioned as a discriminative stimulus in the presence of which requests for food had historically been reinforced. Thus, a contingent token condition was evaluated to determine whether the contingent presentation of tokens (stimuli previously paired with food but in the presence of which appropriate requests for food were never reinforced) would similarly disrupt responding.

Prior to the experiment, Glenn had participated in token training as part of a separate study that suggested that tokens (plastic poker chips affixed with hook-and-loop tape) functioned as reinforcers. During the contingent token condition, no food was present. Instead, the experimenter placed a token on the token board contingent on 10 s of consecutive engagement. Immediately after the session ended, Glenn entered the room across the hall to exchange tokens. The experimenter delivered one piece of cheese puff for each token.

Reinforcer assessment. During the contingent edible stimulus condition, Glenn may have partially reallocated his responding to requests and grabs, behaviors that were incompatible with engagement. Alternatively, cheese puffs may have functioned as punitive stimuli, perhaps because food delivery interrupted engagement with a more highly preferred stimulus (the movie). Thus, we conducted a separate reinforcer assessment to determine if cheese puffs similarly would disrupt a task (placing sheets of paper in a bin) for which measurement did not depend on duration of occurrence; thus, Glenn could request and grab at the food while continuing to respond. The reinforcer assessment also served as a means to assess whether cheese puffs did in fact function as reinforcers and not as punitive stimuli.

Baseline and reinforcement conditions alternated in a reversal design. Each session lasted 2 min. During both conditions, Glenn sat at a table with paper and a bin in front of him. Prior to session, the experimenter physically guided Glenn to complete one response, arranged the appropriate contingencies, and then issued a single prompt to complete the task. Starting with Session 6, the experimenter informed Glenn of the contingencies in effect for each upcoming session. During baseline, food was absent and the experimenter ignored task completion. In the reinforcement condition, the food was in view and task completion resulted in the delivery of a small piece of a cheese puff (placed directly in Glenn's mouth) on a fixed-ratio 1 schedule. Communicative responses and attempts to grab the food produced no differential consequences.

RESULTS AND DISCUSSION

Figure 1 (top) depicts results of the discriminative stimulus analysis. Initially, data were not collected on requests or grabbing. Observers began collecting data on these responses after Glenn began requesting and grabbing at the food during the first contingent edible stimulus

Figure 1. Top panel depicts the percentage of session with stimulus engagement (open circles, primary y axis) and percentage of 10-s intervals with requests and grabs (filled circles, secondary y axis) during the discriminative stimulus analysis. Bottom panel depicts task completion (responses per minute) in baseline (BL) and reinforcement conditions (open circles, primary y axis) and percentage of 10-s intervals with requests and grabs (filled circles, secondary y axis) during the reinforcer assessment.

phase. Across all baseline phases, high and stable levels of engagement ($M = 93\%$) were observed and low to zero levels of requests for food ($M = 1\%$) were observed. The addition of contingent food resulted in lower levels of engagement ($M = 73\%$) and high levels of requests and grabs ($M = 29\%$). The introduction of tokens had no appreciable effect on engagement ($M = 92\%$), and the percentage of 10-s intervals with requests and grabs decreased to zero in both token phases ($M = 3\%$).

Figure 1 (bottom) depicts results from the reinforcer assessment. Overall, responding was higher during reinforcement ($M = 1$ response per minute) than in baseline ($M = 0.3$ response per minute). Mean percentage of 10-s intervals with requests was low during baseline ($M = 1.4\%$), and requests and grabs increased during reinforcement ($M = 15\%$). Task completion remained higher than in baseline even though Glenn continued to request and grab at the food during the reinforcement condition, supporting the notion that responding during the discriminative stimulus analysis was likely decreased as a function of his reallocation of responding to requests and grabs and that cheese puffs did in fact function as reinforcers.

Other research has previously demonstrated the discriminative function of reinforcers (e.g., Thompson, Iwata, Hanley, Dozier, & Samaha, 2003). The current study extends this line of research by suggesting that food served as a discriminative stimulus that occasioned responding, presumably because Glenn's appropriate requests for food historically had been reinforced in the context of his functional communication treatment. Although contingent delivery of tokens exchangeable for the same food did not similarly disrupt engagement, differences in reinforcer delivery across food and token conditions may make interpretation of these results difficult. Specifically, food delivery required some response (i.e., opening his mouth and chewing the food), whereas token delivery did not, perhaps making food

delivery more disruptive to engagement than token delivery. In addition, it remains unclear whether the mere presence of the food or its contingent delivery occasioned requests and grabs. Requests and grabs followed the first food delivery during approximately 88% of contingent edible stimulus and token sessions, suggesting that delivery of food (not its mere presence) may have occasioned responding. However, these conclusions remain tentative, because responding was never assessed under conditions in which food was present but not delivered for engagement.

Other explanations of the results of the discriminative stimulus analysis include adventitious reinforcement of requests and grabs or reinforcement of engagement and requests and grabs as a chain of responses. The conditional probability of reinforcer delivery following requests or grabs (within 10 s of their occurrence) was lower than the unconditional probability of reinforcer delivery ($p = .04$ and $p = .35$, respectively), making adventitious reinforcement of requests and grabs an unlikely explanation. The reinforcement of engagement and requests and grabs as a chain of responses remains less clear.

It is also possible that contingent stimulus delivery punished engagement with a more preferred stimulus, the movie. However, engagement remained high during contingent token delivery, and results of the reinforcer assessment indicated that cheese puffs functioned as reinforcers. These results suggest that contingent stimulus delivery did not punish engagement; however, it remains unclear whether Glenn preferred the movie to food. In addition, several differences that existed between the discriminative stimulus and reinforcer assessments (e.g., dimension of behavior measured, level of preference for activity, and degree of interference from reinforcer delivery) make it difficult to interpret the different effects of contingent food delivery on engagement and task completion. However, data from assessments conducted

under one set of stimulus conditions often are used to predict effectiveness of putative reinforcers under sometimes disparate conditions. Nonetheless, it may be prudent for researchers to conduct reinforcer assessments using stimulus conditions that are comparable to those used during the latter analyses.

The results of the current study suggested that Glenn partially reallocated responding to behavior that was incompatible with engagement with the movie, providing further evidence of the discriminative, sometimes disruptive, properties of reinforcers. The frequency with which practitioners use positive reinforcement in educational and clinical settings underscores the importance of continuing to examine this and other unexpected effects of reinforcer delivery.

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