ON THE CORRESPONDENCE BETWEEN PREFERENCE ASSESSMENT OUTCOMES AND PROGRESSIVE-RATIO SCHEDULE ASSESSMENTS OF STIMULUS VALUE

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The current study examined whether stimuli of different preference levels would be associated with different amounts of work maintained by the stimuli, as determined through progressive-ratio schedule break points. Using a paired-choice preference assessment, stimuli were classified as high, moderate, or low preference for 4 individuals with developmental disabilities. The stimuli were then tested three times each using a progressive-ratio schedule (step size of 1; the break-point criterion was 1 min). In 10 of 12 possible comparisons, higher preference stimuli produced larger break points than did lower preference stimuli.

DESCRIPTORS: progressive-ratio schedules, reinforcer assessment, stimulus preference

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Stimulus preference assessments are designed to predict which stimuli, among several, will serve as the more potent reinforcers for individuals who otherwise have difficulty communicating preferences. For example, Piazza, Fisher, Hagopian, Bowman, and Toole (1996) conducted paired-choice preference assessments (Fisher et al., 1992) for 4 individuals with intellectual and developmental disabilities and separated the stimuli into high-, medium-, and low-preference categories based on the resulting selection percentages. Later, using a concurrent-operants arrangement, they observed that more responding was allocated to stimuli of higher preference than to stimuli of lower preference, suggesting that the higher preference stimuli were more potent reinforcers.

In a subsequent study, Roscoe, Iwata, and Kahng (1999) subjected stimuli identified as high preference (HP) and low preference (LP) via a paired-choice assessment to both concurrent and independent (nonconcurrent) ratio schedules. The concurrent schedule results systematically replicated the results of Piazza et al. (1996), in that more responding was allocated to the HP stimulus in seven of eight cases. However, the independent ratio schedules

revealed that the LP stimuli supported rates of responding that were as high as those produced by the HP stimuli during the concurrent schedules for 6 of 7 participants. These results suggest that even though a stimulus may be relatively less potent than another, it may nevertheless have similar utility as a reinforcer when it is delivered in a manner consistent with common teaching or treatment arrangements.

As in Roscoe et al. (1999), preference assessment results for individuals with developmental disabilities have often been validated by using simple ratio schedules and resulting response rates as an index of reinforcer strength. Response rates may be loosely interpreted as how fast an individual works when a given stimulus is made contingent on that work. A different and also relevant dimension of reinforcer strength—the *amount* of work supported by a reinforcer—has been examined in much basic research through the use of progressive-ratio (PR) schedules (Hodos, 1961). Under PR schedules, reinforcer strength is indexed by the highest ratio schedule completed before the organism ceases to respond for a set period of time (i.e., the break point). Three recent studies have compared PR break points for stimuli identified as HP and LP via preference assessments. Francisco, Borrero, and Sy (2008) found that LP stimuli supported lower break points than HP stimuli when arranged concurrently, but nonetheless supported moderate to high break points when the LP stimuli were tested independently. On the other hand, Glover, Roane, Kadey, and Grow (2008) found that LP stimuli produced break points that were far lower than HP stimuli on both concurrent and independent PR schedules, whereas Penrod, Wallace, and Dyer (2008) observed higher break points for HP stimuli in 3 of 4 participants. Francisco et al. suggested that such discrepancies may come about because researchers selected LP stimuli that varied in their ranking in the preference assessments and that it would be useful to "evaluate the

reinforcing efficacy of other stimuli ranked along the preference hierarchy" (p. 19). The present study extended this line of research by determining if stimuli that lie at different points of a preference hierarchy would correspondingly differ in terms of the break points they produced on PR schedules.

METHOD

Participants and Setting

The participants were 4 individuals, Taylor (16 years old), Carly (11 years old), Melissa (9 years old), and Cynthia (20 years old), who had been admitted to an inpatient unit for the treatment of behavior disorders. Taylor, Carly, and Melissa had been diagnosed with autism and moderate mental retardation. Cynthia had been diagnosed with cri-du-chat syndrome and severe mental retardation. Melissa's and Taylor's sessions were conducted in a session room (2.4 m by 3 m) equipped with a one-way observation window, two chairs, a table, and the necessary supplies for each session. Carly's sessions were conducted in a classroom located in the inpatient unit. The classroom was approximately 6.8 m by 6.8 m and contained several small workstations (i.e., a desk and two chairs divided by a partition). Sessions were conducted at the workstation Carly used during academics. Cynthia's sessions were conducted in a room adjacent to the main living area of the inpatient unit. The room was approximately 7.7 m by 7.7 m, and sessions were conducted at a large table located in the center of the room.

Procedure

Paired-choice preference assessment. The preference assessment included 12 leisure items (e.g., blocks, toy piano, radio) nominated by caregivers and staff and was conducted three times with each participant using procedures described by Fisher et al. (1992). Overall selection percentages and ranks were based on the combined results of the three assessments.

Selection percentages were determined by calculating the percentage of trials in which stimuli were selected when available. The items were then arranged in descending order according to their selection percentages (i.e., the item selected with the greatest percentage was ranked 1, the item with the second highest selection percentage was ranked 2, etc.). The 12 stimuli were then divided into three categories (i.e., high-, medium-, and low-preference stimuli) based on procedures similar to those described by Piazza et al. (1996). High-preference (HP) stimuli were defined as those ranked 1, 2, 3, and 4. Medium-preference (MP) stimuli were those ranked 5, 6, 7, and 8. Low-preference (LP) stimuli were those ranked 9, 10, 11, and 12. One stimulus was then selected from each category for each participant for inclusion in the PR analyses.

Progressive-ratio analyses. Three PR analyses were conducted, in a randomized order, with each stimulus selected for each participant from the preference assessment (i.e. nine PR sessions per participant). A task that the participant could readily complete was chosen for each participant. Melissa's and Taylor's task consisted of placing a block in a bucket. Carly's and Cynthia's target response consisted of a placing a peg in a peg board. Prior to each session, the experimenter prompted the participant to complete the task three times using successive verbal, gestured, and physical prompts. Following the completion of each task, regardless of the level of prompting, the experimenter delivered the appropriate stimulus for 30 s. When the session began, the available stimulus remained within view of the participant, and the experimenter gave the participant a single verbal prompt to engage in the task. The experimenter did not deliver additional prompting throughout the session. The experimenter delivered the stimulus being assessed during a given session for 30 s on a PR schedule beginning with one response (i.e., the experimenter delivered the stimulus for a single

correct completion of the task). During each trial thereafter, the schedule requirement was increased by 1 in an arithmetic progression. Tasks materials were removed after the delivery of each reinforcer and were returned as soon as the 30-s reinforcement period had elapsed. Sessions continued until the participant ceased to respond for 1 min.

Response Definitions, Data Collection, and Interobserver Agreement

During the preference assessments, previously trained observers collected data on which stimuli the participant selected during each trial. *Selection* was defined as touching, reaching toward, or asking for the stimulus within 5 s of its presentation. During the PR analyses, data were collected on the completion of the task and each completed schedule value. For Melissa and Taylor, a completed task was defined as passing the block over the lip of the bucket and dropping it in. For Carly and Cynthia, a completed response was defined as the participant placing a peg in any one of the 25 holes located on a peg board such that the peg stood upright when the participant removed her hand. A second independent observer collected data during a mean of 86% and 63% of all preference assessment trials and PR analysis ratio requirement steps, respectively. An agreement during the preference assessment was scored if both observers recorded selection of the same stimulus during the trial. A disagreement was scored if observers recorded different stimuli. During the PR analysis, agreements on task completion were defined as both observers recording the same number of tasks completed during a given ratio requirement (e.g., both observers recorded five completed tasks when the FR value was 5). A disagreement was scored if observers recorded a different number of completed tasks. Interobserver agreement for the preference assessments and PR analyses was calculated by dividing the number of agreements by the number of agreements plus
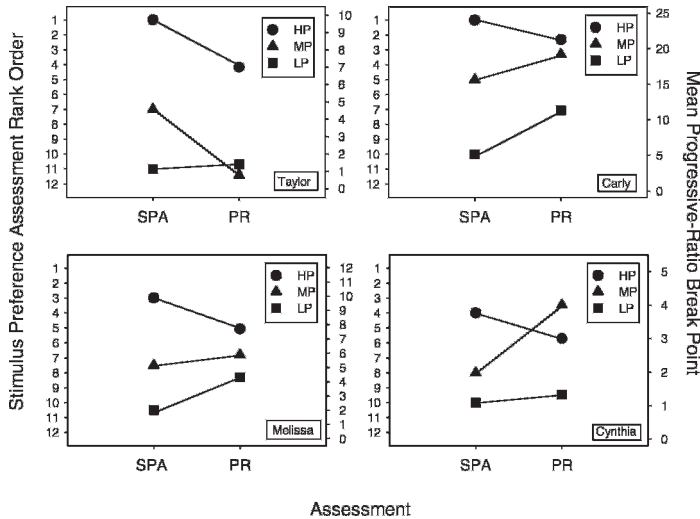
Figure 1. Stimulus preference assessment (SPA) ranks for each stimulus, indexed on the left *y* axes, and mean progressive-ratio (PR) break points, indexed on the right *y* axes, for the 4 participants.

disagreements and converting this ratio to a percentage. Mean percentage agreements across participants for the paired-choice preference assessments were 96% (range, 88% to 100%) and 99% (range, 98% to 100%) for the PR analyses.

RESULTS AND DISCUSSION

The preference assessment ranks and mean PR break points are depicted in Figure 1. For Taylor, the HP stimulus resulted in a mean break point of 7 (11, 0, and 10 across successive PR sessions), the MP stimulus had a mean break point of 1 (1, 1, and 1), and the LP stimulus had a mean break point of 1.3 (1, 1, and 2). For Melissa, the mean break points were 7.3 for the HP stimulus (4, 7, and 11), 5.7 for the MP stimulus (8, 5, and 4), and 4.3 for the LP stimulus (7, 2, and 4). For Carly, the HP stimulus resulted in a mean break point of 20.7 (12, 25, and 25), the MP stimulus had a mean break point of 18.7 (27, 9, and 20), and the LP stimulus had a mean break point of 11.3 (13, 10, and 11). For Cynthia, the mean break points were 3 for the HP stimulus (4, 4, and 1), 4 for the MP stimulus (3, 8, and 1), and 1.3 for

the LP stimulus (2, 1, and 1). Overall, HP stimuli supported higher mean break points than MP stimuli for 3 of 4 participants and higher mean break points than LP stimuli for all 4 participants. MP stimuli supported higher mean break points than LP stimuli for 3 of 4 participants. A Pearson product-moment correlation revealed a significant positive relation between the preference assessment selection percentages (available from the first author) and the mean break points across all stimuli ($r = 0.617$; $p = .033$).

The results suggest that participants may complete a higher number of responses, overall, when higher preference stimuli are delivered as reinforcers than they would when lower preference stimuli are offered as reinforcers. They support the notion that stimuli that lie along different points of a preference continuum are associated with differing amounts of work they will sustain. Along with the results of Glover et al. (2008) and Penrod et al. (2008), this finding may have interesting implications for how reinforcer value is gauged in applied settings. One interpretation of these collective outcomes in relation to the results of Piazza et al. (1996) and Roscoe et al. (1999) is as follows.

Concurrent schedules may be highly sensitive to relative differences in reinforcer value, but the sorts of differences they reveal may not directly map onto programmed reinforcer arrangements in applied settings. Although there may, in fact, be many contingencies that compete for a student's effort and attention at a given time, teachers do not generally offer choices of two or more concurrently available tasks associated with distinct reinforcers. Independent ratio schedules may be more relevant in this respect, but their utility in fully characterizing reinforcer value may be limited, on occasion, by natural limits on response rate (ceiling effects). Even though one reinforcer may be more potent than another, as long as each is moderately effective, the individual may work as fast as possible regardless of which is offered. On the other hand, PR schedules, arranged independently for each stimulus and not influenced by the same sort of ceiling effects, may reveal meaningful differences that may be undetected when using response rate as a metric (i.e., in the amount of work supported by a stimulus).

This conclusion must be offered cautiously, given the small number of participants and administrations of the PR schedules, the variability among break points within individuals, and the two deviations in the relation between assessment rank and mean break points. Also, although the purpose of the current study was to determine the correspondence between the preference assessment and PR schedule outcomes, the lack of no-reinforcement baseline data limits the demonstration of a reinforcer effect for the stimuli. In future research, it would be important to ensure that mean break points were not just as high under no-reinforcement conditions, and the number of administrations of the PR schedules should be increased.

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