

## *A COMPARISON OF TWO APPROACHES FOR IDENTIFYING REINFORCERS FOR PERSONS WITH SEVERE AND PROFOUND DISABILITIES*

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The development of effective training programs for persons with profound mental retardation remains one of the greatest challenges for behavior analysts working in the field of developmental disabilities. One significant advancement for this population has been the reinforcer assessment procedure developed by Pace, Ivancic, Edwards, Iwata, and Page (1985), which involves repeatedly presenting a variety of stimuli to the client and then measuring approach behaviors to differentiate preferred from nonpreferred stimuli. One potential limitation of this procedure is that some clients consistently approach most or all of the stimuli on each presentation, making it difficult to differentiate among these stimuli. In this study, we used a concurrent operants paradigm to compare the Pace et al. (1985) procedure with a modified procedure wherein clients were presented with two stimuli simultaneously and were given access only to the first stimulus approached. The results revealed that this forced-choice stimulus preference assessment resulted in greater differentiation among stimuli and better predicted which stimuli would result in higher levels of responding when presented contingently in a concurrent operants paradigm.

**DESCRIPTORS:** assessment, concurrent operants, predictive validity, reinforcer preference, severely mentally retarded

The identification of powerful reinforcers can be particularly difficult among clients with severe to profound mental retardation (Wacker, Berg, Wiggins, Muldoon, & Cavanaugh, 1985). Although reinforcer surveys used with higher functioning persons are not applicable to this population, a number of promising procedures have recently been reported, including (a) training individuals to activate microswitches to indicate reinforcer preferences (Dattilo, 1986; Wacker et al., 1985); (b) extending the Premack Principle, wherein contingent opportunity to exhibit high-probability aberrant behaviors (e.g., stereotypies, echolalia) was compared to contingent presentation of food (Charlop, Kurtz, & Casey, 1990); and (c) measuring the relative

percentage of approach responses made to a standardized set of stimuli repeatedly presented to the client (Green et al., 1988; Green, Reid, Canipe, & Gardner, 1991; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Steege, Wacker, Berg, Cigrand, & Cooper, 1989).

Of these procedures, the most common method for identifying reinforcers for persons with severe to profound retardation is the procedure developed by Pace et al. (1985). These investigators developed a two-step process (henceforth referred to as the Pace procedure) in which clients were first systematically exposed to 16 stimuli while observers measured whether the client approached each stimulus. In the second step, the procedure was validated by demonstrating that those stimuli frequently approached were more potent reinforcers than stimuli not frequently approached. This procedure has been found to be superior to caregiver opinion in identifying reinforcers (Green et al., 1988, 1991) and is useful in the development of treatment packages for maladaptive behavior (Mason, McGee, Farmer-Dougan, & Risley, 1989; Steege et al., 1989). However, Green et al. (1988, 1991) also reported

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that not all stimuli identified as preferred were equally effective as reinforcers. Therefore, it may be useful to develop an extension of the Pace procedure that has greater selectivity in differentiating between preferred and nonpreferred stimuli.

Mason *et al.* (1989) applied the Pace procedure in combination with an abbreviated stimulus-preference assessment completed daily to provide an ongoing method of identifying reinforcers. In this mini-assessment, the stimuli were presented two at a time, and the children were instructed to pick just one. This forced-choice presentation format may better differentiate preferred from nonpreferred stimuli than the Pace procedure because it more closely approximates natural situations in which an individual chooses between potentially available stimuli through differential responding.

In basic operant experiments, a concurrent operants paradigm has been used to examine choices or preferences (Catania, 1963, 1966; Herrnstein, 1970). With this paradigm, two or more consequences are simultaneously available to the subject and are associated with different responses (e.g., for a pigeon, pecking could be reinforced on a variable-interval 30-s schedule for Key A and on a variable-interval 20-s schedule on Key B). Under such a paradigm, the rate or duration of each response will generally be proportional to the rate or magnitude of reinforcement associated with that response, thus providing a means for assessing relative preferences for various stimuli or schedules (Catania, 1963, 1966). In the example above, the pigeon could receive two reinforcers per minute on Key A and three per minute on Key B; thus, 40% of responses would occur on Key A and 60% on Key B.

In the current investigation, a concurrent operants paradigm was used to help determine whether the forced-choice method of stimulus presentation described above might be a useful extension of the Pace procedure. Specific predictions were that (a) significantly more stimuli would be identified as highly preferred through the Pace procedure than through the forced-choice format and (b) the results of the forced-choice assessment would better predict

which stimuli would result in higher levels of responding in a concurrent operants paradigm.

## METHOD

### *Subjects and Setting*

Ava was 2 years 9 months old and had severe mental retardation and a seizure disorder. Carl was 5 years 6 months old and exhibited moderate mental retardation, organic brain syndrome, left hemiparesis, a left visual field defect, and a seizure disorder. Don was 7 years 10 months old and had profound retardation, microcephaly, right hemiparesis, pervasive developmental disorder, and a seizure disorder. Kati was 10 years old and exhibited severe mental retardation, Down syndrome, and hypothyroidism.

All sessions were conducted in individual treatment rooms (approximately 3 m by 3 m). Observers recorded participant responses while seated in the room or from behind a two-way mirror.

### *Data Collection and Reliability*

During stimulus preference and forced-choice sessions conducted in Phase 1, a trained observer recorded whether the participant approached each item presented. A second independent observer collected reliability data during 80.2% of Phase 1 sessions. The average agreement coefficients across subjects were (a) occurrence, 94.6% (range, 87.9% to 97.4%); (b) nonoccurrence, 89.4% (range, 80.8% to 97.5%); and (c) total, 98.4% (range, 98.1% to 98.8%).

During Phase 2 for Ava, Carl, and Kati, two squares (0.7 m by 0.7 m) were drawn on the floor of the treatment room, and the trained observer recorded on a laptop computer the duration of in-square behavior. In-square behavior was defined as having any body portion inside the square. For Don, two chairs were present in the treatment room, and duration of in-seat behavior (buttocks touching the seat of the chair) was used as the dependent variable. A second independent observer collected reliability data during 69.6% of Phase 2 sessions. Exact interval-by-interval agreement coefficients

were calculated for duration of in-seat or in-square behavior by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100. An agreement was defined as a 10-s interval during which both observers recorded the same duration (in seconds) of the target behavior. In Phase 2, the average exact agreement coefficient across clients was 97.6% (range, 95.3% to 99.5%).

### *Procedure*

*Phase 1.* The stimuli used in the Pace et al. (1985) study were compared using the stimulus preference procedure developed by Pace et al. and a forced-choice method of stimulus presentation. The stimuli were a mirror, a light box, taped music, a beeper, coffee grounds, hibiscus, juice, a cracker, a vibrator, a fan, a heat pad, an ice pack, a rocking chair, a swivel rocker, a therapist clapping, a hug from the therapist. For the stimulus preference assessment, the 16 stimuli were individually presented a total of 10 times each over the course of eight sessions. Within a session, four stimuli were presented five times each in a counterbalanced order. For each trial, one stimulus was placed approximately 0.7 m in front of the client. Client approaches resulted in access to the stimulus for approximately 5 s. If a client did not approach a stimulus after 5 s, the therapist prompted the client to sample the stimulus for 5 s. After sampling the item, it was again placed 0.7 m in front of the client for another 5 s; an approach resulted in access to the stimulus for 5 s.

During the forced-choice assessment, the same 16 stimuli were presented in pairs. Each stimulus was paired once with every other stimulus, in a randomized order, for a total of 120 stimulus-pair presentations. For each trial, two stimuli were placed 0.7 m apart and approximately 0.7 m in front of the client. Client approaches to one of the stimuli resulted in access to that stimulus for 5 s and removal of the other stimulus. Client approaches to both stimuli simultaneously were blocked. If a client did not approach either stimulus within 5 s, the therapist prompted the client to sample each

stimulus for 5 s. After sampling each item, the two stimuli were again placed in front of the client for another 5 s. Client approaches to one of the stimuli resulted in access to that stimulus for 5 s and removal of the other stimulus. If the client did not approach either item within 5 s, both items were removed, and the next trial began.

*Phase 2.* The initial plan was to compare three types of stimuli: (a) stimuli approached on at least 80% of trials on both stimulus preference and forced-choice assessments (high-high stimuli), (b) stimuli approached on at least 80% of stimulus preference trials and 60% or fewer forced-choice trials (SP-high stimuli), and (c) stimuli approached on at least 80% of forced-choice trials and 60% or fewer stimulus preference trials (FC-high stimuli). However, the results of Phase 1 produced high-high stimuli and SP-high stimuli, but no FC-high stimuli. Therefore, only high-high and SP-high stimuli were compared in Phase 2. The specific stimuli selected by each client as high-high and SP-high are available from the authors upon request.

When multiple stimuli met criteria for a high-high stimulus, two stimuli with the greatest agreement between the stimulus preference and forced-choice assessments were selected. When multiple stimuli met criteria for SP-high, two stimuli with the greatest disagreement between the stimulus preference and forced-choice assessments were selected. For Ava, only one stimulus met the SP-high criterion; therefore, the stimulus that most closely approximated the criterion was included so that there would be a pair of SP-high stimuli (this additional stimulus was approached on 75% of the stimulus preference trials and only 16% of forced-choice trials).

During both the initial and return-to-baseline sessions, a therapist was present in the treatment room but did not interact with the client. None of the stimuli were present during baseline. Following baseline, the client received training trials to teach him or her to gain access to the stimuli being assessed. A training trial consisted of placing the stimuli in a box (or chair) in front of the client. The client was given 5 s to move into the box or

chair independently and then given sequential verbal, gestural, and physical prompts every 5 s until the client displayed the target response. Immediately after displaying the target response, the client was given access to the stimuli for approximately 10 s. Training ended when the client emitted the target response independently on 80% of trials for three consecutive blocks of 10 trials.

During treatment, sessions were conducted in a manner identical to baseline except that two stimuli were positioned in each of the boxes on the floor or directly next to each of the chairs. The two high-high stimuli were placed with one box or chair, and the two SP-high stimuli were placed with the other box or chair. The client could gain access to high-high or SP-high stimuli by engaging in independent in-square or in-chair behavior in the corresponding box or chair on which those stimuli were placed. That is, if the client exhibited in-square or in-chair behavior, the therapist presented the stimuli associated with that square or chair to the client. If the client left a box or chair for 3 s, the therapist withdrew the stimuli and returned them to the designated box or chair.

## RESULTS

The results from Phase 1 are presented in Figure 1. The type of stimulus is represented by a letter (A through P) positioned below the abscissa. In the left panel, stimuli are presented from left to right, rank-ordered according to the approach responses measured during the forced-choice assessment. In the right panel, the same data are presented rank-ordered according to the approach responses measured during the stimulus preference assessment. The data are presented in this format to highlight the similarities and differences between the two assessments.

There were nine stimuli identified as highly preferred by both assessments for the 4 clients. These were the only nine stimuli identified as highly preferred by the forced-choice assessment. There were 27 additional stimuli identified as highly preferred by the stimulus-choice assessment, 19 of which met criteria for an SP-high stimulus (i.e., approached

on 80% or greater stimulus preference trials and 60% or fewer forced-choice trials). The chance probability that all 19 disagreements would be SP-high stimuli and none would be FC-high stimuli is exceedingly low ( $Z = 4.36$ ;  $p < .0001$ ).

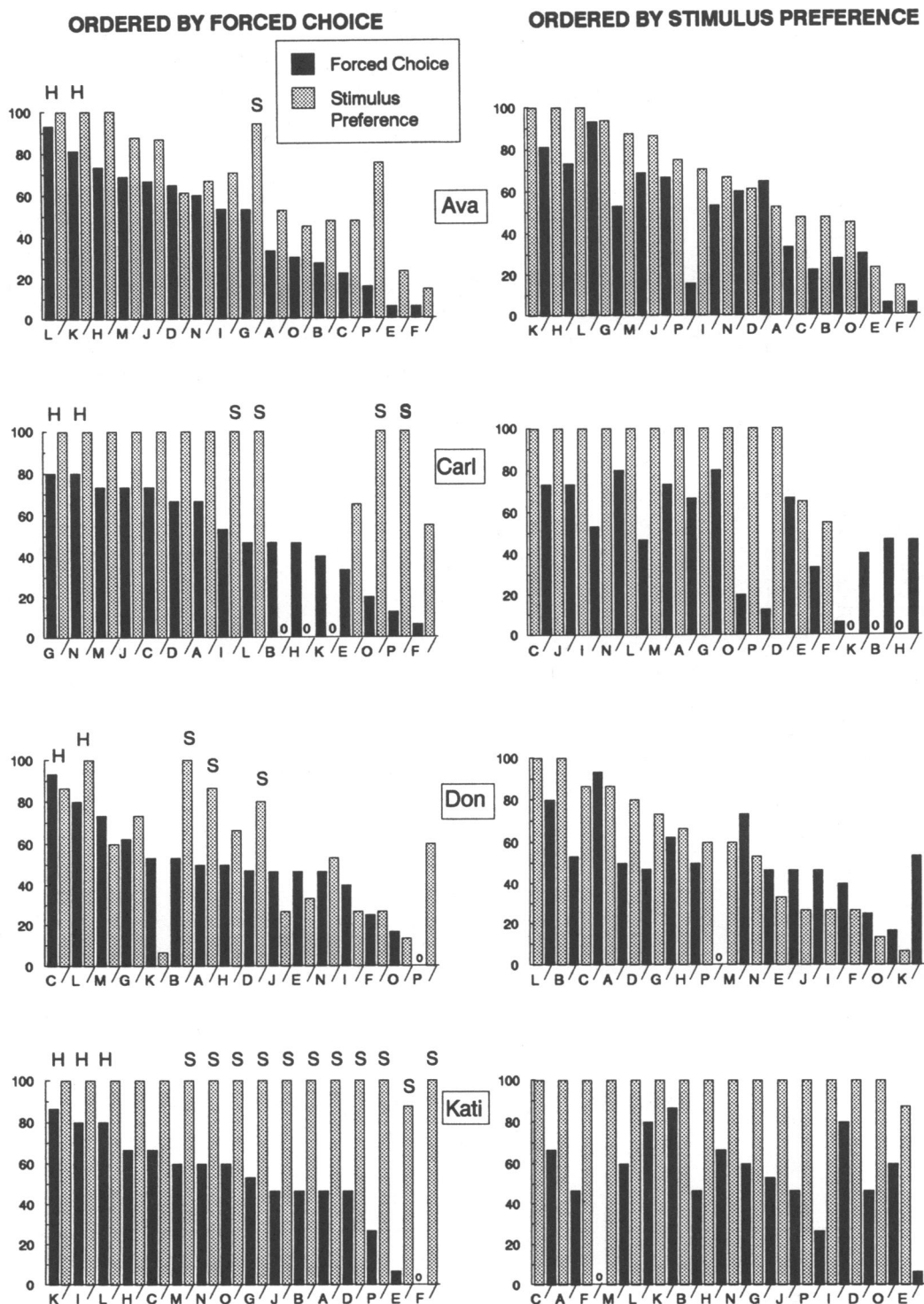
The results of Phase 2 are depicted in Figure 2. For all 4 clients, the duration of in-seat and in-square behavior was significantly higher when these behaviors resulted in access to high-high stimuli than during baseline. The duration of in-seat and in-square behavior was somewhat higher than baseline for Carl when this behavior resulted in access to SP-high stimuli, and was unchanged for Don and Kati or was slightly lower than baseline for Ava. Finally, within the concurrent operants phase, the duration of in-seat and in-square behavior was significantly higher for the chair or square associated with high-high stimuli than for the chair or square associated with the SP-high stimuli.

## DISCUSSION

In Phase 1 of this investigation, a comparison of two stimulus assessments showed that (a) all of the items identified as highly preferred by the forced-choice assessment were also identified as highly preferred on the stimulus preference assessment and (b) on all of the stimuli for which the two assessments disagreed, the stimulus preference assessment identified the item as highly preferred and the forced-choice assessment identified the item as low to moderate. These results suggest that the forced-choice assessment has good concurrent validity and that the stimulus preference assessment tends to identify stimuli as highly preferred too often. This may occur because the stimuli are presented individually, and alternative stimuli are not available to the client. Although the forced-choice format appears to be a useful extension of the Pace *et al.* (1985) procedure, the original procedure may still be preferable with extremely low functioning individuals who have difficulty making reliable choice responses.

In Phase 2, stimuli on which the two procedures agreed (high-high stimuli) and disagreed (SP-high stimuli) were compared using a concurrent operants

# PERCENTAGE OF APPROACH RESPONSES



## STIMULI

Figure 1. The percentage of approach responses to each of the 16 stimuli during the forced-choice and stimulus preference assessments conducted in Phase 1. An H above a stimulus indicates that the stimulus meets criteria as a high-high stimulus; an S indicates that the stimulus meets criteria as an SP-high stimulus.

PERCENTAGE OF TIME

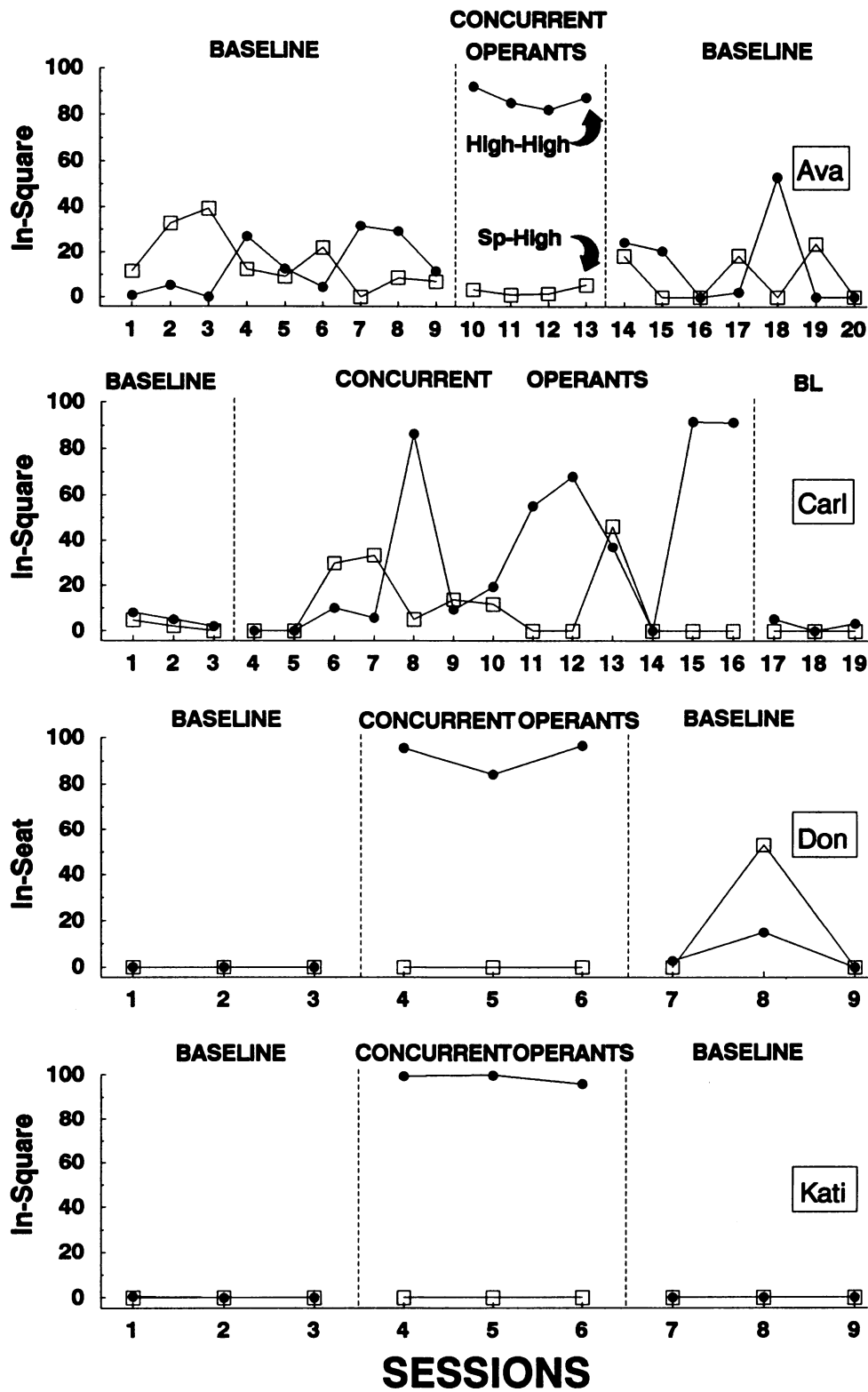


Figure 2. The percentage of time each client engaged in the in-square or in-chair behavior associated with high-high and SP-high stimuli during the baseline and concurrent operants conditions.

paradigm. For all 4 clients, greater increases in responding occurred with high-high stimuli than with SP-high stimuli, indicating that the forced-choice assessment better predicted which stimuli would function as more potent reinforcers when a concurrent operants paradigm was used as the criterion (i.e., the forced-choice assessment had better predictive validity).

A concurrent operants paradigm was used because it is efficient and allows comparisons of reinforcers or schedules that cannot be accomplished in a paradigm in which operants are evaluated at different points in time (i.e., in a single operant paradigm). The concurrent operants paradigm has been employed primarily in basic operant research on schedules of reinforcement, but the current results suggest that it may also be useful for assessing reinforcers for clinical purposes. The advantage of this paradigm for assessing the relative strength of two or more reinforcers is that the magnitude of responding for each operant is a function of the magnitude of reinforcement and type of schedule employed (interval or ratio) and is not related to interference or competition between the responses (Catania, 1966). When concurrent responses are reinforced on variable-interval (VI) schedules, the magnitude of each response is directly proportional to, or matches, the magnitude of reinforcement associated with that response. When concurrent responses are reinforced on ratio schedules, the subject will generally maximize reinforcement by emitting only the response associated with the densest schedule of reinforcement (Herrnstein, 1970). Neither the matching nor maximizing phenomenon occurs when operants are studied individually, in that large increases in reinforcement magnitude may produce only small changes in the magnitude of responding (Catania, 1966).

In Phase 2 of the current investigation, client responses were reinforced on a ratio schedule (i.e., continuous reinforcement). Three of 4 clients (Ava, Don, and Kati) responded in a manner consistent with maximization, in that almost all of their in-square or in-seat behavior occurred in the square or chair associated with the high-high stimuli. It is possible that the SP-high stimuli would have produced some increases in responding for these 3

clients if the concurrent operants were reinforced on equal VI schedules, or if the SP-high stimuli were presented in a single operant paradigm. Based on the basic operant literature, use of concurrent VI schedules may be most appropriate when the clinician wishes to determine the relative preference value of two or more stimuli (through the matching phenomenon). Ratio schedules may be most appropriate when the clinician wishes to identify quickly the stimulus with the highest preference value (through the maximization phenomenon). Use of a single operant paradigm may be most appropriate when the clinician wishes to determine whether each individual stimulus can function as a reinforcer.

For Carl, maximization did not occur, and both high-high and SP-high stimuli produced only moderate increases in in-square behavior during the concurrent operants phase, with the mean duration of in-square behavior being somewhat higher for the high-high stimuli. There are at least two possible explanations of Carl's results: (a) As Mason et al. (1989) found, preferences may change over time for some clients and (b) none of the 16 stimuli compared in this investigation were among Carl's most preferred stimuli. The forced-choice or stimulus preference assessments can identify reinforcers from this or any set of stimuli only if one or more of the stimuli in the set are, in fact, reinforcers for a given individual. Green et al. (1991) found that use of a similar set of 12 stimuli resulted in identification of reinforcers for most, but not all, clients. They also found that caregiver opinion may be a useful adjunct for the minority of clients for whom none of the standard stimuli function as reinforcers. Future investigators may wish to determine how to best integrate caregiver information with standardized reinforcer assessment procedures.

The comparison in Phase 2 would have been strengthened if single examples of high-high and SP-high stimuli were compared, rather than presenting the stimuli in pairs. The Phase 2 procedures were based on our normal clinical practices in which we routinely present multiple preferred stimuli to increase the probability of a reinforcement effect. Given that client preferences change over time (Mason et al., 1989), this seems to be a reasonable

strategy. However, it is not possible to draw conclusions about individual stimuli when using this procedure. Future investigators may wish to determine the extent to which the forced-choice assessment accurately predicts the reinforcement effects of individual stimuli.

## REFERENCES

- Catania, A. C. (1963). Concurrent performances: A baseline for the study of reinforcement magnitude. *Journal of the Experimental Analysis of Behavior*, **6**, 299-300.
- Catania, A. C. (1966). Concurrent operants. In W. K. Honig (Ed.), *Operant behavior: Areas of research and application* (pp. 213-270). New York: Appleton-Century-Crofts.
- Charlop, M. H., Kurtz, P. F., & Casey, F. G. (1990). Using aberrant behaviors as reinforcers for autistic children. *Journal of Applied Behavior Analysis*, **23**, 163-181.
- Dattilo, J. (1986). Computerized assessment of preference for severely handicapped individuals. *Journal of Applied Behavior Analysis*, **19**, 445-448.
- Green, C. W., Reid, D. H., Canipe, V. S., & Gardner, S. M. (1991). A comprehensive evaluation of reinforcer identification processes for persons with profound multiple handicaps. *Journal of Applied Behavior Analysis*, **24**, 537-552.
- Green, C. W., Reid, D. H., White, L. K., Halford, R. C., Brittain, D. P., & Gardner, S. M. (1988). Identifying reinforcers for persons with profound handicaps: Staff opinion versus systematic assessment of preferences. *Journal of Applied Behavior Analysis*, **21**, 31-43.
- Herrnstein, R. J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior*, **13**, 243-266.
- Mason, S. A., McGee, G. G., Farmer-Dougan, V., & Risley, T. R. (1989). A practical strategy for ongoing reinforcer assessment. *Journal of Applied Behavior Analysis*, **22**, 171-179.
- Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T. J. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. *Journal of Applied Behavior Analysis*, **18**, 249-255.
- Steege, M. W., Wacker, D. P., Berg, W. K., Cigrand, K. K., & Cooper, L. J. (1989). The use of behavioral assessment to prescribe and evaluate treatments for severely handicapped children. *Journal of Applied Behavior Analysis*, **22**, 23-33.
- Wacker, D. P., Berg, W. K., Wiggins, B., Muldoon, M., & Cavanaugh, J. (1985). Evaluation of reinforcer preferences for profoundly handicapped students. *Journal of Applied Behavior Analysis*, **18**, 173-178.

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