JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2003, **36,** 59–76 NUMBER 1 (SPRING 2003)

RESPONSE-RESTRICTION ANALYSIS: II. ALTERATION OF ACTIVITY PREFERENCES

GREGORY P. HANLEY
UNIVERSITY OF KANSAS

BRIAN A. IWATA
UNIVERSITY OF FLORIDA

EILEEN M. ROSCOE
NEW ENGLAND CENTER FOR CHILDREN

RACHEL H. THOMPSON
UNIVERSITY OF KANSAS

AND

JANA S. LINDBERG
BRIGHAM YOUNG UNIVERSITY

We used response-restriction (RR) assessments to identify the preferences of 7 individuals with mental retardation for a variety of vocational and leisure activities. We subsequently increased their engagement in nonpreferred activities using several procedures: response restriction per se versus a Premack-type contingency (Study 1), supplemental reinforcement for engagement in target activities (Study 2), and noncontingent pairing of reinforcers with nonpreferred activities (Study 3). Results indicated that preferences are not immutable and can be altered through a variety of relatively benign interventions and that the results of RR assessments may be helpful in determining which types of procedures may be most effective on an individual basis.

DESCRIPTORS: preference, reinforcer assessment, restriction, contingency, Premack principle, differential reinforcement, conditioning

Response-restriction (RR) analyses have been used primarily as a basis for predicting the manner in which responding is reallocated across available activities as preferred options become fewer in number (Bernstein & Ebbeson, 1978; Green & Striefel, 1988; Lyons & Cheney, 1984; McEntee & Saunders, 1997). Green and Striefel described an extension of RR procedures for identifying activity preferences for children with autism. More recently, Hanley, Iwata, Lindberg, and Conners (2003) conducted RR assessments of work and leisure preferences with adults with developmental disabilities and found that RR assessments yielded (a) outcomes that were idiosyncratic across participants

This research was based on a dissertation submitted by the first author to the University of Florida in partial fulfillment of requirements for the PhD degree and was supported in part by a grant from the Florida Department of Children and Families. We thank Michele Wallace and April Worsdell for their assistance in conducting various aspects of this study. We also thank Marc Branch, Maureen Conroy, Timothy Hackenberg, Mark Lewis, and Timothy Vollmer for their comments and suggestions on earlier versions of this manuscript.

Reprints may be obtained from Greg Hanley, Department of Human Development and Family Life, 1000 Sunnyside Ave., University of Kansas, Lawrence, Kansas 66045 (e-mail: ghanley@ku.edu).

but consistent within participants and (b) data on a wider range of preferences than those resulting from a more typical free-operant assessment. In addition, rules for determining when to remove activities from the choice array were described, along with alternative means for summarizing data generated from RR assessments. In the current study, several different patterns of responding evident in the outcomes of RR assessments were used as baselines for examining strategies for altering preexisting preferences.

Although client preference should be one determining factor in the selection of leisure activities and vocational opportunities, certain patterns of preference may be problematic. For example, an individual who exclusively prefers one or few activities (as is often reported for individuals diagnosed with autism) will not contact alternative sources of stimulation available from other activities. Alternatively, an individual who participates only in passive leisure activities (e.g., lying in bed and watching television) may derive little benefit from vocational training or even from more "constructive" leisure activities required for community involvement. Although accepting these preferences rather than attempting to alter them may be consistent with notions of free choice and self-determination (Bannerman, Sheldon, Sherman, & Harchik, 1990), it is possible that engagement in a particular activity is strongly influenced by the number and type of activities available as well as by other events taking place where the activity of interest occurs. Thus, exclusive preference for socially undesirable activities may reflect a limited environmental history that has not allowed the individual to contact reinforcers associated with more varied or productive behavior.

Identifying activity preferences and then implementing relatively benign strategies to expand limited preferences or to alter undesirable preferences would provide a means for balancing individuals' right to choose with therapists' responsibilities to provide therapeutic or habilitative services. This general approach was adopted in the current series of studies. We first used RR assessments to identify the activity preferences of seven individuals with developmental disabilities. We then determined the extent to which RR per se or the arrangement of a contingency between highly preferred and less preferred activities influenced 4 participants' engagement in less preferred activities (Study 1). We also evaluated the effects of two procedures in altering preference for concurrently available activities: One procedure involved embedding additional response-contingent reinforcers in less preferred activities (Study 2); the other involved pairing the noncontingent delivery of reinforcers with less preferred activities (Study 3).

GENERAL METHOD

Participants and Setting

Seven adults with developmental disabilities who attended a workshop program participated (see Table 1 for participant information). Sessions were conducted in workshop areas or conference rooms that contained tables, chairs, and, at times, other employees of the workshop.

Response Measurement

Data were collected on laptop computers by trained observers on participants' interaction with each of the available activities during 5-min sessions. Interaction was scored during continuous 5-s intervals on a partial-interval basis and was recorded when a participant's hand contacted any part of the materials for at least 1 s. Data were summarized as the percentage of intervals during which interaction with a particular activity occurred. Percentage of intervals of interaction was selected as the primary dependent measure because it provided a common basis

Table 1
Participant Characteristics

Name	Age (years)	Diagnosis and sensory impairments
Rob	50	Profound mental retardation, autism
Dan	23	Moderate mental retardation, seizure disorder
Jed	26	Moderate mental retardation
Lee	42	Moderate mental retardation, seizure disorder
Ed	33	Mild mental retardation
Bud	41	Moderate mental retardation
Ann	45	Mild mental retardation, Prader-Willi syndrome

for comparing data across a wide range of activities.

Interobserver Agreement

Interobserver agreement was assessed by having a second observer collect data simultaneously but independently during at least 25% of the sessions in each condition across participants (M = 36.8%; range, 27.8% to 100%). Observers' records were compared on an interval-by-interval basis, and an agreement was scored in any interval in which the two observers both scored either the occurrence or nonoccurrence of interaction with respect to each activity. Agreement percentages were calculated for each activity by dividing the number of agreement intervals by the total number of intervals and multiplying by 100%. Mean agreement for interaction was 97.5% across assessments and participants (range, 92.5% to 100%).

RR Assessments

An initial group of activities was identified for each participant by administering a structured questionnaire (Fisher, Piazza, Bowman, & Amari, 1996) to either the participant or a staff member. Activities from this group were included in an individual's RR assessments if the activities (a) were reported to be preferred, (b) were reported or were observed to be available in the participant's home or workshop area, and (c) could be placed on a table and interacted with while alone. At least two additional activities reported to be less preferred or nonpreferred were included in the assessments. A total of seven activities were included in the each of two RR assessments with each participant (see Table 2 for descriptions of the types of activities included in the study).

RR assessments were conducted using the

Table 2
Activity Descriptions

Activity	Description
Blocks	Small (3 cm) colored wooden cubes
Electronic game	Electronic version of Connect 4
Hygiene tasks	Toothbrush, toothpaste, water; hairbrush; face cloth; deodorant
Legos®	Colored plastic squares and rectangles that lock together
Photo album	Photographs of family and friends in binder
Walkman®	A personal radio and cassette player with headphones
Writing	Writing tablets and pens and pencils

Note. Additional activity descriptions can be found in Hanley, Iwata, Lindberg, and Conners (2003).

same procedures described by Hanley et al. (2003). Prior to the first assessment, the participant was prompted to manipulate each of the seven activities for 30 s. At the beginning of each session, the seven (or remaining) activities were arranged in an arc on a table in front of the participant, and the therapist pointed to each activity while naming it. The therapist informed the participant that he or she may interact with one, some, or none of the items and then began the session. During the session, no prompts or consequences were delivered, and the participant was free to engage in activities simultaneously. Sessions were 5 min in duration, and four to eight sessions were conducted each day with 2- to 3-min breaks between sessions. Activities were removed from the array in subsequent sessions once a preference for one or more of the activities was discernible (see Hanley et al., 2003, for activity-restriction rules). The RR data provided baselines of preference from which several experimental manipulations were evaluated.

Study 1: Response Relations

One common strategy for altering existing preferences (response allocation) consists of using access to one response as a consequence for a second response via one of two models. The Premack principle (Premack, 1959, 1962) involves access to a high-probability behavior as reinforcement for engaging in a low-probability behavior. Response deprivation (Timberlake & Allison, 1974) involves access to a restricted response when another response is emitted at above-baseline levels. Results from several studies have shown that the response deprivation model is more accurate in predicting reinforcement effects (e.g., Konarski, 1987; Konarski, Johnson, Crowell, & Whitman, 1980; Timberlake & Wozny, 1979); nevertheless, most applied research continues to refer to the Premack principle when arranging contingencies between responses (Amari, Grace, & Fisher, 1995; Charlop, Kurtz, & Casey, 1990; Hanley, Iwata, Thompson, & Lindberg, 2000).

Regardless of the model, an interesting conceptual and practical question raised by these arrangements is whether a contingency is actually necessary. That is, would restriction alone (simply removing the high-probability activity or the contingent response) be sufficient to increase the likelihood of a low-probability (or instrumental) behavior? Some studies have included a control condition to isolate the effects of mere restriction, in which access to the contingent response (i.e., the response used as a reinforcer) was noncontingently available (Bernstein & Ebbeson, 1978; Konarski, 1987; Konarski et al., 1980; Timberlake & Wozny, 1979). For example, Konarski et al. arranged a "matched-control" condition in which the response previously programmed as a reinforcer was noncontingently available, with the number of presentations and the overall availability of this response yoked to the preceding condition in which a contingency was arranged. Responding by 1 of the 2 participants was similar in the contingent and matched-control conditions, suggesting that the supposed reinforcement effect observed in the contingent condition may have been a result of merely restricting access to the contingent response. In other words, when one response option is removed, more time is available to engage in other responses.

Increases in responding that are observed in most studies in which response–response relations were arranged did not include controls for the effects of restriction alone (e.g., Allen & Iwata, 1980; Amari et al., 1995; Charlop et al., 1990; Mitchell & Stoffelmayr, 1973; Salzberg, Wheeler, Devar, & Hopkins, 1971). As a result, behavioral changes may not have been a function of programmed reinforcement but, rather, of the removal of other competing responses.

Thus, the matched noncontingent control conditions described by Bernstein and Ebbeson (1978), Konarski (1987), and Konarski et al. (1980) are important in that only one element, the contingency, is altered between the experimental condition and control condition (see Rescorla & Skucy, 1969, for a more detailed discussion). However, the strength of this control condition may be limited under some circumstances. For instance, the matched aspect of the control condition, which refers to the yoking of the number of presentations and overall availability of the contingent response between the control (noncontingent) and test (contingent) conditions, necessitates that the participant experience the test condition prior to the control condition. Adventitious reinforcement of the instrumental response may occur under these conditions (Neuringer, 1970), which would reduce the effectiveness of the matched noncontingent condition as a control for the effects of a contingency (Konarski et al., 1980).

An alternative arrangement for assessing the influence of a contingency independent of the effects of mere restriction was recently described by Hanley et al. (2000). Following baselines in which two responses were concurrently available (stereotypy and object manipulation), the higher probability response (stereotypy) was removed, and measurement of the remaining response continued until stability was observed. This condition (labeled restriction) *preceded* a reinforcement condition in which contingent access to stereotypy was made available following emission of object manipulation and served as an adequate control for the effects of simply removing access to a high-probability response prior to observing the effects of its contingent delivery.

Identifying the functional elements of response relations is helpful on practical grounds: Changes in patterns of behavior in multiresponse environments can be facilitated with the least effortful strategies. An additional practical question addressed here is the extent to which results of an RR assessment predict whether restriction alone or a contingency would be necessary to increase engagement in less preferred activities. If so, the procedures required to increase participation in less preferred activities may be known prior to implementing treatment, thereby expediting the intervention process.

Procedure

Following RR assessments, highly preferred and less preferred activities were selected for inclusion in an analysis of response relations for 4 participants (Dan, Lee, Rob, and Jed). Highly preferred activities were those associated with the highest percentage of interaction: nuts-and-bolts task for Dan, jigsaw puzzles for Lee, blocks for Rob, and a Walkman® radio for Jed (see the top panels of Figures 1 through 4). If responding was reallocated to every activity during the RR assessment (see the top panels of Figures 1 and 2 for Dan and Lee, respectively), items associated with low interaction percentages and ranked in the bottom half of the hierarchy were selected as the less preferred activities. These were weights for Dan and a Walkman® radio and art book for Lee. Less preferred activities for Rob and Jed were selected from those in which no responding was observed during the RR assessment (see the top panels of Figures 3 and 4 for Rob and Jed, respectively). These were the stamp-and-stuff task for Rob and the sort-and-pack and hygiene tasks for Jed.

A highly preferred activity and a less preferred activity were concurrently available (placed on a table in front of the participants) in the initial and subsequent baseline conditions. No consequences for engaging in either activity were provided by the therapist during baseline. Prior to each session throughout the analyses, two prompts to engage in the less preferred activity were pro-

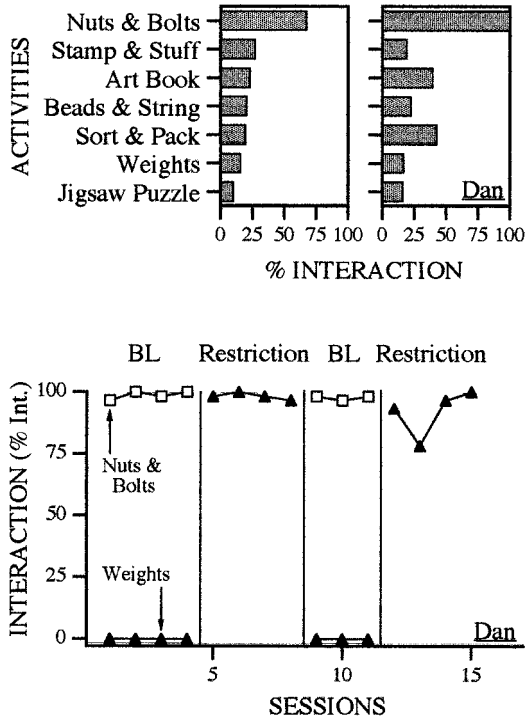

Figure 1. Percentages of interaction during Dan's RR assessments (top panel) and during his assessment of response relations (bottom panel).

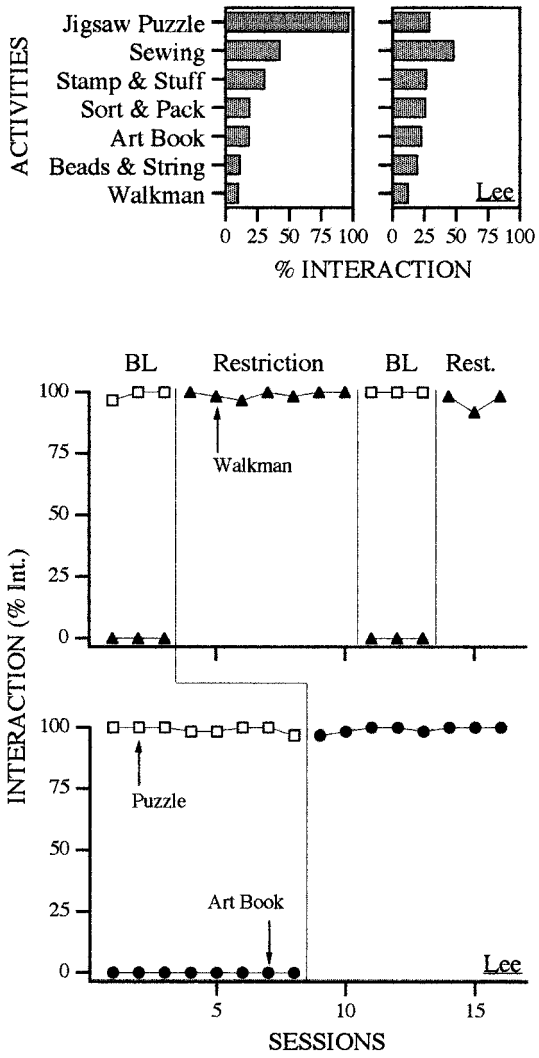

Figure 2. Percentages of interaction during Lee's RR assessments (top panel) and during her assessment of response relations (middle and bottom panels).

vided using a three-step sequence (e.g., Horner & Keilitz, 1975) to ensure that (a) the participants experienced the presence or absence of consequences for engaging in the less preferred activities, and (b) prompting remained constant so that changes in responding could be attributed to the independent variables of interest (restriction or reinforcement).

When stable levels of interaction were observed, the activity associated with higher levels of interaction (high-probability activity) was removed such that only the alternative activity (low-probability activity) was available; this condition is labeled restriction. Thus, the independent effects of restricting access to a high-probability activity were observed prior to the arrangement of a reinforcement contingency. If high levels of interaction with the low-probability activity were observed during the restriction condition, these effects were replicated in either a reversal design (Dan and Lee) or a multiple baseline across behaviors design (Lee).

If interaction with the low-probability activity did not increase above baseline levels during the restriction condition, access to the high-probability activity was provided contingent upon engaging in the low-probability activity (this condition is labeled reinforcement). During Rob's reinforcement condition, 30-s access to the blocks activity

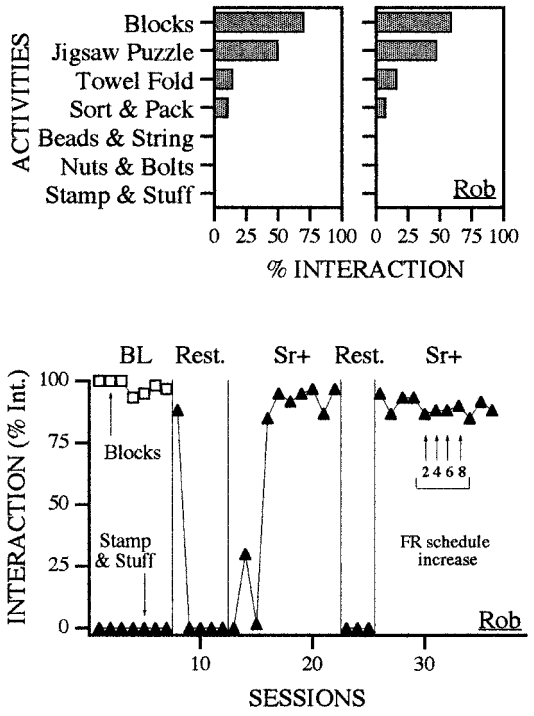

Figure 3. Percentages of interaction during Rob's RR assessments (top panel) and during his assessment of response relations (bottom panel).

was available following the completion of one work unit that involved stamping a sheet of paper, folding it in thirds, and stuffing it in an envelope. The work requirement was gradually increased, such that eight units were required to obtain the blocks activity for 30 s. During Jed's reinforcement phases, 30-s access to the radio was initially made contingent on either completing one hygiene activity (combing his hair, applying deodorant, brushing his teeth, or wiping his face) or completing one work unit (placing a rubber band, piece of paper, and pencil in a bag and placing the bag in a designated area on the table). The work requirement was later increased (Sessions 60 and 64), such that completion of all four hygiene tasks (i.e., the entire hygiene routine) or four work units was required in order to gain access to the radio for 30 s. The 5-min sessions were extended for 30 s for each reinforcer delivery; thus, the data reflect 5 min of observation during which only the low-probability activities were available. The effects of the contingency were evaluated in a reversal design (Rob and Jed) and a multiple baseline design (Jed).

Results and Discussion

Results of the RR assessments for the 4 participants are shown in the top panels of Figures 1 through 4. Dan reallocated responding to all activities during his RR assessment (top panel of Figure 1) and showed a preference for the nuts-and-bolts activity (M = 67.2% and 100% for the first and second assessments, respectively) relative to the weights activity (M = 15.3% and 16.7%). Based on these results, one might predict an increase in interaction with the less preferred activities in the absence of a contingency. This was assessed with the nuts-and-bolts and weights activities (bottom panel of Figure 1). Consistent with the relative rankings observed in the RR assessments, Dan interacted exclusively with the nuts-and-bolts task (M = 98.8%) and did not interact with the weights (M = 0%) during baseline. When the nuts-and-bolts task was removed, an immediate and sustained increase in interaction with the weights (M = 98.3%) was observed in the absence of a programmed reinforcement contingency. This effect was replicated by reintroducing and withdrawing the nuts-and-bolts activity.

Lee also reallocated responding to all activities during her RR assessments (top panel of Figure 2). Her most preferred activity was jigsaw puzzles (M = 62.6%), whereas the art book (M = 20.3%) and radio (M = 11%) were less preferred. The effects of restriction were assessed on two separate baselines, jigsaw puzzles versus the radio (middle panel of Figure 2) and jigsaw puzzles versus the art book (bottom panel of Figure 2). As would be predicted based on the outcomes of Lee's

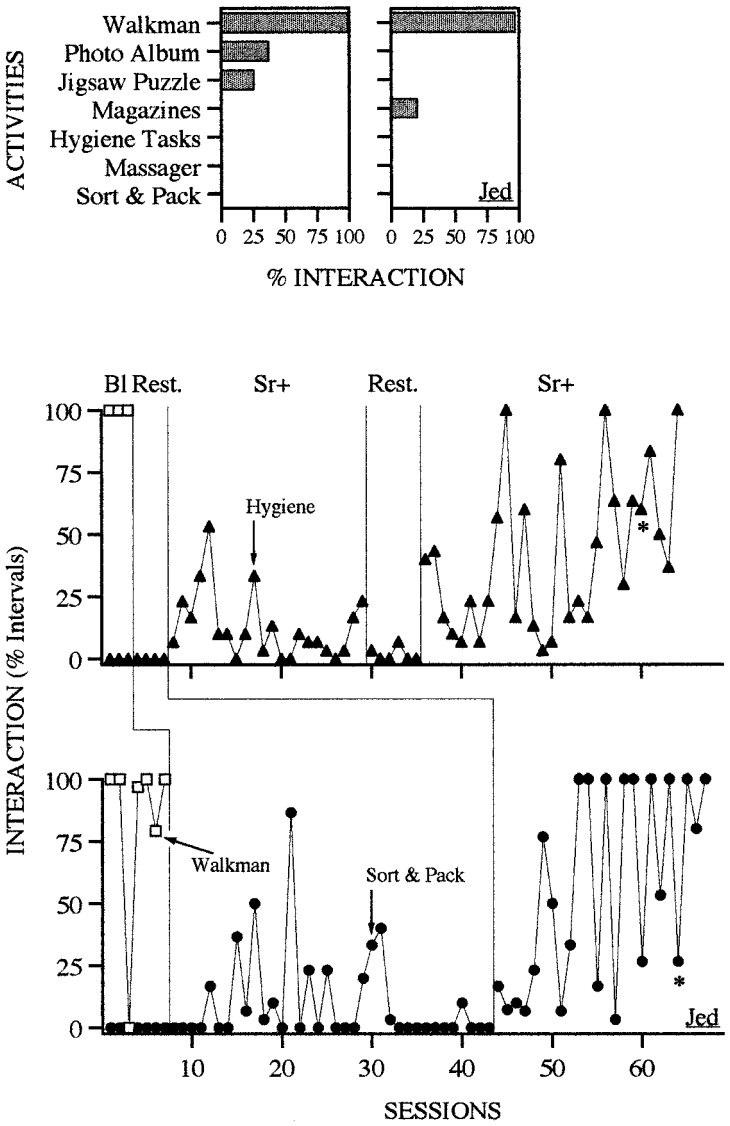

Figure 4. Percentages of interaction during Jed's RR assessments (top panel) and during his assessment of response relations (middle and bottom panels). Asterisks mark points at which the criterion for reinforcement increased from one to four units.

RR assessments, she interacted exclusively with the jigsaw puzzles during the baselines. Following removal of the jigsaw puzzles, high levels of interaction were observed with the less preferred activities (radio and art book). The effects of restriction were replicated by the reintroduction and subsequent removal of the jigsaw puzzles (middle panel of Figure 2).

Results of Rob's two RR assessments were nearly identical (top panel of Figure 3) and indicated that his most preferred activity was blocks. By contrast, Rob never interacted with the beads-and-string, nuts-and-bolts, and stamp-and-stuff activities, suggesting that restriction alone would not produce increases in these activities. We explored this possibility in greater detail by evaluating both restriction and reinforcement interventions (bottom panel of Figure 3).

Consistent with the results of Rob's RR assessment, he interacted exclusively with the blocks when both the blocks and the stamp-and-stuff activities were concurrently available during baseline. When blocks were removed (restriction), Rob interacted with the stuffing task during the first session but not at all during four subsequent sessions. When a contingency between completing a unit of the stuffing task and access to blocks was arranged, increased engagement in the stuffing task was observed eventually; this effect was replicated when the contingency was removed and then reinstated. During the final reinforcement condition, high levels of engagement in the stuffing task were maintained as the schedule was increased from a fixed-ratio (FR) 1 to an FR 8. It should be noted that the contingency was placed on completion of units of the stamp-and-stuff activity rather than on engagement per se. Still, the rate at which the activity units were completed (for Rob as well as for other participants) followed the same trend as that observed for interaction; therefore, the rate data are not reported.

A similar pattern of response reallocation was observed in Jed's RR assessments (top panel of Figure 4): He stopped interacting with the activities after the array had been restricted past two or three activities. Jed's most highly preferred item was the radio, which was included in an analysis of both restriction and reinforcement with two tasks that occasioned no engagement during the RR assessment (hygiene and sort and pack, middle and bottom panels, respectively, of Figure 4).

Jed's responding was exclusively allocated to the radio during the radio versus hygiene baseline. Removal of the radio in the restriction condition produced no increase in interaction with the hygiene materials, as predicted by the outcomes of his RR assessments. When 30-s access to the radio was made contingent on completing one hygiene unit, his hygiene performance was variable but higher than that observed previously. Removal of the contingency resulted in low levels of hygiene activity, and reinstatement of the contingency resulted in an immediate increase in levels of interaction with the hygiene material. High levels of interaction were maintained, as completion of the entire hygiene routine was required to gain access to the radio.

Similar effects were observed on Jed's second baseline (radio vs. sort and pack), in which responding was allocated exclusively to the radio. Removal of the radio did result in an increase in engagement with the sort-and-pack activity; however, this behavior was not maintained (no interaction with the sort-and-pack materials was observed in 10 of the last 11 sessions in this condition). When completing a unit of the sort-and-pack activity produced 30-s access to the radio, a gradual increase in interaction with the sort-and-pack materials was observed. Although Jed's responding was highly variable, it was maintained as the reinforcement requirement was increased from one to four sort-and-pack units.

In summary, two different components of a Premack procedure produced increases in interaction with less preferred activities for the 4 participants. The inclusion of a control condition in which activity restriction alone was implemented prior to the arrangement of a putative reinforcement contingency has practical implications. The arrangement of a contingency would typically require monitoring the target performance and presenting and removing the reinforcing activity as needed. Recognizing the conditions under which restriction alone is sufficient to increase engagement in less preferred activities would thus be more efficient in terms of both staff training and subsequent staff deployment. Moreover, the extent to which a reinforcement contingency was instrumental in increasing low-rate behavior was actually

evident in the outcomes of RR assessments, perhaps making such assessments useful in determining when the implementation of somewhat complex reinforcement contingencies is needed.

Finally, these data may have more general implications for a discussion of how contingencies, especially those involving response–response relations common in Premack arrangements, affect behavior. That is, increases in behavior following the implementation of a contingency may or may not be indicative of the process of reinforcement (see Branch & Hackenberg, 1998, for elaboration). In the present study, introduction of a Premack contingency would have been associated with behavior change in all 4 participants but would have been responsible for behavior change in only 2 of them (Rob and Jed).

Study 2: Preference Shifting Via Embedded Reinforcement

Another method for altering response allocation among concurrently available activities is to arrange supplemental reinforcement for engaging in the less preferred activity (Hanley, Iwata, & Lindberg, 1999; Hoch, McComas, Johnson, Faranda, & Guenther, 2002). In so doing, response allocation may be shifted to the less preferred option even though access to other highly preferred activities remains available. This strategy seems desirable when restricting access to highly preferred activities, as is required when arranging contingencies with respect to two or more activities, is not feasible (e.g., when one owns his or her own television that competes with time spent earning funds or socializing).

Procedure

Preference hierarchies were established for 2 participants (Ed and Bud) by conducting two RR assessments using the same procedures described previously. In subsequent (third and fourth) RR assessments, reinforcement was delivered for engaging in a specific low-preference activity. Reinforcement was not made contingent on the choice of the target low-preference activity; rather, reinforcement was delivered for particular responses that were pertinent to that activity. Praise (e.g., "nice work," "looking good") was delivered each time Ed moved the weight from below his chin to above his head during his third RR assessment. During his fourth RR assessment, praise was delivered each time Ed strung a bead. Bud was given a small drink (1.5-oz cup) of diet soda each time he pressed a button on an electronic music device (third RR assessment) or stacked Legos® (fourth RR assessment). Participants were prompted to engage in each of the seven activities twice for 15 s prior to the third and fourth RR assessments to ensure that each participant contacted the reinforcement contingency embedded in the target low-preference activities. The effects were evaluated in reversal and multiple baseline designs for both participants.

Results and Discussion

Ed's preferences were relatively stable across the first and second RR assessments, in which the beads and weights activities were consistently observed to be least preferred (Figure 5). When praise was delivered for lifting the weights in the third assessment, Ed's highest levels of interaction were observed with the weights activity. When praise was subsequently available only for stringing beads in the fourth RR assessment, Ed's highest levels of engagement were observed with the beads activity, whereas his engagement in the weights activity decreased. Similar results were obtained with Bud (Figure 5). The electronic music (Micro Jammers®) and Legos® activities were consistently observed to be least preferred during his first and second RR assessments. When reinforcement was delivered for press-

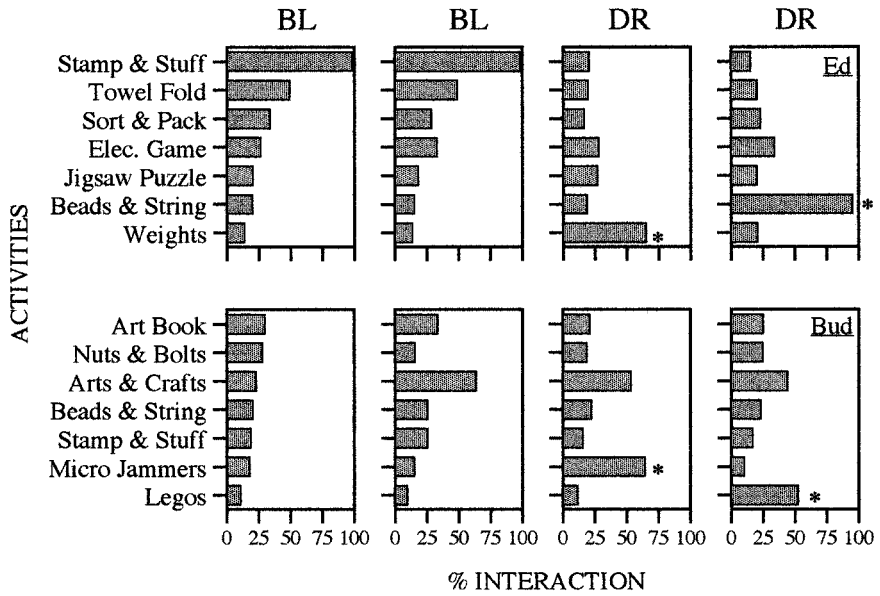

Figure 5. Percentages of interaction during Ed's (top row) and Bud's (bottom row) two baseline (BL) RR assessments and during two assessments in which differential reinforcement (DR) was provided for engagement in specific activities. Asterisks indicate the activities for which reinforcement was delivered.

ing buttons on the electronic music devices in the third RR assessment, Bud's highest levels of interaction were observed with this activity; this effect was replicated in the fourth RR assessment when reinforcement was delivered for engaging in the Legos® activity. Effects of the embedded reinforcement on Ed's and Bud's behavior are evident in that (a) preference shifted to the activity for which reinforcement was delivered in the third and fourth RR assessments, and (b) engagement in the activity associated with reinforcement in the third assessment (weights for Ed, electronic music for Bud) returned to baseline levels when reinforcement was removed.

These data provide a systematic replication of the results reported by Hanley et al. (1999) and show that activity preferences can be altered by embedding reinforcement contingencies in less preferred activities. Preference shifts as a function of embedded reinforcement can be found in many naturally occurring situations, such as when extra praise and encouragement are delivered for approximations to successful performance when someone attempts a new sport or hobby. After contacting the supplemental reinforcement, the newcomer may begin to show a preference for the novel activity. As performance improves and the individual contacts more automatic reinforcers (Vaughan & Michael, 1982) for specific behaviors (e.g., as in seeing the basketball go through the hoop or the tennis ball land inside the lines when one follows through with a shot or swing), preference for the novel activity is maintained when supplemental reinforcement is withdrawn. The final step noted here, in which contact with automatic reinforcers maintains preference for an originally less preferred activity, was not demonstrated in this experiment but represents an interesting and potentially useful maintenance strategy that could be explored in future research.

Although preferences may be altered via reinforcement contingencies, an argument can be made that shifts in response allocation do not reflect alterations in preferences

per se. Speaking loosely, the individual may simply be responding for the embedded reinforcement while the original preferences for the respective activities remain intact. The final study was conducted to determine whether a closer approximation to a shift in "preference" could be affected through conditioning.

Study 3: Preference Shifting Via Conditioning

If limiting access to highly preferred activities results in a redistribution of responding towards remaining (less preferred) alternatives, interventions that enhance the reinforcing effects of less preferred activities may influence behavior even when the more preferred activities are once again available. It is possible that, by simply pairing an originally less preferred activity with reinforcers delivered noncontingently, preference for that activity may emerge as a result of either its having acquired conditioned reinforcing properties (Williams, 1994) or the individual contacting and developing a preference for automatic reinforcers associated with that activity. This study sought to demonstrate such an effect.

Procedure

Two activities for which the highest and the lowest levels of interaction were observed during RR assessments were made concurrently available during baseline conditions for Lee and Ann (Lee also participated in Study 1). Items included in Lee's analysis of response relations (Study 1) were excluded from this study; therefore, the activities associated with the next highest and lowest levels of interaction (sewing and beads, respectively) were included. The beads and jigsaw puzzle activities were included in Ann's assessment. At the beginning of each session, the therapist placed the two activities on a table in front of the participant and pointed to and named each activity. The therapist indicated that the participant was free to interact with one, both, or neither activity and then began the session. The therapist did not interact with the participant during the session. Data were collected on interaction with each activity during 5-min sessions. Baseline or test sessions (see below) were conducted once per day, 4 to 5 days per week. Two to six conditioning sessions were conducted on days in which training was scheduled, 4 to 5 days per week.

Conditioning sessions began following a demonstration of preference for one of the activities during baseline. Only one of the activities was available in each 5-min session during conditioning. Initially, six conditioning sessions were conducted with each participant in a multielement design such that each activity was exclusively available three times. During conditioning sessions involving the less preferred (LP) activity, an already established reinforcer was delivered noncontingently on a fixed-time (FT) 30-s schedule throughout the 5-min session. Lee's reinforcers included varied snack items (one half of a peanut butter M&M®, reduced-fat Cheez-Its®, or a piece of low-fat popcorn); Ann's reinforcers were diet cola and social interaction (comments and questions unrelated to the target activities). Both participants could engage in the leisure activities while consuming the reinforcers. During sessions involving the highly preferred (HP) activity, no reinforcement pairing was arranged. Opportunities to interact with the HP activity were scheduled to ensure that participants were exposed to the two activities for an equal amount of time during the assessment and to expose each participant to the *differential* pairing of the reinforcers.

Following six sessions (three LP conditioning sessions and three HP control sessions), a test session was conducted in which both activities were concurrently available as in baseline (no reinforcers were delivered). The test session was conducted to assess

whether preference had shifted to the originally less preferred activity. This pattern of six conditioning and control sessions followed by a test session was continued until (a) a shift in preference emerged (three consecutive test sessions in which engagement in the original LP activity was higher than in the original HP activity), (b) preference remained stable (five consecutive test sessions showing continued preference for the original HP activity), or (c) no clear preference for either activity was observed (responding was variable for at least eight test sessions). If a conditioned preference emerged, the number of conditioning and control sessions conducted prior to each test session was gradually eliminated (i.e., from 6 to 4 to 2 to 0), and at least three test sessions were conducted in the absence of prior conditioning sessions.

Following a shift in preference and the termination of conditioning sessions, the reinforcement pairing procedure was reversed twice for Lee. By contrast, the durability of the conditioned preference was evaluated with Ann by continuing her test sessions for 1 month (two to three sessions per week) following termination of the conditioning sessions. Hence, control of the independent variable (pairing established reinforcers with LP activities) was evaluated in a reversal (Lee) and a multiple baseline across subjects (Lee and Ann) design.

Results and Discussion

Results of Lee's RR assessments showed that she consistently preferred sewing over bead stringing (top panels of Figure 6, reproduced from Figure 2). This preference was repeatedly shown during baseline test sessions in which both activities were available, in that all responding was allocated towards sewing (Figure 6). Snacks were then delivered every 30 s independent of responding during beads-conditioning sessions (results of the conditioning sessions are not displayed on Figure 6), after which a preference for beads over sewing emerged during test sessions and was maintained even after the conditioning sessions were terminated (prior to Session 13). Snacks were then delivered during sewing-conditioning sessions, and preference for sewing immediately reemerged and was maintained. Finally, the conditioning procedure was reassigned to the beads activity and, over time, a preference for this activity reemerged.

Lee's data show that preference for an activity can be conditional on a history of noncontingent pairings with other reinforcers. However, the durability of a preference established in this manner was uncertain because maintenance was observed across only a few sessions (3 to 4 calendar days), and because Lee's preference readily shifted when reinforcer pairing was assigned to different activities. Therefore, the replication conducted with Ann included a more rigorous evaluation of the durability of conditioned preference.

In Ann's RR assessments, the beads-and-string activity was associated with the highest levels of interaction, whereas the jigsaw puzzles were associated with the lowest levels of interaction (Figure 6). Her preference for beads over puzzles was replicated in the baseline condition (Figure 6), in which all responding was allocated to the beads activity. The availability of diet soda and social interaction in the presence of the puzzle activity did not affect Ann's preference in the initial three test sessions; thereafter, however, she interacted exclusively with the puzzles. Her apparent preference for the puzzles activity was maintained for an additional 30 days following termination of the conditioning sessions.

Ann's data provided a replication of Lee's results and, in addition, suggested that shifts in preference established via simple pairing may endure long after pairing has been discontinued. It is possible that Lee's and Ann's

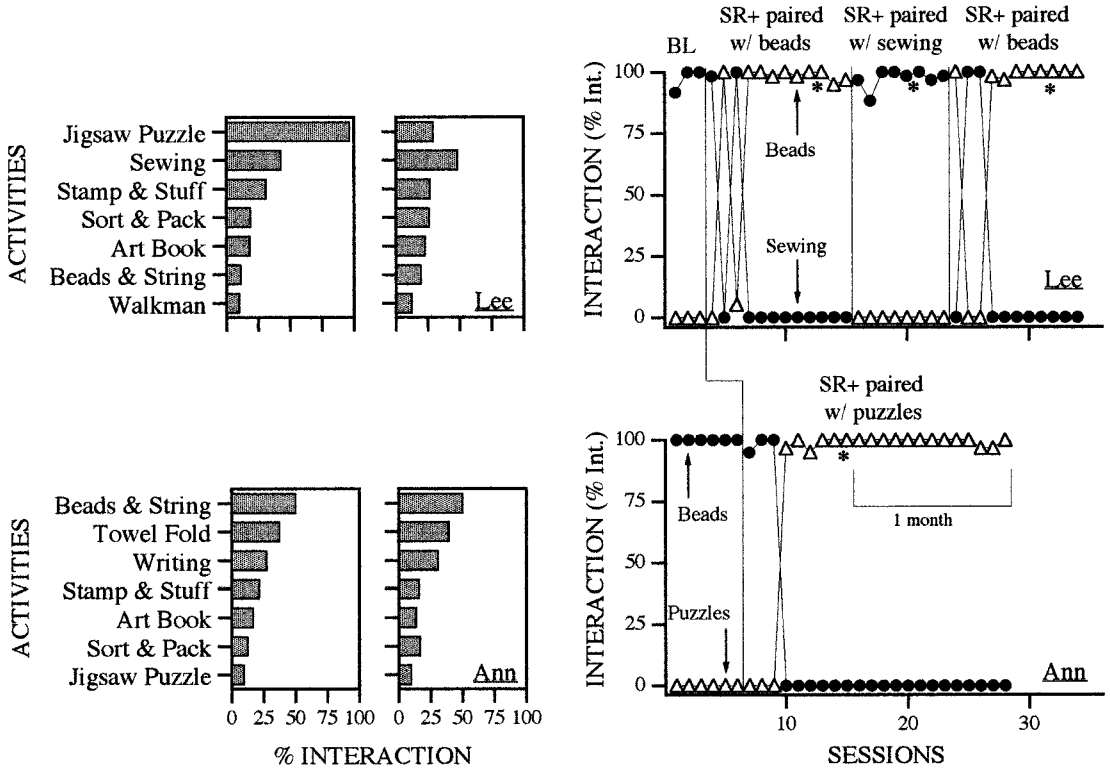

Figure 6. Percentages of interaction during Lee's (top row) and Ann's (second row) RR assessments, and percentages of interaction during baseline and test sessions conducted during the conditioning evaluation (Lee, third top panel; Ann, third bottom panel). Asterisks mark the points at which conditioning sessions were terminated.

preferences were either fragile (easily manipulable) or dependent only on very recent conditioning histories. If so, the persistence of Ann's preference for puzzles may have been a function of not having any experiences with the beads activity in a reinforcing context during the maintenance period of the study.

Several additional factors may account for the outcomes observed with Lee and Ann. First, it is possible that learning occurred during the conditioning phase, such that participants' skills improved with respect to the LP activity. However, Lee's rate of stringing beads and Ann's inserting puzzle pieces did not increase substantially from baseline rates during the conditioning phases. Second, contact with novel automatic reinforcers could have occurred simultaneously with conditioning and could have facilitated initial preference shifts as well as maintenance. However, this seems somewhat unlikely given that Lee interacted with the beads and Ann interacted with the puzzles during the RR assessments and, as a result, would have experienced these reinforcers prior to the conditioning sessions. Control of preference shifts via novel automatic reinforcers seems especially unlikely for Lee, whose preference was readily altered during reversal phases. Third, it is possible that the noncontingent delivery of the snacks and social reinforcers may have adventitiously reinforced engagement in the LP activities. If so, extinction of responding with respect to the "conditioned" activity would be expected to occur when reinforcers were no longer available; however, no disruption in response alloca-

tion was noted for either participant when test sessions were conducted in the absence of preceding conditioning sessions.

Thus, although several factors may have influenced the patterns of behavior observed with Lee and Ann, each seems unlikely to have produced the systematic (Lee) or durable (Ann) shifts in preference observed here, and the notion that the LP activities acquired conditioned reinforcing properties as a result of the procedures described herein seems most plausible. Whether the shifts in preferences that emerged resulted from respondent or operant processes, or a combination of both, cannot be determined given the current procedures (see Williams, 1994, for a discussion). In application, the answer to this question may be less important than simply identifying the conditions under which conditioned preferences are most likely to emerge.

The idea that activity preferences can be altered simply by arranging contiguities with other events holds promise as a relatively benign strategy for altering time allocation in multiresponse environments. In fact, pairing LP events (workplace meetings, efforts at home improvement) with already established reinforcers (e.g., doughnuts and coffee or pizza and beer) is a commonly observed practice. Although the effects of such pairings are rarely assessed (i.e., meeting organizers generally do not withhold the doughnuts and coffee and observe whether people continue to show up for their meetings), such demonstrations are needed to identify the relevant histories that give rise to actual conditioned preferences. The methods and design used in the current study (i.e., the assessment of preference in the absence of reinforcer pairings and the gradual reduction of conditioning sessions) may be helpful in determining whether procedures are in fact effective in conditioning a preference for a particular event.

Finally, it is important to note that both participants engaged in the target (LP) activities at least to some degree when more highly preferred activities were unavailable during their RR assessments as well as during the conditioning sessions. This provided an opportunity to pair food and social reinforcers with activity engagement and presumably to condition a preference for that activity. By contrast, the complete absence of engagement in the target activity would preclude any opportunities for pairing, and, as a result, would fail to establish preference for activities in which a person does not participate to any extent. An interesting direction for future research might be to develop procedures for conditioning preferences for activities that are not simply less preferred (as in the present study) but are, instead, explicitly nonpreferred. One strategy would be to implement prompting and differential reinforcement procedures initially, similar to those described in Studies 1 and 2. Once the individual begins to participate in the target activity to some extent, the contingency could be gradually eroded until reinforcers are delivered noncontingently (i.e., simply paired). Performance during alternating conditioning and test sessions could then be examined to determine if a conditioned preference for the target activity was established.

GENERAL DISCUSSION

The RR assessment used in the present studies provided an initial basis for identifying preferences among a variety of activities for individuals with developmental disabilities. Results of RR assessments also predicted whether restriction alone would be sufficient, or whether a reinforcement contingency would be necessary, to increase engagement in LP activities (Study 1). Finally, the assessment provided baseline data for examining shifts in preference as a function of several interventions.

The most efficient method for shifting ac-

tivity allocation is simply to limit access to HP activities, which may redistribute engagement among LP (but perhaps more socially desirable) alternatives. If restriction alone does not result in response reallocation, contingent access to HP activities may be used as a reinforcer for engaging in LP activities. If restricting access to HP activities (a precondition for arranging Premack-type contingencies) is impractical or undesirable, embedding reinforcers (social or edible) within LP activities may increase engagement in those activities even when more preferable alternatives are concurrently available. The benefit of this strategy is that the individual still has the option of choosing the original (HP) activity; the reinforcing value of the LP activity is merely increased. Finally, the noncontingent delivery of reinforcers during an activity may actually establish (condition) a preference for that activity. As shown in the current study, this arrangement may be particularly attractive in that durable shifts in preference may be produced and maintained when the procedure (pairing) is eliminated.

Preference is often discussed by laypersons and psychologists alike as a durable tendency that influences the manner in which one behaves. But stating that a person made a particular choice or engaged in a particular behavior because the person "preferred" that option is simply restating the fact that the person engaged in that particular behavior. Thus, treatment of preference as an independent variable discourages the study of its determinants. Data from numerous basic studies of operant behavior and from the current experiments suggest that preference is not immutable but, rather, is heavily influenced by events (alternative options, contingencies, and contiguities) that are present in one's immediate environment. Therefore, it seems more appropriate to view preference as merely a convenient description of response allocation that is a product of historical and current environmental events.

This view raises questions about the role of preference in the habilitative process for persons with developmental disabilities. Accepting an individual's preferences at face value and then using them as the basis for making important programmatic decisions (e.g., about vocational or living placements) is akin to accepting an accidental history, one that may have arisen from insufficient or unplanned experiences, and one that may or may not contribute to further development or long-term improvement in the quality of one's life. An alternative strategy, illustrated in the present study, involves first identifying current preferences for a range of activities via direct measurement and then, as needed, implementing relatively benign interventions that establish a history of engaging in alternative activities that may eventually acquire reinforcing properties (i.e., become preferred). Although this strategy is more direct in that it relies on design rather than on accident, it may ultimately yield greater benefits to and satisfaction on the part of clients.

The procedures used here for identifying and altering preference are applicable to many clinical situations in which problem behavior occurs in multiresponse environments. But, the strategies described in the present set of experiments are more generally applicable to the assessment of current environmental arrangements as well as to the design of more reinforcing habilitative environments, although they represent just a few of potentially numerous methods derived from basic and applied research. Greater attention to continuous observation of behavior (e.g., Bernstein, 1998) over longer periods of time would permit further refinement of methods for identifying factors that influence behavior in multiresponse environments.

REFERENCES

Allen, D. L., & Iwata, B. A. (1980). Reinforcing exercise maintenance using existing high-rate activities. *Behavior Modification, 4,* 337–354.

Amari, A., Grace, N. C., & Fisher, W. W. (1995). Achieving and maintaining compliance with the ketogenic diet. *Journal of Applied Behavior Analysis, 28,* 341–342.

Bannerman, D. J., Sheldon, J. B., Sherman, J. A., & Harchik, A. E. (1990). Balancing the right to habilitation with the right to personal liberties: The rights of people with developmental disabilities to eat too many doughnuts and take a nap. *Journal of Applied Behavior Analysis, 23,* 79–89.

Bernstein, D. J. (1998). Establishment of a laboratory for continuous observation of human behavior. In K. A. Lattal & M. Perone (Eds.), *Handbook of research methods in human operant behavior* (pp. 509–540). New York: Plenum.

Bernstein, D. J., & Ebbeson, E. B. (1978). Reinforcement and substitution in humans: A multiple-response analysis. *Journal of the Experimental Analysis of Behavior, 30,* 243–253.

Branch, M. N., & Hackenberg, T. D. (1998). Humans are animals, too: Connecting animal research to human behavior and cognition. In W. O'Donohue (Ed.), *Learning and behavior therapy* (pp. 15–35). Boston: Allyn-Bacon.

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.

Fisher, W. W., Piazza, C. C., Bowman, L. G., & Amari, A. (1996). Integrating caregiver report with a systematic choice assessment to enhance reinforcer identification. *American Journal on Mental Retardation, 101,* 15–25.

Green, G., & Striefel, S. (1988). Response restriction and substitution with autistic children. *Journal of the Experimental Analysis of Behavior, 50,* 21–32.

Hanley, G. P., Iwata, B. A., & Lindberg, J. S. (1999). Analysis of activity preferences as a function of differential consequences. *Journal of Applied Behavior Analysis, 32,* 419–435.

Hanley, G. P., Iwata, B. A., Lindberg, J. S., & Conners, J. (2003). Response-restriction analysis: I. Assessment of activity preferences. *Journal of Applied Behavior Analysis, 36,* 47–58.

Hanley, G. P., Iwata, B. A., Thompson, R. H., & Lindberg, J. L. (2000). A component analysis of "stereotypy as reinforcement" for alternative behavior. *Journal of Applied Behavior Analysis, 33,* 285–297.

Hoch, H., McComas, J. J., Johnson, L., Faranda, N., & Guenther, S. (2002). The effects of magnitude and quality of reinforcement on choice responding during play activities. *Journal of Applied Behavior Analysis, 35,* 171–181.

Horner, R. D., & Keilitz, I. (1975). Training mentally retarded adolescents to brush their teeth. *Journal of Applied Behavior Analysis, 8,* 301–309.

Konarski, E. A. (1987). Effects of response deprivation on the instrumental performance of mentally retarded persons. *American Journal of Mental Deficiency, 98,* 537–542.

Konarski, E. A., Jr., Johnson, M. R., Crowell, C. R., & Whitman, T. L. (1980). Response deprivation and reinforcement in applied settings: A preliminary analysis. *Journal of Applied Behavior Analysis, 13,* 595–609.

Lyons, C. A., & Cheney, C. D. (1984). Time reallocation in a multiresponse environment: Effects of restricting response classes. *Journal of the Experimental Analysis of Behavior, 41,* 279–289.

McEntee, J. E., & Saunders, R. R. (1997). A response-restriction analysis of stereotypy in adolescents with mental retardation: Implications for applied behavior analysis. *Journal of Applied Behavior Analysis, 30,* 485–506.

Mitchell, W. S., & Stoffelmayr, B. E. (1973). Application of the Premack principle to the behavioral control of extremely inactive schizophrenics. *Journal of Applied Behavior Analysis, 6,* 419–423.

Neuringer, A. J. (1970). Superstitious key pecking after three-peck produced reinforcements. *Journal of the Experimental Analysis of Behavior, 13,* 127–134.

Premack, D. (1959). Toward empirical behavioral laws: Instrumental positive reinforcement. *Psychological Review, 66,* 219–233.

Premack, D. (1962). Reversibility of the reinforcement relation. *Science, 136,* 255–257.

Rescorla, R. A., & Skucy, J. C. (1969). Effect of response-independent reinforcers during extinction. *Journal of Comparative and Physiological Psychology, 67,* 381–389.

Salzberg, B. H., Wheeler, A. J., Devar, L. T., & Hopkins, B. L. (1971). The effect of intermittent feedback and intermittent contingent access to play on printing of kindergarten children. *Journal of Applied Behavior Analysis, 4,* 163–171.

Timberlake, W., & Allison, J. (1974). Response deprivation: An empirical approach to instrumental performance. *Psychological Review, 81,* 146–164.

Timberlake, W., & Wozny, M. (1979). Reversibility of reinforcement between eating and running by schedule changes: A comparison of models. *Animal Learning & Behavior, 7,* 461–469.

Vaughan, M. E., & Michael, J. L. (1982). Automatic reinforcement: An important but ignored concept. *Behaviorism, 10,* 217–228.

Williams, B. (1994). Conditioned reinforcement: Experimental and theoretical issues. *The Behavior Analyst, 17,* 261–271.

Received February 12, 2002
Final acceptance November 19, 2002
Action Editor, Gary Pace

STUDY QUESTIONS

1. Summarize the methods used to conduct the initial response-restriction (RR) assessments.

2. Describe the restriction and reinforcement conditions of Study 1.

3. Briefly summarize the results of Study 1. How did these results compare with those obtained in the initial RR assessments?

4. Describe the embedded reinforcement procedure used in Study 2. What advantage might this procedure have over the reinforcement procedure used in Study 1?

5. What pattern of responding was observed in both participants' data in Study 2?

6. Briefly describe the conditioning procedures in Study 3.

7. How were the effects of conditioning evaluated in Study 3, and how was experimental control demonstrated?

8. Why did the authors suggest that it is undesirable to view preference as an independent variable, that is, to describe a person's choices as a function of preference?

Questions prepared by Stephen North and Natalie Rolider, The University of Florida