

*ON THE RELATIVE REINFORCING EFFECTS OF CHOICE AND DIFFERENTIAL CONSEQUENCES*WAYNE W. FISHER, RACHEL H. THOMPSON, CATHLEEN C. PIAZZA,
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Research on the reinforcing effects of providing choice-making opportunities to individuals with developmental disabilities (i.e., allowing them to choose reinforcers or tasks) has produced inconsistent results, perhaps because the mechanisms underlying such effects remain unclear. Choice may produce a reinforcement effect because it is correlated with differential consequences (i.e., choice may increase one's access to higher preference stimuli), or it may have reinforcement value independent of (or in addition to) the chosen stimulus. In Experiment 1, we used a concurrent-operants arrangement to assess preference for a choice condition (in which participants selected one of two available reinforcers) relative to a no-choice condition (in which the therapist selected the same reinforcers on a yoked schedule). All 3 participants preferred the choice option. In Experiment 2, we altered the schedules so that the participant selected one of two lower preference reinforcers in the choice condition, whereas the therapist selected a higher preference stimulus for the participant either half or all of the time in the no-choice condition. Participants typically allowed the therapist to select reinforcers for them (i.e., they allocated responding to the no-choice condition) when it resulted in greater access to higher preference stimuli.

DESCRIPTORS: choice, preference, concurrent operants, developmental disabilities

Providing choice-making opportunities to individuals with developmental disabilities is an important part of the normalization process. Therefore, a number of investigators have evaluated the effects of choice on both appropriate and inappropriate behavior. Koegel, Dyer, and Bell (1987) found that social avoidance behaviors decreased when a child with autism was allowed to select an activity relative to when the activity was dictated by the adult. Other investigations have produced similar results (e.g., Dyer, Dunlap, & Winterling, 1990; Mason, McGee, Farmer-Dougan, & Risley, 1989).

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One possible explanation for these findings is that the effects of choice may have been, in whole or in part, a function of increased access to preferred stimuli. That is, when given a choice of reinforcers or tasks, individuals select the ones that are more preferred (e.g., Fisher et al., 1992), and individuals may prefer choice conditions simply for this reason. An alternative (but not mutually exclusive) explanation is that individuals with disabilities prefer choice over no-choice conditions even when both produce the same outcome. Consistent with this hypothesis, a small body of basic research has shown that organisms prefer free-choice conditions (i.e., having two or more response options) over forced-choice conditions (i.e., having only one option), even when both produce identical reinforcement (see Catania, 1980, for a review).

Several applied studies have attempted to determine whether choice affects responding

even when it is not associated with increased access to preferred stimuli. To properly address this question, an analysis of choice should control for the effects of differential consequences, which means that the control condition (i.e., the no-choice condition) must produce the same outcome as the choice condition.

One approach to equating the consequences associated with choice and no-choice conditions has been to first complete a preference assessment (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985) and then to present only high-preference items in the choice and no-choice conditions. Using this approach, Parsons, Reid, Reynolds, and Bumgarner (1990) found that on-task behavior was high under two conditions: (a) when the client chose the task and (b) when the therapist assigned the client a previously assessed, higher preference task. By contrast, on-task behavior was relatively low when the therapist assigned the client a lower preference task. Similarly, Smith, Iwata, and Shore (1995) and Lerman *et al.* (1997) found that highly preferred stimuli were equally effective reinforcers, regardless of whether they were selected by the participant or by the experimenter. Thus, the results of these three investigations suggest that the effects of choice may be due to increased access to preferred stimuli.

However, some investigators have found an effect for choice even when the choice and no-choice conditions produced the same consequences. Bambara, Ager, and Koger (1994) found similar levels of on-task behavior when participants chose or were assigned high-preference tasks. However, having a choice between two low- or two moderate-preference tasks resulted in small but consistent increases in on-task behavior for 1 participant. Similarly, Vaughn and Horner (1997) found that choice reduced problem behavior for 2 of 4 participants when low-preference tasks were available but had no

effect when higher preference tasks were presented. These investigations suggest that choice may produce effects on responding that are independent of or in addition to those that result from differential consequences. However, it should be noted that in these latter two studies, choice produced relatively small effects that occurred with some but not all participants and only with lower or moderately preferred stimuli.

Dunlap *et al.* (1994) found much larger differences between a choice and a no-choice condition than the studies previously cited (see Experiment 2 in that investigation). The activity consisted of the teacher reading a book to the student. In the first phase, the teacher selected the books (no choice). In the second phase, the child selected the books (choice). In the third phase, the teacher selected the same books in the same sequence as chosen by the child in the previous phase (a yoked no-choice condition). In the fourth phase, the child selected the books (choice). Higher levels of task engagement and lower levels of disruptive behavior were associated with the choice relative to the no-choice condition. However, it is possible that the differences were due to variables other than choice (i.e., differential consequences and satiation). In the first no-choice phase, the teacher selected books that were different from those selected by the child (i.e., differential consequences). In the second no-choice phase, the teacher selected books that were previously chosen by the student. However, it is possible that repeated exposure lowered the student's preference for these books (i.e., satiation), because (with one exception) the student did not select them again when given the opportunity in the final choice phase.

One potential reason for the inconsistent findings noted above is that these studies used a single-operant arrangement. Concurrent-operants arrangements are more sensitive to changes in a variety of reinforcement

parameters, such as rate, magnitude, immediacy, and quality of reinforcement (e.g., Conger & Killeen, 1974; Fisher et al., 1992; Neef, Mace, & Shade, 1993). In a concurrent-operants arrangement, two schedules of reinforcement (or two qualitatively different reinforcers) are in direct competition, and response rates tend to be higher for the response option that produces a more favorable outcome (e.g., higher rate or quality of reinforcement). When a single-operant arrangement is used, similar rates of responding are often maintained even when variables such as rate, magnitude, or quality of reinforcement are manipulated (Catania, 1992).

Brigham and Sherman (1973) evaluated the effects of choice using both single- and concurrent-operants arrangements, and found a clear effect for choice only under the concurrent arrangement. Using concurrent-chains schedules, Catania and Sagvolden (1980) showed that pigeons preferred a condition in which they had multiple response options (free choice) over one in which there was only one option (forced choice), even though both conditions produced the same reinforcement. Catania also suggested that this free-choice preference can be temporarily disrupted by altering reinforcement parameters (e.g., changing the rate of reinforcement to favor forced choice); however, a preference for free choice returns when reinforcers in terminal links become equal again (Catania, 1980).

It is clear that individuals with developmental disabilities prefer choice over no-choice conditions when they are correlated with differential consequences favoring the choice condition (i.e., when choice produces increased access to preferred stimuli). It is less clear, however, whether they prefer choice over no-choice conditions when both produce identical consequences or, for that matter, when the choice condition produces a less favorable outcome than the no-choice condition. A concurrent-operants arrange-

ment would provide a sensitive measure of the reinforcement effects of choice when both (a) choice and no choice produce equal reinforcement and (b) the no-choice condition produces greater access to preferred stimuli than does the choice condition. This latter arrangement is analogous to situations in which individuals let someone else make decisions (or choices) for them in order to produce a better outcome (e.g., a child allowing a parent to select a matching outfit; an investor allowing a mutual fund manager to make stock selections).

In the current investigation, we examined the relation between choice and differential consequences (i.e., access to higher and lower preference stimuli) using a concurrent-operants arrangement. In Experiment 1, we examined the effects of choice on clients' switch pressing when the choice and no-choice conditions produced identical reinforcement (i.e., the therapists' selections were yoked to the participants'). In Experiment 2, we evaluated whether participants preferred the no-choice over the choice condition when the former was associated with increased access to preferred stimuli (i.e., when allowing the therapist to choose for them produced a better outcome).

GENERAL METHOD

Participants and Setting

Three children participated in this investigation while they were inpatients on units specializing in the assessment and treatment of either destructive behavior (Lindsay and Sammy) or feeding disorders (Jessica). Lindsay was an 8-year-old girl who had been diagnosed with mild mental retardation, attention deficit hyperactivity disorder (ADHD), and oppositional defiant disorder (ODD). Jessica was a 10-year-old girl who had been diagnosed with a chromosomal abnormality (10q deletion syndrome), mild mental retardation, and ADHD. Sammy was a 13-year-old boy who

had been diagnosed with moderate mental retardation.

All sessions were conducted in a room (3 m by 3 m) equipped with a one-way observation window. Approximately one to four sessions were conducted per day with each participant.

Apparatus

During all sessions in Experiments 1 and 2, the participants were seated at a table with three identical microswitches (22 cm by 14 cm) positioned on the table approximately 60 cm in front of them and approximately 15 cm apart (i.e., right, middle, and left). Presses on a switch closed an electric circuit that recorded the frequency of key presses on an attached counting device. During the reinforcer assessment, variable-interval (VI) reinforcement intervals were timed by a computer program that visually signaled to the therapist when the VI intervals had elapsed. The computer was positioned so that only the therapist could view the screen.

Procedure

Prior to the start of the experiment, the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996) was administered to the participants' caregivers. The RAISD is a structured interview used to generate a list of child-preferred stimuli from the following general domains: visual, auditory, olfactory, edible, social, tactile, and toys. Caregivers generated 16 items for Lindsay, 12 for Jessica, and 9 for Sammy.

A stimulus choice assessment (Fisher *et al.*, 1992) was then conducted with each participant to develop a hierarchy of preferred items based on the list generated by caregivers. During the stimulus choice assessment, each of the caregiver-generated items was paired with every other item and presented in random pairs to the participant. For each presentation, the two items were placed in front of the partic-

ipant. If either item was approached (defined as verbally asking for or reaching for the item), access to that item was allowed for 5 s, and the other item was immediately removed. Simultaneous approach responses toward both items were blocked by the therapist. If no approach response was emitted after 5 s, the participant was allowed to interact with each item (to ensure familiarity with each stimulus), and the items were re-presented. Following completion of the stimulus choice assessment, the stimuli were ranked according to the percentage of trials on which each item was approached. For all participants, two independent observers recorded approach responses for 100% of trials. Interobserver agreement for approach responses was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Agreement coefficients were 98.9% for Lindsay, 98.8% for Jessica, and 100% for Sammy.

For each participant, the two items ranked as most highly preferred (higher preference stimuli) and the two items ranked as least preferred (lower preference stimuli) were identified. Piazza, Fisher, Hagopian, Bowman, and Toole (1996) have shown that the stimulus choice assessment results can be used to predict the relative reinforcing value of stimuli categorized as high, medium, and low preference. The specific stimuli that were identified as higher preference for each participant were, for Lindsay, an electronic fishing game and potato chips; for Jessica, orange slices and hugs; and for Sammy, television and Nintendo®. The stimuli that were identified as lower preference for each participant were, for Lindsay, pizza and a book; for Jessica, a toy with moving beads and a book; and for Sammy, clapping and a puzzle.

EXPERIMENT 1

Procedure

A three-phase assessment was conducted with each participant. Prior to each session,

the three microswitches were randomly assigned as Keys 1, 2, or 3 (e.g., Key 1 was randomly assigned to either the right, middle, or left switch). Responses on Keys 1 and 2 produced reinforcement on independent but concurrent VI schedules, and responses on Key 3 produced no programmed consequences (control). Key 1 was labeled the choice key because reinforcement consisted of the therapist presenting two stimuli and allowing the participant to select between them. The participant was then given access to the selected stimulus for a prespecified period of time (see below). Key 2 was labeled the no-choice key because reinforcement consisted of the therapist selecting a reinforcer for the participant. The selections made by the therapist in the no-choice condition were the same as the selections made by the participant in the previous session (i.e., a yoked schedule).

During the higher preference (HP) phase, the first and second highest ranked items from the stimulus choice assessment were available on both the choice and the no-choice keys. That is, if the criterion for reinforcement on the choice key was met (i.e., the switch was pressed after the VI interval had elapsed), the participant was allowed to choose between these two higher preference stimuli and was then given the chosen item. If the criterion for reinforcement was met on the no-choice key, the participant was presented with one of the higher preference stimuli according to a yoked schedule.

The stimuli associated with the choice and no-choice keys were presented according to independent but concurrent VI 30-s schedules for Lindsay and VI 15-s schedules for Jessica and Sammy. During the first session of each phase, the stimuli assigned to the no-choice key were scheduled to be presented according to a random, counterbalanced schedule. In the remainder of the sessions, stimuli assigned to the no-choice key were presented on a yoked schedule. That is,

the stimuli chosen by the participant in each session were recorded and then presented in a random order for presses on the no-choice key in the next session.

The reinforcement interval was 30 s for Lindsay and 15 s for Jessica and Sammy. Nonedible items were delivered for the duration of the reinforcement interval. Edible items (three bites for Lindsay, two for Jessica) were delivered one bite at a time, equally spaced throughout the reinforcement interval. During the reinforcement interval, attempts to press the keys were blocked. Sessions for all participants were terminated after the participant had the opportunity to press the key for a total of 10 min (i.e., the session clock stopped during reinforcement delivery). Upon completion of the session, the frequency of switch presses from each of the three counters was recorded on a data sheet by the therapist.

Prior to each session, the positions of the choice, no-choice, and control switches were randomly assigned, and the participant was told which stimuli would be available for responding on each of the switches. The participant then was prompted to press each of the switches one at a time and was allowed to sample the items available for pressing that switch. This sampling procedure was repeated twice for each switch prior to the start of the session.

The lower preference (LP) phase was similar to the HP phase except that the two stimuli used were the two lowest ranked stimuli from the stimulus choice assessment for each participant. The HP & LP phase was similar to the HP phase except that one higher and one lower preference item were selected for presentation. That is, the participant was allowed to choose between the higher and lower preference stimuli if the criterion for reinforcement was met on the choice key. The therapist selected and presented the same stimuli on a yoked schedule if the criterion for reinforcement was met on

the no-choice key. For Lindsay and Jessica, the HP and LP stimuli were those chosen most frequently during the HP and LP phases, respectively (for Lindsay, HP was potato chips and LP was pizza; for Jessica, HP was hugs and LP was a bead toy). For Sammy, a handheld Nintendo® game was chosen as the HP stimulus because a television was not available for all sessions. The puzzle was chosen as the LP stimulus for Sammy because it had been chosen almost exclusively in the last two sessions of the LP phase.

Results and Discussion

The results of Experiment 1 are presented in Figure 1. All 3 participants responded almost exclusively on the choice key. The mean rates of switch pressing in the choice condition across all three phases were 106.9 (range, 45.1 to 130.4) for Lindsay, 15.9 (range, 3.4 to 37.3) for Jessica, and 97.9 (range, 0.5 to 170.1) for Sammy. The rates of responding on the choice key were similar in each of the three phases (LP, HP, and HP & LP) for Lindsay and Jessica. For Sammy, however, responding on the choice key was low in the initial phase (HP) but then rapidly increased. This steep upward trend in responding on the choice key continued in the first half of the second phase (LP) but began to level off thereafter. By contrast, the participants rarely responded on the no-choice or control keys. In fact, the only session in which a participant's responding was highest on a key other than the choice key was Jessica's first session, in which her response rate was highest on the control key, perhaps because she had not yet learned the contingencies associated with each condition. Thus, all 3 participants showed a clear preference for a condition in which they chose the stimuli over one in which the therapist chose the same stimuli for them on a yoked schedule. That is, choice produced a clear effect on responding even when it was not correlated with increased access to high-

er preference stimuli. Moreover, choice affected responding regardless of whether the stimuli presented were two higher preference stimuli, two lower preference stimuli, or one higher and one lower preference stimulus.

All 3 participants occasionally responded on the no-choice key in Experiment 1, but only Jessica and Sammy met criterion for reinforcement in the no-choice condition. Jessica met this criterion in Sessions 3, 10, and 16, and Sammy did so in Session 12. We examined the raw data from these sessions to assess whether the yoking procedure actually equated the consequences delivered in the choice and no-choice conditions. In Sessions 3, 10, and 16, Jessica exclusively selected one stimulus over the other (e.g., in Session 3, she selected the bead toy 100% of the time in the choice condition), and in each session she received that same stimulus when she met criterion for reinforcement on the no-choice key. In Session 12, Sammy selected the puzzle on 27 of 28 (96%) occasions, and he received this stimulus on the one occasion when he met criterion for reinforcement on the no-choice key. Thus, in all cases, meeting the criterion for reinforcement in the no-choice condition produced the same stimulus consistently selected as reinforcement in the corresponding choice condition, indicating that the yoking procedure effectively equated the consequences for the two conditions.

Table 1 shows the percentage of times each stimulus was selected in the choice condition during each phase of Experiment 1. Interestingly, in most phases, the participants chose each of the available stimuli at least some of the time (exceptions were the LP phase for Jessica and the HP & LP phase for Sammy). For example, Jessica chose hugs 53.5% of the time and orange slices the remaining 46.5% of the time during the HP phases. Even when the choice was between one higher and one lower preference item (i.e., during the HP & LP phases), Jessica and Lindsay occasionally

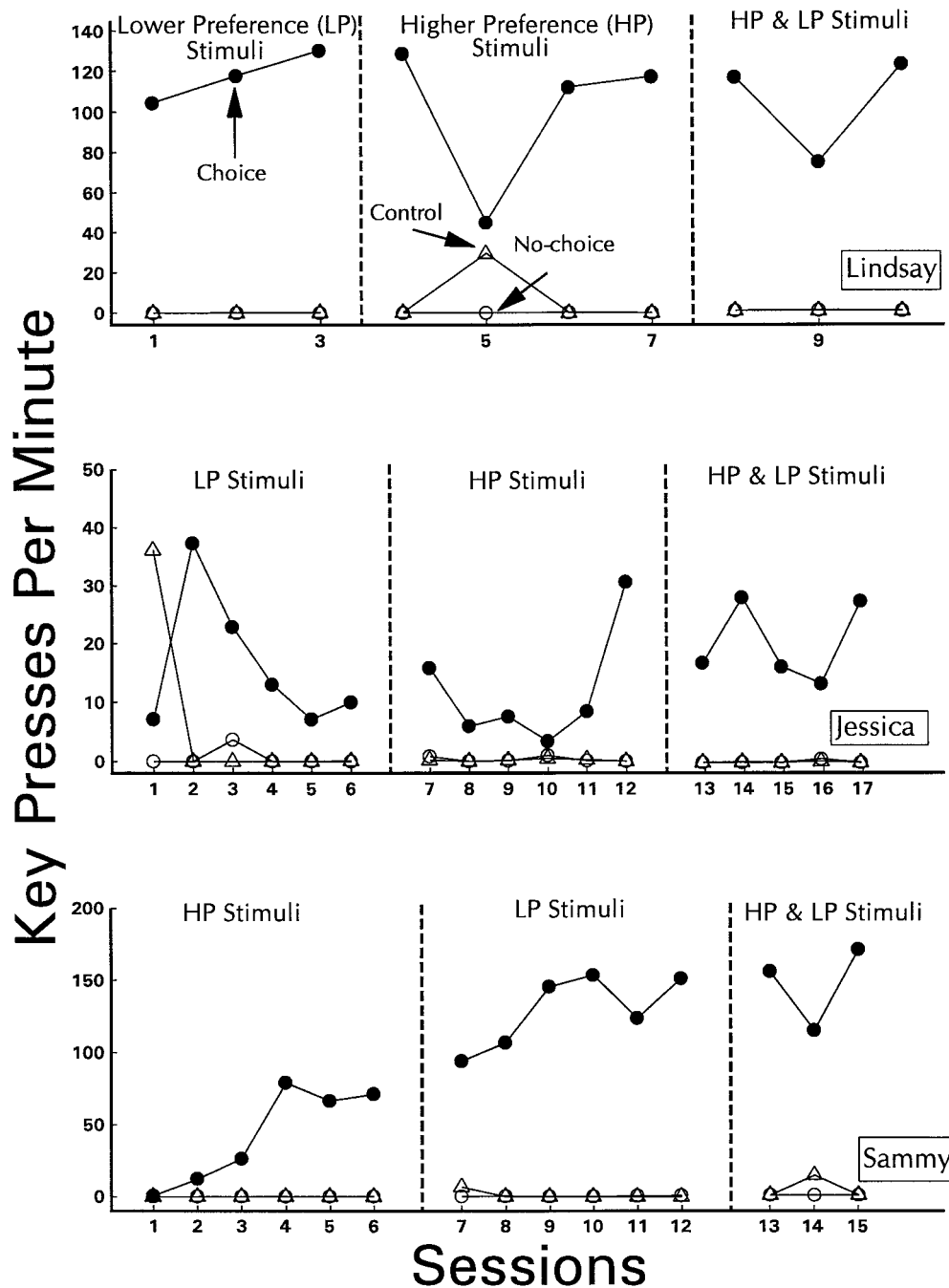


Figure 1. Number of key presses per minute on the choice, no-choice, and control keys during Experiment 1 for Lindsay (top panel), Jessica (middle panel), and Sammy (bottom panel).

chose the stimulus that was previously assessed to be less preferred.

Although choice produced a clear and consistent effect on responding (i.e., the partici-

pants clearly preferred the choice condition), the strength of the participants' preference for the choice condition was not evaluated in Experiment 1. That is, the results of Experiment

Table 1
The Percentage of Trials in Which Each Stimulus Was Chosen During Experiment 1

Participant	HP phases	LP phases	HP & LP phases
Lindsay	Game, 42.5% Chips, 57.5%	Pizza, 81% Book, 18.9%	Chips (HP), 93.6% Pizza (LP), 6.4%
Jessica	Orange, 46.5% Hug, 53.5%	Bead toy, 100% Book, 0%	Hug (HP), 94.7% Bead toy (LP), 5.3%
Sammy	TV, 72.7% Nintendo®, 27.3%	Clap, 51.5% Puzzle, 48.9%	Nintendo® (HP), 100% Puzzle (LP), 0%

1 do not indicate how much they preferred the choice over the no-choice condition. The participants received the same stimuli as often and for the same amount of time, regardless of whether they responded on the choice or the no-choice key. Under this arrangement, even a slight preference for choice would be sufficient to “tip the scales” and produce exclusive or near-exclusive responding on the choice key, just as individuals often respond almost exclusively on the denser of two concurrent-ratio schedules, even when the difference between the two schedules is small (e.g., a variable-ratio [VR] 25 and a VR 35; Herrnstein & Loveland, 1975).

One approach that has been used to assess strength of preference for a particular reinforcement parameter (e.g., immediacy of reinforcement) has been to compare it with another one (e.g., amount of reinforcement) in a concurrent-operants arrangement (e.g., Mazur, 1981; Neef *et al.*, 1993). For example, a number of investigations have shown that when given a choice between smaller, more immediate reinforcers and larger, more delayed reinforcers, individuals often choose the former over the latter (e.g., Logue & King, 1991; Schweitzer & Sulzer-Azaroff, 1988; Solnick, Kannenberg, Eckerman, & Waller, 1980). In Experiment 2, we used a similar method to evaluate how strongly participants preferred the choice over the no-choice option. Responding on the choice key produced a choice, but it was between relatively less preferred stimuli, whereas responding on the no-

choice key produced higher preference reinforcers selected by the therapist. Thus, participants' preference for choice was in direct competition with their preference for higher quality reinforcers.

EXPERIMENT 2

Procedure

The procedures for Experiment 2 were similar to those used in Experiment 1. The reinforcement schedules (i.e., concurrent VI schedules on Keys 1 and 2 and no programmed consequences for Key 3) were the same for each participant, as were the reinforcement intervals. In addition, the initial HP & LP phase in Experiment 2 represents data from the HP & LP phase in Experiment 1. Procedures used in this and the subsequent HP & LP phases were identical to those described in Experiment 1.

In the choice = LP/no choice = HP & LP phase, responses on the choice key resulted in a choice between the two lower preference stimuli that had been identified for each participant (i.e., the stimuli used in the LP phase of Experiment 1). Responses on the no-choice key resulted in presentation of either a higher or lower preference stimulus selected by the experimenter, with selections randomized and equally divided between the higher and lower preference stimuli (i.e., the stimuli used in the HP & LP phase of Experiment 1). Thus, therapist selections were not yoked to participant selections during this phase. With this ar-

rangement, the choice condition led to less preferred stimuli than did the no-choice condition. Responding on the choice key allowed the participant to choose, but the choice was always between two lower preference stimuli. By contrast, responding on the no-choice key resulted in the therapist selecting the reinforcer, which consisted of the higher preference stimulus on half of the trials and the lower preference stimulus on the remaining half.

The choice = LP/no choice = HP phase (Sammy only) was similar to the choice = LP/no choice = HP & LP phase, except that the therapist selected one of the two higher preference stimuli identified for Sammy following responses on the no-choice key (i.e., the stimuli used in the HP phase of Experiment 1).

Results and Discussion

The results of Experiment 2 are presented in Figure 2. Lindsay responded at consistently higher rates on the choice key than on the no-choice key in both HP & LP phases. By contrast, responding on the choice key decreased and was replaced with high rates of responding on the no-choice key after the first session in the choice = LP/no choice = HP & LP phases. Lindsay rarely responded on the control key except in the first session of the second HP & LP phase, during which responding on the control key was high for unknown reasons.

In the initial HP & LP phase, Jessica responded at consistently higher rates on the choice key than on the no-choice key. Her responding shifted toward the no-choice key in both choice = LP/no choice = HP & LP phases. However, during the replication of the HP & LP phase (i.e., the third phase), Jessica responded at low variable rates on both the choice and the no-choice keys for unknown reasons. Jessica rarely responded on the control key during any condition.

In each of the three HP & LP phases conducted with Sammy, he responded at con-

sistently higher rates on the choice key than on the no-choice key. In the first choice = LP/no choice = HP & LP phase, Sammy's responding shifted toward the no-choice key, but this effect was not replicated in the second choice = LP/no choice = HP & LP phase. In both choice = LP/no choice = HP phases, Sammy responded almost exclusively on the no-choice key. Sammy displayed near-zero rates of responding on the control key in all phases.

In general, the results of Experiment 2 showed that the participants preferred the choice over the no-choice condition when the reinforcers presented in these two conditions were the same, but they preferred the no-choice condition when it produced access to higher preference stimuli and the choice condition did not. That is, their preference for choice (i.e., selecting the reinforcers themselves rather than allowing the therapist to select for them) was outweighed by their preference for higher quality reinforcers.

GENERAL DISCUSSION

The effects of choice were evaluated in Experiment 1 by equating the reinforcement delivered in the choice and no-choice conditions (i.e., the same stimuli were delivered regardless of whether the participant or the therapist selected them). Under this arrangement, participants responded almost exclusively on the key that allowed them to choose among the available reinforcers. This preference for choice occurred in every phase of Experiment 1, regardless of whether the available reinforcers were two higher preference stimuli, two lower preference stimuli, or one higher and one lower preference stimulus. Thus, choice produced a clear effect that was independent of the specific consequences associated with the choice and no-choice conditions because the same stimuli were presented in each.

In Experiment 2, responding on the

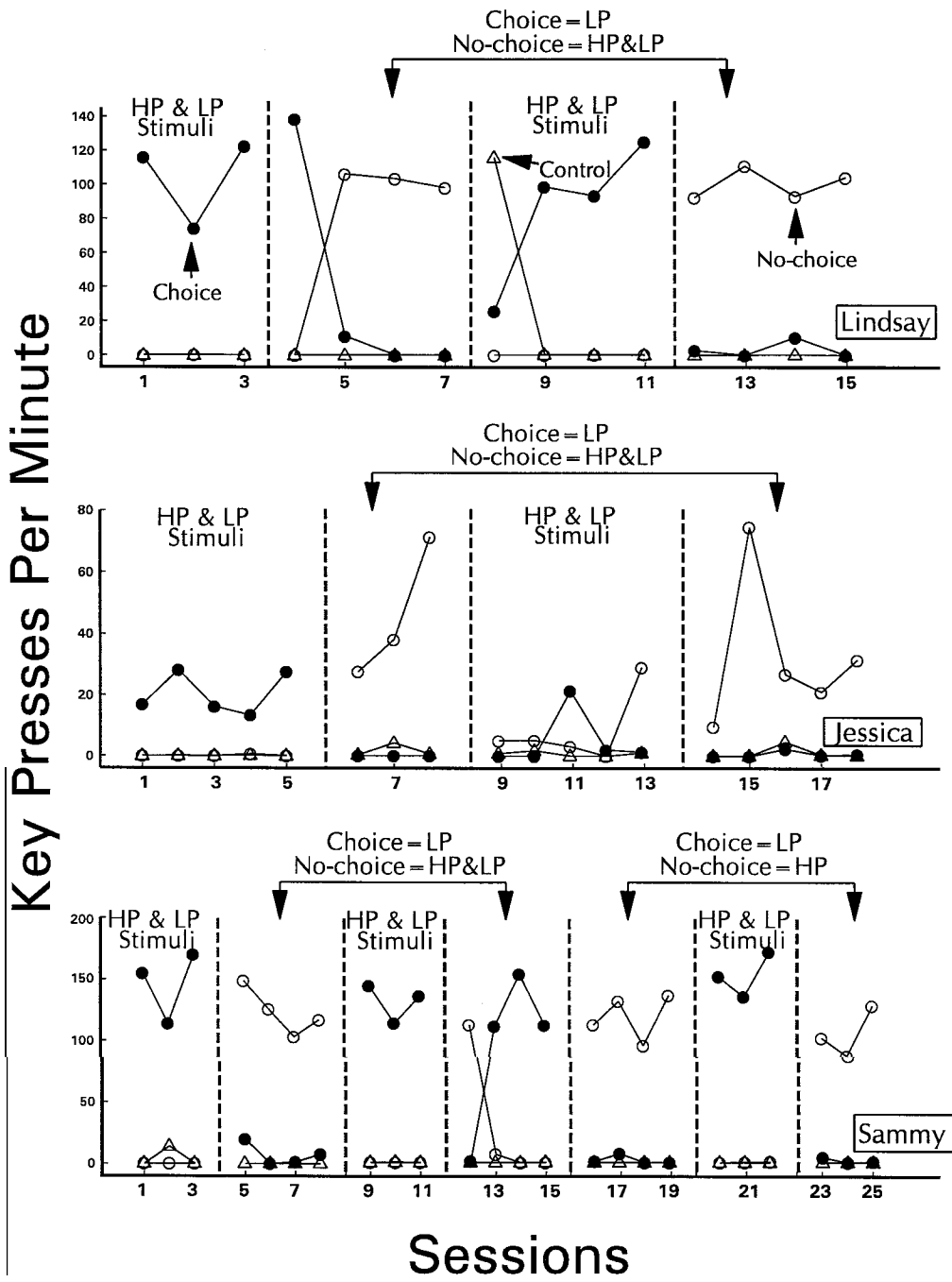


Figure 2. Number of key presses per minute on the choice, no-choice, and control keys during Experiment 2 for Lindsay (top panel), Jessica (middle panel), and Sammy (bottom panel). HP = higher preference; LP = lower preference.

choice and no-choice keys produced the same consequences in some phases, but in others, the choice key was associated with less favorable outcomes than was the no-choice key. As in Experiment 1, participants preferred the choice over the no-choice condition when both produced the same reinforcement (except in the second HP & LP phase for Jessica). However, when responding on the no-choice key produced increased access to higher quality stimuli (relative to the choice key), responding shifted to the no-choice option. That is, participants preferred to select reinforcers for themselves when the stimuli available through the choice and no-choice options were equated, but preferred to have the therapists select for them when higher quality reinforcers were available through the no-choice option. One deviation from these general findings was that Sammy displayed near-exclusive responding on the no-choice key only when it always produced higher preference stimuli and the choice key produced lower preference stimuli. In general, all 3 participants surrendered their option to choose a reinforcer when allowing the therapist to choose for them resulted in greater access to higher quality reinforcers.

Previous studies on the effects of choice among persons with developmental disabilities have produced less consistent results than has the current investigation. In some studies, there were no apparent effects of choice when high-preference stimuli were available in both the choice and no-choice conditions (e.g., Lerman et al., 1997; Parsons et al., 1990; Smith et al., 1995). In other studies, the effects were observed with some individuals but not with others, and only when the choice was between lower or moderately preferred tasks (Bambara et al., 1994; Vaughn & Horner, 1997). Taken together, the results of previous investigations might lead one to conclude that (a) the reinforcing effects of high-preference stimuli

are more robust than the effects of choice and (b) providing individuals with choices does not increase reinforcer effectiveness when preferred stimuli are used. The results of the current investigation are consistent with the former conclusion but not with the latter one.

The results of Experiment 2 showed that the participants surrendered their opportunity to choose among the available reinforcers when allowing the therapist to choose for them resulted in greater access to preferred stimuli. The results of Experiment 1 showed that reinforcer effectiveness can be increased by providing individuals with choices, even when the choice is between two higher preference stimuli. The results of the current investigation indicate that providing choices to individuals with mental retardation adds to the reinforcement value of the chosen stimuli and thus may have the potential to improve the effectiveness of behavioral programs.

The current investigation differs from previous studies in several ways. One difference was the method used to present choices to participants. In most previous studies (e.g., Bambara et al., 1994; Parsons et al., 1990; Smith et al., 1995), participants were presented with a choice between reinforcers or activities prior to each session, and the selected stimulus remained in effect throughout the session (for a notable exception, see Lerman et al., 1997). Thus, in most studies, choice preceded responding (i.e., it was an antecedent), and it occurred just once per session. By contrast, participants in the current investigation chose between the two available reinforcers each time they met criterion for reinforcement. Thus, choice occurred many times per session (i.e., up to 37 times), and it immediately followed the target response (and also immediately preceded reinforcement delivery). It is possible that one or more of these variables contributed to the effects of choice that were observed

in the current investigation. For example, the choice procedure used in the current investigation allowed the participants to switch reinforcers if their relative preferences for the items changed within a session. In fact, each participant switched between the available reinforcers in at least some of the sessions in Experiment 1 (50% of sessions for Lindsay, 12% for Jessica, and 55% for Sammy). In addition, it is unlikely that the preferences of the current participants changed between the time when a choice was offered and when the reinforcer was delivered because the two events occurred contiguously (i.e., reinforcement delivery immediately followed choice). Future research might assess whether choice affects responding more when (a) it is a consequence (i.e., presented after the target response), (b) it is provided multiple times per session, or (c) it occurs in close temporal proximity to reinforcer delivery.

A second difference is that previous studies of the effects of choice among individuals with developmental disabilities used single-operant arrangements (e.g., Bambara *et al.*, 1994; Lerman *et al.*, 1997; Parsons *et al.*, 1990; Smith *et al.*, 1995), whereas a concurrent-operants arrangement was used in this investigation. Two previous investigations also evaluated the effects of choice using concurrent-operants arrangements, but with different populations (i.e., kindergarten children, Brigham & Sherman, 1973; and pigeons, Catania & Sagvolden, 1980). Each study that used a concurrent-operants arrangement found that participants consistently preferred the choice over the no-choice condition. Taken together, the results of these investigations suggest that a concurrent-operants arrangement may provide a more sensitive measure of the effects of choice on responding than does a single-operant arrangement.

The results of Experiments 1 and 2 also highlight an important distinction between single- and concurrent-operants arrange-

ments. In a single-operant arrangement, there is generally one dependent variable (i.e., absolute response rate), whereas in a concurrent-operants arrangement, there are two (i.e., absolute and relative response rates). Absolute response rate refers to the total number of responses in a given session or condition divided by a unit of time. Relative response rate refers to the rate of one response in proportion to the combined rate of all available responses in a concurrent-operants arrangement (e.g., in a two-operant arrangement, the rate of Response A divided by the combined rate of Responses A and B). In general, relative response rate is a more sensitive measure of preference. For example, if nickels and dimes were each available for finishing simple math problems at different times on FR 1 schedules (i.e., two single-operant schedules), a child might work as fast as possible on each schedule, thus producing equivalent (absolute) response rates. However, if the two schedules were concurrently available, the child would still work as fast as possible (i.e., absolute response rates would remain the same), but the child would probably allocate all of his or her time to the schedule that produced dimes (i.e., relative response rates would be higher for the schedule that produced more reinforcement).

The effects of choice were evident in terms of relative but not absolute response rates in the current investigation. Relative response rates were higher for the choice than for the no-choice option when each one produced the same reinforcers. When choice was associated with less preferred stimuli, relative response rates were higher for the no-choice than for the choice option. However, absolute response rates did not appear to be affected by choice or by the quality of the stimuli (i.e., higher vs. lower preference stimuli). For Lindsay and Jessica, absolute response rates in Experiment 1 were similar across phases, regardless of whether the stim-

uli available were both lower preference, both higher preference, or one of each. For Sammy, there was an upward trend in absolute response rates over the course of Experiment 1. However, this trend was not related to the quality of the available reinforcers because only higher preference stimuli were presented in the first phase, when absolute response rates were lowest. Absolute response rates were also remarkably similar across phases in Experiment 2 for Lindsay and Sammy, independent of whether they responded on the choice or no-choice keys, or whether they received lower or higher preference stimuli or a combination of the two. Jessica's absolute response rates were more variable but did not appear to be a function of choice or whether higher or lower preference stimuli were presented.

A third difference between previous studies and the current one was the functioning level of the participants. The participants in most previous investigations (e.g., Bambara et al., 1994; Lerman et al., 1997; Parsons et al., 1990; Smith et al., 1995) had more severe disabilities (i.e., severe to profound mental retardation) than did the individuals in the current investigation (i.e., mild to moderate mental retardation). It is possible that individuals with more severe disabilities are less likely to show a strong preference for choice, perhaps because historically they have had fewer opportunities to make choices (Bannerman, Sheldon, Sherman, & Harchick, 1990). Future research might be directed toward determining whether the reinforcing effects of choice correlate with age, developmental level, history of choice-making opportunity, or other characteristics.

The results of the current investigation showed that the participants preferred the choice over the no-choice option, even when both options produced the same consequences. However, the mechanisms that are responsible for the development of this preference remain unknown. Catania (1980)

suggested that the source of the preference for choice may be phylogenetic (result from evolutionary advantages), ontogenic (shaped through environmental contingencies), or both. For example, from an evolutionary standpoint, individuals who prefer multiple food sources over a single source may be more likely to survive when food supplies become scarce (see Catania, 1980, for additional examples).

From an ontogenic perspective, Catania (1980) suggested that individuals may prefer choice over no choice because it provides a mechanism for adjusting reinforcer delivery in relation to momentary fluctuations in motivation (presumably resulting from satiation, deprivation, or other establishing operations; Michael, 1993). If this is true, then choice could become a conditioned reinforcer over time because it is often correlated with increased access to preferred stimuli. For example, individuals with developmental disabilities may learn that when they make a choice, they select the reinforcer that is most preferred at that point in time, whereas parents, teachers, and therapists may or may not. If this happens repeatedly in a variety of situations, then choice may become a conditioned reinforcer and produce reinforcement effects even in situations in which the choice and no-choice conditions produce equal consequences (as in Experiment 1).

Although this ontogenic hypothesis provides a plausible account of the effects of choice observed in Experiment 1, the results of Experiment 2 are somewhat more difficult to explain from this perspective. In Experiment 2, the effects of choice were overridden when the no-choice option was correlated with increased access to higher quality reinforcers. However, the preference for choice returned for Lindsay and Sammy (but not for Jessica) when the consequences in the choice and no-choice options became equal again. Catania reported the same basic finding with pigeons, suggesting that the effects

of choice tend to be durable and resilient (see Catania, 1980, for a discussion). One might expect the effects of choice to persist in the absence of differential consequences if choice was previously correlated with increased access to preferred stimuli. However, it is not so likely that these effects would return after choice was correlated with decreased access to preferred stimuli. In fact, based on a conditioned reinforcement account, one might expect the participants to continue to show a temporary preference for the no-choice option after it had been correlated with increased access to preferred stimuli in Experiment 2.

The results of the current investigation also have potential applied implications. First, it was encouraging to find that participants surrendered their option to choose when choice was correlated with decreased access to preferred stimuli. Being able to discriminate conditions in which it is advantageous to make choices or decisions for oneself from those in which it is better to allow someone else to make them is an important skill, and one that is seldom, if ever, explicitly taught to individuals with developmental disabilities. Obviously, in most natural situations, discriminating between such conditions (when it is and is not advantageous to choose) can be much more difficult than it was in the current investigation. Nevertheless, the basic method used in this investigation provides a means of teaching such discriminations (i.e., alternating between conditions in which it is and is not advantageous to surrender one's opportunity to choose).

Second, integrating choice into behavioral programs may help to lessen the potentially negative effects of reinforcer satiation. Egel (1981) found that satiation effects were mitigated when the experimenter alternated reinforcers within a session. It is possible that individuals do the same thing when given choices by periodically alternating from one

reinforcer to another. Future research might assess whether these switching responses are a function of momentary fluctuations in motivation that result from satiation or other establishing operations (e.g., competing sources of reinforcement in the environment).

If individuals choose reinforcers in accordance with momentary fluctuations in preference, it may be particularly important to incorporate choice into reinforcement schedules that are used to increase appropriate behavior or decrease inappropriate behavior. That is, allowing the individual to choose from an array of available reinforcers should insure that the reinforcer delivered is the one that is most preferred at that point in time. By incorporating choice into reinforcement delivery, the individual should switch or vary reinforcement only when an alternative stimulus is momentarily preferred over the one previously chosen. Who could be better at determining when to change reinforcers than the individual who receives them?

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STUDY QUESTIONS

1. According to the authors, what two factors might explain an individual's preference for having opportunities to make choices?
2. The authors noted that response rates under choice and no-choice conditions might be similar in a single-operant arrangement in spite of differences in reinforcer rate, magnitude,

or quality across conditions, whereas greater response differentiation might be observed under a concurrent arrangement. Why is that so?

3. Describe the general arrangement for Experiment 1. How was preference equated across the choice and no-choice conditions?
4. What results were obtained in Experiment 1, and what conclusion is suggested about the reinforcing effects of choice?
5. In what way were the findings from Experiment 1 limited, and how did the authors address this limitation in Experiment 2?
6. How do the results obtained in Experiment 2 temper those obtained in Experiment 1?
7. What procedural variations may have accounted for the stronger preference observed for choice in this study when compared to that found in other studies?
8. In discussing their results, the authors noted that "The effects of choice were evident in terms of relative but not absolute response rates in the current investigation" (p. 434). Because this fact was a direct result of using a concurrent-operants procedure, in what way might the procedure be limited when attempting to determine whether a given stimulus functions as a reinforcer?

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