Evaluation Of Contextual Variability In Prediction Of Reinforcer Effectiveness

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Abstract: Previous research has shown that stimulus preference assessments based on caregiver-opinion did not coincide with results of a more systematic method of assessing reinforcing value unless stimuli that were assessed to represent preferences were also preferred on paired stimulus presentation format, and that the relative preference based on the results of a choice assessment using a concurrent operants paradigm predicts relative reinforcer effectiveness. However, it is not clear whether preference varies under different environmental conditions influencing effectiveness of reinforcement. In the current study, we attempted to address this question by categorizing stimuli as context-dependent and context-independent based on results of preference assessment, and then compared their reinforcing effectiveness in different contexts (home vs. structure of rehabilitation). Independent stimuli, when compared to dependent ones, were more effective in increasing target responses in both contexts. Dependent stimuli consistently functioned as reinforcers only in their corresponding context. These results suggest that establishing operation can be used to predict reinforcing value of various stimuli, which, in turn, may help to improve clinical change.

Reinforcement is a central mechanism in the development of operant behavior. In attempting to apply operant procedures to establish or maintain socially desirable gains, considerable emphasis is placed on the selection of suitable reinforcement schedules and contingencies. However, the process of reinforcer selection is often taken for granted. Thus, it likely that at least some of the failures to obtain behavior change can be attributed to either an inappropriate stimulus selection, or a lack of empirical assessment of stimulus value. Potential reinforcers may be identified quite readily for some individuals by simply asking them what they prefer (Barrett, 1962), or by exposing them to an array of stimuli and recording the duration or frequency of interaction with each one (Quilitch, Christophersen, & Risley, 1977). In contrast, for many impaired individuals who may be non verbal or with limited sensory and motor capabilities, the identification of reinforcing stimuli has been problematic (Egel, 1981; Rincover, Newsom, Lovaas, & Koegel, 1977).

Evidence of the difficulties encountered in attempting to teach new skills to a population with profound mental retardation exists in the recognition that many individuals retarded have participated for long periods of times in training programs without making any demonstrable skill gains (Bailey, 1981). One of the reasons as to why certain individuals do not respond to training endeavors is the inability to find reinforcing stimuli to use in training programs (Wacker, Berg, Wiggins, Muldon, & Cavanaugh, 1985). Because of this difficulty there have been a number of calls to develop systematic methods of identifying reinforcing items for this population.

Typical attempts in this field rely on the subjective opinions of caregivers (e.g., par-
ents, institutional direct care staff, or teachers) regarding what they think given clients prefer. Caregiver opinions were employed because traditional methods are usually impossible to use with individuals who are profoundly handicapped considering the severity of their mental and physical impairments (Pace, Ivancic, Edwards, Iwata, & Page, 1985). Furthermore, caregiver opinions about likes and dislikes of their clients can be not very accurate (Favell & Cannon, 1976). Studies that compared information obtained from caregiver interviews with results from direct assessments have shown a lack of correspondence between caregiver information and the direct observations of preference. In contrast, Fisher, Piazza, Bowman, and Amari (1996) found good levels of agreement between these two sources of information. There are two limitations of these comparative studies with regard to use of findings to plan applications and future research. First, because all were focused on caregivers who were paid staff members, results may not be generalizable to parents and other family members who have had more long-term relationships with the individual. Further, in comparative studies investigators did not interview other members of a support network, such as peers who may have different suggestions on preferences. Given these limitations, a growing number of researchers have investigated methods designed to promote personal expression, and assess preferences and choices of individuals with severe and profound mental retardation who are not able to express these preferences through speech or other symbolic systems (Campbell, 2003; LeBlanc, Patel, & Carr, 2000; Lindauer, Zarcone, Richman, & Schroeder, 2002; Roane, Piazza, Cercone, & Grados, 2002). In general, three themes in this literature support the need for systematic preferences assessment. First, researchers have shown that preference and choice are not synonymous. Choice is an observable behavior whereas preference is inferred from the choice. Stimuli that are chosen systematically over time are considered to be preferred. A person demonstrated choice by acting to get something when the occasion arises (Skinner, 1971). Factors that influence the probability of choice as a response are those that affect the value of any reinforcer, such a satiation, an individual’s reinforcement history, and the operating environmental contingencies (Catania, 1984). Further, methods in which potential reinforcers not easily represented in stimulus preference assessments, such as social reinforcers, represent another line of research (LeBlanc et al., 2000; Roane, Lerman, & Vorndran, 2001).

A second theme in the preference assessment literature is utilization of direct measures of the response versus reliance on opinions of caregivers or others who know the participants. Given a lack of correspondence between caregiver information and direct observations of preference, an overall conclusion is that it would be risky to rely solely on caregiver opinions in assessing preferences (Pino, 2002, 2004). In addition, the reinforcing value of the selected or preferred stimulus has been assessed empirically by observing its effect on an individual’s subsequent performance (Hughes, Pitkin, & Lorden, 1998; Ivancic & Bailey, 1996). Pace et al. (1985) reported one of the first studies aimed at developing direct procedures for identifying reinforcers for subjects with profound mental retardation. This procedure consists of a two-steps process in which subjects were first systematically exposed to a large array of assessment stimuli, and preferences were identified via approach responding to single-choice presentations (stimulus preference assessment designed to predict reinforcer function). The second step validated these preferences as reinforcers by increasing compliant behavior when preferred stimuli were delivered as consequences and by failing to increase complaint behavior when less preferred stimuli were applied as consequences (reinforcer value assessment designed to verify reinforcer function for the small set of stimuli previously identified as highly preferred). This procedure has been found to be superior in identifying reinforcers than that based on caregiver opinion (Mason, McGee, Farmer-Dougan, & Risley, 1989). The first advance of this method was a shift from presenting stimuli singly to presenting them in pairs. This modification successfully increased the accuracy of the procedure. Fisher (Fisher et al., 1992; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996) extended the findings of Pace et al. by com-
paring the results of a single-stimulus and a forced-choice presentation format where pairs of stimuli were presented simultaneously, and the client was asked to choose one stimulus over the other. The forced-choice assessment has been suggested as a more efficient alternative reinforcement identification procedure; it resulted in greater differentiation among stimuli, and more reliably identified reinforcers than the single-stimulus presentation (Green et al., 1988). The second advance again involved a change in presentation format. Instead of presenting stimuli singly or in pairs, all stimuli were presented simultaneously in an array (DeLeon & Iwata, 1996). De Leon and Iwata compared paired-stimulus preference assessments to multiple-stimulus preference assessment in which stimuli were either removed from the array following selection (without replacement) or left in the array following selection (with replacement). The research showed that the multiple-stimulus without replacement (MSWO) procedure produced results similar both in terms of overall ranks and consistency of ranks to those obtained with the paired-stimulus procedure. Windsor, Piche, and Locke (1994) compared the paired-stimulus procedure to a method in which all stimuli were presented simultaneously. The paired-stimulus assessment was conducted in a manner similar to that described by Fisher et al. In the multiple-stimulus presentation format, all items were presented simultaneously for each assessment trial. Windsor et al. found that although the paired-stimulus method required more time to administer, it provided more accurate preference information. Higbee, Carr, and Harrison (2000) conducted an extensive experimental validation of the results obtained from the preference assessment by conducting several MSWO preference assessments using a multielement design embedded within a reversal design. The stimulus identified as most highly preferred functioned as reinforcer for six of the nine participants. As preference has been shown to change over time, it follows that preference should be assessed frequently.

A third theme in preference assessment is the modification of preference across time, setting and persons. Results of research on teaching individuals with severe disabilities suggests that this population may not generalize from specialized to in vivo contexts. This prior research, combined with Belfiore, Browder, and Mace (1994) initial findings on setting differences in choice responses, suggests the need for much more research on impact of setting on expression of preference and for practitioners to consider the potential influence of setting on assessment outcomes. It is possible that the reinforcing effects observed when stimuli were applied contingent upon the response may not generalize to the complex responses and situations that are encountered by practitioners in naturalist settings (Higbee et al., 2000). Recent research has verified a common observation that preference is a transitory phenomenon and that it may change over time. Assessments conducted periodically are likely to show that over time those items or events identified as preferred will change, suggesting that frequent assessment of preference may be necessary (Carr, Nicolson, & Higbee, in press). A second consideration of context is the status of person who presents the options in direct preference assessment. In most studies, the researchers offered options to participants with severe disabilities. Whether or not researchers and participants had an ongoing history of communication together is not indicated in several investigations. In general, the influence of the presenter’s relationships to the participant has not been evaluated in research and is not known. Nozaki and Mochizuki’s (1995) research suggests the need for further research on the effect of the presenter. They found different preferences among people and settings, but they failed to isolate whether differences were due to changes in people, setting, or both. Most research has been conducted in special education classrooms, day program sites, experimental training rooms, or group homes. In contrast, Dyer (1987) conducted assessment in naturalistic environments, such as a hall, office, public park, kitchen, and living room.

Because the stimulus value is functionally related to the context in which that stimulus occurs, it is fundamental at theoretical and applied levels of analysis to look at the context
as a independent variable and, for consequence, manipulate it. This manipulation allows observing either if a stimulus presents a function independent from contexts or a function specifically derived from a particular contextual situation. As a motivation variable, context can show an establishing operation effect, and this function should be considered when analyzing behavior. The EO is defined as an environmental event, operation, or stimulus condition that affects an organism by momentary altering: a) the reinforcing effectiveness of other events (reinforcer establishing effect), and b) the frequency of occurrence of that part of the organism’s repertoire relevant to those events as consequences (Michael, 1993). Because of changes in the future frequency define functions-altering relationships (reinforcement, punishment, extinction) whereas changes in current frequency define evocative relationships, we consider context as having a function-altering effect, in that it can alter the reinforcing effect of preferred stimuli. In a preliminary analysis Nozaki and Mochizuki (1995) demonstrated that the participant’s choice responses changed when in the presence of different activity partners and activity locations. These results suggest that preference may be a combination of the characteristics of the stimuli offered as options and the environmental variables present when the selection is made. In addition, social validity studies may also be conducted to determine how preference assessments can be modified to make their use more likely in applied settings.

The purpose of the present investigation was twofold. First, we evaluated whether Context Independent Stimuli (CIS) consistently function as reinforcers in two different contexts and have a better effect than Context Dependent Stimuli (CDS), which consisted either in Home Dependent Stimuli (HDS), or Structure Dependent Stimuli (SDS). In order to verify this hypothesis we contrasted the results obtained in different contexts (children’s home vs. structure of rehabilitation) (Experiment 1). Second, we aimed to demonstrate whether CDS would function as reinforcers only in their specific context (Experiment 2).

**Method**

**Participants and Settings**

Three children with diagnoses of profound mental retardation between the ages of 7-8 years (subject A was age 8-3, subject B 8-11, and subject C 7-8), who attended speech therapy and psychomotor programs in a specialized center participated as subjects. Participants were recruited from one intermediate care facility for persons with mental retardation. Two participants had a diagnosis of emiparexis. They also exhibited a high rate of hyperactivity or stereotypic behavior. These individuals were chosen to participate in the investigation because of their profound handicapping conditions and their previous lack of progress in behavior change programs as reflected in their program records and reports from their educators and caregivers. All sessions took place either in two different contexts: the subjects’ residences or day treatment programs at the structure of rehabilitation. Subject and two independent observers were present in the room at any given time and each independently recorded selections for purposes of interobserver agreement (IOA). Agreements were defined as both observers recording the occurrence or nonoccurrence of a selection for each trial. Following preference assessment, subject A and subject B were assigned to the experimental phases which aimed to evaluate if CIS have a better effect than CDS, (first hypothesis), and if their function could be is generalized across contexts.

In order to counterbalance the sequence of stimuli presentation, subject A and B participated in a AB1AB2 multielement design: subject A received CIS first and then CDS, while subject B received the counterbalanced order of presentation. Independent stimuli were delivered in both contexts, dependent ones only in their specific contexts.

Subject C participated in the second experiment in which only CDS were used. Contextual variability of these stimuli was tested through one AB1AB2 multielement design (second hypothesis); in the first training phase both HDS and SDS were presented in the subject’s residence while in the second training phase both stimuli were presented in the structure context.
General Procedure

Assessment of Stimulus Preference

Caregiver and parent interview. In order to assess stimulus preference, on the basis of Child Reinforcement Survey (Fantuzzo, Rohrbeck, Hightower, & Work, 1991) and Reinforcement Assessment for Individuals with Severe Disabilities (Fisher et al., 1996) a checklist Valutazione della Preferenza dello Stimolo (VPS) was developed. Both parents and caregivers (professionals identified as assuming the care and the supervision of the clients during their stay in the rehabilitation center) are requested to specify, using a Likert type scale, their prediction regarding children’s preference about seven categories of stimuli consisting of different items and activities. A scale’s value from 5 (most preferred) to 0 (least preferred) has to be assigned to each stimulus. Items were selected from a compilation of potential reinforces listed in widely used textbooks on behavior analysis and for their frequent use with individuals with mental retardation. Thus, the VPS provided a pool of specific stimuli that are considered to be representative of potential reinforces. This checklist includes 45 items in the following seven categories: edible (e.g., juice), tactile (e.g., tickle), social (e.g., smile), vestibular (e.g., cylinder), visual (e.g., cartoons), toys (e.g., ball) and auditory (e.g., jingle bell). The goal of the VPS is to facilitate the identification of the things and activities that the subjects have, to make, as many potential reinforces as possible. Furthermore, caregivers and parents were also asked to describe the conditions under which those stimuli were preferred by children. Thus, the stimuli that received a rate ranging from 4 to 5 were coded as Highly Preferred Stimuli (HPS): \( n = 14 \) for subject A; \( n = 16 \) for subject B, and \( n = 21 \) for subject C). Based on this list, we extracted the independent stimuli (which were the items that overlapped across parents and caregivers judgments) and context dependent stimuli (which were the items that showed their reinforcing function only in either home context or structure context). Table 1 shows results of stimulus preference assessment indicating CIS and CDS for all the three subjects. For each subject, the highest ranked stimuli (13 for subject A, 15 for subject B, and 20 for subject C) were used in the forced-choice assessment described below.

The stimuli used in the forced-choice assessment for each individual were as follows: for subject A, carillon, music, verbal praise, kisses, chips, pasta, pianos, hugs, jingle bell, ball, soft-colored ball, caresses and applause; for subject B fables, kisses, hugs, applause, chip, Coke®, ice-cream, music, guitar, colors, colored shapes, picture cards, ball, Lego® and tickle; and for subject C biscuit, ball, caresses, applause, to play tag, ring a rang a roses, to simulate a buying, chips, ice-cream, orange juice, Nutella®, colors, cartoons, fables, cars, spinning top, basket, and cylinder.

Responses Definition, Data Collection and Reliability

All sessions were conducted either in individual treatment rooms situated in the rehabilitation structure, or at the subject residence. A second trained observer recorded subject responses while the experimenter was seated in the room with the subject. During the forced-choice assessment, observers recorded each time the subject approached the presented stimuli during each trial. “Approach responses” were defined as the individual making an apparent voluntary hand movement toward the stimulus, maintaining contact with the stimulus for at least 3 s, exhibiting a positive facial expression, or making a positive vocalization within 5 s following stimulus presentation. Observers recorded selections on data sheets specifically designed for this purpose. Two experimenters were present and each independently recorded selections for purposes of IOA. An agreement was defined as both observers recording that the same stimulus was approached (i.e., occurrence agreement) or that neither stimulus was approached (i.e., non-occurrence agreement). A disagreement was defined as either (a) the two observers recorded that one of the stimuli was approached (used only for occurrence reliability), or (b) one observer recorded that one of stimuli was approached and the other observer recorded that no approach response occurred (used for both occurrence and non-occurrence agreement). IOA for each participant was calculated by dividing the number...
of agreements by the sum of agreements plus disagreements and multiplying by 100%. Across all subjects, stimuli and assessment trials, overall reliability for approach behaviors averaged 96%.

**Selection of Stimuli to Assess (Forced-Choice Assessment)**

Use of multiple assessment procedures for the selection of stimuli to use during treatment is appealing in that it permits clinicians to obtain additional information regarding the reinforcing value of stimuli beyond parents and caregivers reports. The intent of forced-choice assessment was to obtain a more systematic assessment of the subjects’ preferences, which is to determine whether preferred stimuli could be identified for each subject based on the occurrence of consistent approach behaviors. To make such an analysis, we carried out the forced-choice procedure described by

### TABLE 1

<table>
<thead>
<tr>
<th>Categories</th>
<th>Stimuli</th>
<th>Subject A</th>
<th>Subject B</th>
<th>Subject C</th>
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<tbody>
<tr>
<td>Edible</td>
<td>Chips X</td>
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<td></td>
<td>Pasta X</td>
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<td></td>
<td>Coke X</td>
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<td></td>
<td>Ice-cream X</td>
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<td></td>
<td>Biscuits X</td>
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<td></td>
<td>Sweetmeats X</td>
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<td></td>
<td>Orange juice X</td>
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<td></td>
<td>Nutella® X</td>
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<td>Auditory</td>
<td>Carillon X</td>
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<td></td>
<td>Music X</td>
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<td></td>
<td>Pianos X</td>
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<td></td>
<td>Jingle bell X</td>
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<td></td>
<td>Guitar X</td>
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<td>X</td>
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<td></td>
<td>Fables X</td>
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<td></td>
<td>Colours X</td>
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<td></td>
<td>Coloured shapes X</td>
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<td></td>
<td>Cars X</td>
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<td>Picture cards X</td>
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<td></td>
<td>Ball X</td>
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<td>Lego® X</td>
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<td>Spinning-top X</td>
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<td>Toys</td>
<td>Basket X</td>
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<td>Visual</td>
<td>Cartoons X</td>
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<td></td>
<td>Cylinder X</td>
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<td>Vestibular</td>
<td>Soft-coloured ball X</td>
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<td></td>
<td>Verbal praise X</td>
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<td>Kisses X</td>
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<td>Hugs X</td>
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<td></td>
<td>Caresses X</td>
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<td></td>
<td>Applause X</td>
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<td></td>
<td>To play tag X</td>
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<td>X</td>
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<tr>
<td></td>
<td>Ring-a-rang-a roses X</td>
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<td>X</td>
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<tr>
<td>Social</td>
<td>To stimulate a buying X</td>
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<td></td>
<td>X</td>
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<tr>
<td>Tactile</td>
<td>Tickle X</td>
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**Note.** CIS = Context Independent Stimuli, HDS = Home Dependent Stimuli, SDS = Structure Dependent Stimuli.
Fisher (Fisher et al., 1992; Piazza et al., 1996), each stimulus classified as having high-preference was paired once with every other stimulus for each subject using a concurrent operant paradigm, where potential reinforcers were concurrently available, and their efficacy was evaluated in relation to the efficacy of the alternatively available stimuli. During each trial, two stimuli were presented either by placing the stimulus in front of the subject or, for social stimuli, by having the experimenter act out the activity. Subject approach responses to one of the stimuli resulted in 5 s of access to that stimulus and removal of the other stimulus. Simultaneous approach to both stimuli (e.g., reaching for both stimuli) was blocked by the experimenter. If no approach response was made within 5 s, the experimenter prompted the subject to sample both stimuli by giving the stimulus to the subject or by engaging in the activity with him/her (e.g., throws a ball to the subject). The two stimuli were then represented for an additional 5 s period, and approach responses resulted in 5 s of access to the chosen stimulus. If no response was made within 5 s, the stimuli were removed, and the next trial began. The number of trials for each subject was 182 for subject A, 240 for subject B and 420 for subject C.

Data from the forced-choice procedure resulted in two set of stimuli: a) HPS were those approached on at least 60% or more of trials, b) Low Preferred Stimuli (LPS) were approached below of the 50% of trials. Percent scores for each category of potential reinforcers for CIS and CDS (HDS and SDS) for each participant during forced-choice assessment are reported in Table 1. Subject A’s CIS were approached 82% (colored pencil), 70% (musical cassette), and 77% (carillon); his HDS stimuli were approached 70% (chips), 72% (pianos) and 68% (pasta); and his SDS were 75% (rattle), 74% (rubber ball) and 68% (marble). Subject B’s CIS were approached 75% (musical cassette), 68% (plastic glasses) and 64% (table book), whereas his HDS were approached 75% (guitar), 73% (ice-cream) and 70% (Coke®), and his SDS 65% (puzzle), 68% (ball) and 62% (Lego®). Finally, subject C’s approach behavior for HDS were 70% (orange-juice), 66% (chips), 68% (candy), and for SDS 80% (top), 62% (basket) and 83% (small car) (see Figure 1). Because we hypothesized that HPS could function as reinforcers better than LPS, they were utilized during training phases.

**Experiment 1**

*Comparison of Context Independent vs. Context Dependent Stimuli Assessment*

The reinforcement assessment was a comparison of the differential reinforcing effectiveness of stimuli defined as CIS and CDS based on the results of the choice assessment. These stimuli were administered in both situations (rehabilitation structure vs. children’s residence). Subject A and subject B participated in this experiment. Three CIS and six CDS, selected among the highly preferred ones, were utilized for each subject. CIS were the three items or activities that were ranked as high preference in both parents/caregivers hierarchies, and were approached most frequently by the subject during the forced-choice assessment. CDS were classified into two categories; HDS and SDS. The HDS were the stimuli identified as highly preferred only by parents during preference assessment, and during forced-choice assessment were approached by the subject on 60% or more of the trials. SDS were identified as highly preferred only by caregivers and were approached by the subject on 60% or more of the trials during forced-choice assessment.

The dependent variable measure consisted of a correct response in performing six targeted skills at the experimenter’s request (three at home and three in the structure of rehabilitation), selected on the basis of their low frequency of occurrence before this investigation (e.g.; matching geometric pictures on the basis of color and shape for subject A and building a tower with cubes of different sizes for subject B). In order to verify the contextual variability of stimuli selected, for all the subjects the occurrence of each behavior was reinforced delivering a specific stimulus alone.

*Experimental Design*

In order to compare effects of two types of reinforcers (CIS vs. CDS) a multielement
AB1AB2 reversal design (Bailey & Bostow, 1979; Kazdin, 1982) was carried out for each participant. In general, the training evaluation for each subject started with a baseline condition followed by CIS or CDS. Phase A was the baseline, in which engaging in the target behavior resulted in no differential consequence. During training phases participants received all the three types of stimuli in both contexts, counterbalanced across subjects. During the first training phase (B1) for subject A, correct responding for the three tasks was associated with different consequences (by giving CIS). In the second training phase (B2) he received both CDS stimuli (delivering HDS at home context and SDS in the structure). For subject B, order of training phases was counterbalanced.

Procedure

Baseline. Baseline 1 and 2 lasted for eight sessions, of eight trials per session. Each session continued for 20 min, with up to three sessions completed during a day. During the 1st and the 2nd baseline the experimenter simply presented each request about task performance with an intertrial interval of approximately 10/15 s. No systematic consequence was provided for complying with the request in this phase.

If the child did not engage in the target response within 5 s, a graduated sequence of verbal, gesture and physical prompts was introduced to assist the child. For example, for subject A’s target behavior of matching, the experimenter began each trial showing the sample and saying, “(name), give me that like this”. If the child did not comply within 5 s, the experimenter repeated the instruction and partially guided the child by placing his hand on the child’s shoulder. If the child again failed to comply, the experimenter paired the instruction with increased physical assistance by partially guiding the student by touching his elbow. Failure to comply at this step was followed by the repetition of the instruction and providing more intensive physical assistance by guiding the child at the wrist. The final level of prompt, if needed, was a verbal instruction with hand-over-hand, and full physical guidance. Correct, spontaneous
performance received only verbal praise. If the child did not do the target behavior, the trial ended and next trial began.

**Training (Phase B1 and Phase B2).** During the reinforcement phase, reinforcing effects of the stimuli were evaluated using a single-operant arrangement. Each stimulus was presented for 5 s contingent on the emission of correct response. B1 and B2 training procedures were the same as baseline, except that a potential reinforcer selected from one of the three stimulus groups was presented to the subject contingent on a designated behavior. Presentations of each type of stimuli were counterbalanced across phases. During training, the experimenter stood behind the subject, verbally instructed him/her to perform the specific task, and provided physical guidance if the subject did not respond appropriately to the request. A training trial consisted of presenting the task to be performed, and then allowing the child 5 s to independently engage in the target behavior. If the child failed to engage in it, sequential verbal, gesture, and physical prompts were used to assist the child to emit the behavior. When the child responded appropriately to the task, the selected stimulus was provided. Because the study was designed to assess relative reinforcer effectiveness, the focus was on teaching the contingencies in effect rather than on acquisition of a specific response or skill. Thus, we wanted to make the contingencies and the responses as simple and as clear as possible (response \(a\) produces reinforcer \(a\), response \(b\) produce reinforcer \(b\)). Subject A and subject B received six CIS (three at his/her residence and three at the rehabilitation center) and, during training B2, received six CDS (three HDS at home, and three SDS at the structure). When spontaneous target response reached the 80% for three consecutive blocks of eight trials for each subject, training was concluded.

**Results**

Results of Experiment 1 for subject A and B and for both contexts are presented in separate panels of Figures 2 and 3. Specifically, the top panel show results for subject A in the structure context, and indicates that during baseline the spontaneous emission of target behaviors is rather low, whereas during the contingent presentation of CIS mean level of
behavior occurrence increased steadily, with the last session averaging all independent responses. When baseline was reinstated the level of emission rapidly decreased. In contrast, during the second training, when CDS (HDS at home and SDS at the rehabilitation structure) was introduced, mean level of emission again increased but did not reach the highest level of emission. Specifically, as indicated in the graph, during CIS condition (Training 1) the level of target behaviors was better than in HDS and SDS conditions (Training 2). In fact, when CIS was delivered to subject A, the criterion of 80% of trials for three consecutive blocks was reached more rapidly (at the sixth session at home, and the sixth session at the rehabilitation structure), and also the highest level of emission was reached (100% of responding).

Figure 3 shows the reinforcement effects for subject B. Results for this subject were similar to those for subject A. Specifically, the criterion was reached on average at the seventh session in both contexts for the CIS, whereas during the contingent presentation of CDS in both contexts, it was reached at the eleventh session. For both participants, CIS functioned as reinforcer more than HDS and SDS, increasing the rate of target responses when presented as a consequence in both contexts.

Experiment 2

Context-House Dependent vs. Context-Structure Dependent Stimuli Assessment

The second experiment aimed to evaluate the contextual variability of reinforcer function. Although the first experiment demonstrated that effectiveness of reinforcement varies positively with degree of preferences (i.e., preference for stimuli demonstrated during paired-choice assessment predicts their effectiveness), it is not clear whether the value of reinforcement varies with the context. From an applied standpoint, it is important to clinicians to have a variety of potential reinforcers available and to be able to predict relative effectiveness of those stimuli as reinforcers when the context was varied. Thus, in the current investigation, we evaluated whether reinforcing function of CDS could be due to their specific context. Subject C participated in this experiment.
Dependent Measures

The dependent variable measured was represented by frequency of emission of six behaviors (three at home and three in the structure of rehabilitation, e.g., discriminating the numbers 1 and 4). Three HDS and three SDS were utilized. The purpose of training B1 was assessing the reinforcing effect of CDS in their corresponding contexts. The aim of training B2 was, instead, demonstrating contextual dependence through the stimulus shift condition, in that CDS were presented in the non-corresponding contexts.

Design

In order to verify the contextual variability of the two types of dependent stimuli, a single-subject reversal design was used. Twelve stimuli were used (six at home and six in the structure of rehabilitation). Order of phases was the same as Experiment 1, except that training B2 represented the stimulus shift condition: in training 1 CDS were presented in their corresponding contexts, whereas in training 2 we delivered CDS (different stimuli from those used in training 1) in the non-corresponding context.

Procedure

Baseline and training sessions were conducted similar to Experiment 1, except that phase of the reversal of baseline was followed by a “stimulus shift condition,” where CDS was provided in the non-corresponding context. In other terms, HDS was presented in the structure of rehabilitation, while SDS was presented at the children’s residence.

Results

Results from the reinforcer assessment for subject C are depicted in Figure 4. Data indicate that in baseline phases, spontaneous emission of target behaviors is rather low, whereas during contingent presentation of CDS, mean level of behavior emission steadily increased in both contexts. Specifically, during the training 1, when CDS were presented in their corresponding context, level of target behavior emission increased more than CDS delivered in the opposite context. In fact,
when HDS were delivered at home (training 1) the criterion was reached more rapidly (at the 12th session) rather than when presented in the opposite context (training 2, at the 14th session). In contrast, when SDS were delivered in the corresponding context (training 1), the criterion was reached at the 10th session and at the 12th session in the opposite context (training 2).

Conclusions

In the current investigation, we attempted to determine the extent to which preference, based on results of choice assessment, predicted relative reinforcer effectiveness. Stimuli categorized as highly preferred and independent from context are more effective in increasing target responses, when compared to dependent ones, and consistently functioned as reinforcers across all subjects and situations. In comparison, stimuli identified as highly preferred by the choice assessment but context-dependent consistently functioned as reinforcers only in their corresponding context. The development of this research line is particularly noteworthy considering that (a) until recently, context had received little experimental attention from researchers or practitioners, and (b) variability is critical to measure because preferences were found to change over time and vary among participant (e.g., Kennedy & Haring, 1993; Nozaki & Mochizuki, 1995). Such variability should be expected because of factors such as environmental contingencies, reinforcer satiation, and individuals’ reinforcement histories, which affect the value of individuals’ preferences (Skinner, 1971).

In the present study, the methodology used enabled us to evaluate reinforcer substitutability. Green and Freed (1993) define substitutability as “a characteristic of the relationship between commodities or reinforcers; thus, substitutability describes a continuum of possible interactions among reinforcers” (p. 142). At one end of the continuum, reinforcers are completely substitutable. At the other end of the continuum are reinforcers that tend to be used jointly. These reinforcers are complementary. Finally, independent reinforcers lie at the middle of the continuum. However, substitutability is dependent upon context, in that one reinforcer may easily replace another in some situation but not in other. Reinforcers found to be highly substitutable (in all conditions) could then be used across clinical setting.

Furthermore, because the stimulus value can be modified by changing the context in which that stimulus occurs, contexts in which potential reinforcers are provided were manipulated. In the case of the independent stimuli, their function is related to the effectiveness of reinforcement, whereas in the case of the dependent stimuli their function is related to the availability of reinforcement. Therefore, it seems appropriate to indicate context for the dependent stimuli as having a discriminative function: in fact, CDS did work better as reinforcer in the corresponding context rather than in the opposite one. Similar to previous findings (Ivancic & Bailey, 1996), data from both experiments indicated that stimuli approached on at least 60% of trials during stimulus preferences assessment (i.e., HPS) tended to function as a reinforcer, and that their contextual variability represents a conditional event that set their value.

In conclusion, independent stimuli can be used in order to facilitate the training gains in that a training program in which highly preferred stimuli are used often changes the individual’s aptitude to participate in training sessions. Furthermore, dependent stimuli should be used by paying particular attention to relationships with the context where they are available. Results of the present study suggest that stimuli identified as similarly preferred via a commonly used preference assessment were differentially effective under different situations. Given the limited nature of this investigation, however, these results should be considered preliminary. Nevertheless, these data suggest that context is a powerful independent variable and can be manipulated to change a variety of human behaviors. It is possible that many research questions will be posed, such as the relation between the establishment of discriminative control and context, or the role of context in the multiple control of behavior. However, context and contextual variability of reinforcers probably play a relevant role in all of applied behavior analysis, and a complete functional analysis should include them, especially
into intervention programs with persons with mental retardation. Future research may address the issue of generality of stimulus preference assessment results. Stimuli identified as potential reinforcers in preference assessments could be applied to a variety of different behaviors in the natural environment to observe the extent of their reinforcing effects and to observe if these effects change as response effort and complexity increase. If expressing preferences and making choices are expected to serve a function in people’s lives and extend their self-determination and quality of life, occasions to practice these skills must be incorporated into the environment in which people live and throughout their everyday activities.

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