Reinforcer Identification in Infants

Thomas S. Higbee
University of Nevada

Martha Peláez-Nogueras
Florida International University

Abstract

Recent research with adults and children with disabilities has yielded procedures for systematically identifying potential reinforcers. Used primarily with adults with developmental disabilities, this methodology, stimulus preference assessment, has been shown to accurately identify stimuli as reinforcers and rank them according to effectiveness. Although preference procedures have been used in basic infant research, no methodology specifically designed to compare various potential reinforcers for infants has been developed. As many operant interventions with infants involve reinforcer-based procedures, reliable knowledge about potential reinforcers would be of great value. An adaptation of the stimulus preference assessment procedure for use with infants is proposed and discussed along with the potential practical benefits of such a procedure.

Operant conditioning procedures have been used to investigate various developmental phenomena in infants, including: attention, perception, memory, language, and emotional and socialization processes (Gewirtz & Peláez-Nogueras, 1992). Interventions based upon operant principles have also been used to change maladaptive infant behaviors (e.g., Lamm & Greer, 1988; Mathews, Friman, Barone, Ross, & Christophersen, 1987). Although methods have been developed to evaluate infant preferences for various stimuli (e.g., DeCasper & Spence, 1986), a systematic methodology specifically designed to assess effectiveness of potential reinforcers for infant behavior is lacking. This is unfortunate, as most behavior analytic research studies and applied interventions with infants use reinforcement-based procedures (Peláez-Nogueras, 1998). Recently, a technology for the identification and ranking of stimuli as potential reinforcers has been developed and successfully implemented with adults and children with developmental disabilities. This method, termed stimulus preference assessment, does not require that the person being assessed possess extensive language skills or a large behavioral repertoire. As a result, it is ideal for use with nonverbal individuals. As infants also lack sophisticated language skills and typically have fairly limited behavioral repertoires, an adapted version of current stimulus preference assessment methods could yield valuable information about potential reinforcers for at risk infants or infants with developmental disabilities. Knowledge of these potential reinforcers could allow professionals to design more effective reinforcement based interventions for these infants.

Stimulus Preference Assessment

Behavior analytic researchers have recently developed a systematic method for identifying potential reinforcers and predicting their effectiveness. This method, called stimulus preference assessment, has been shown to accurately predict reinforcers for adults with developmental disabilities (Fisher, Piazza, Bowman, Hagopian, Owens & Slevin, 1992; Green, Reid, White, Halford, Brittain, & Gardner, 1988; Pace, Ivancic, Edwards, Iwata, & Page, 1985), children with developmental disabilities (Paclawskyj & Vollmer, 1995), and children with attention deficit hyperactivity disorder (Northup, Jones, Broussard, & Vollmer, 1995). The identification of powerful reinforcers is important since reinforcement-based interventions are often used in the treatment of behavioral excesses and deficits in adults and children with disabilities. The success or failure of these interventions is often determined by the potency of the reinforcer(s) identified. Reinforcer identification is often difficult in these populations, especially in pre-verbal individuals or those who lack expressive language skills. Stimulus preference assessment provides a way to overcome this obstacle by identifying probable reinforcers beforehand and increasing the probability of designing effective reinforcer-based interventions.

Methods of Assessing Stimulus Preference

By expanding on the work of Pace et al.

(1985), Fisher et al. (1992) developed a concurrent operants choice procedure to assess stimulus preference in adults with developmental disabilities. Piazza, Fisher, Hagopian, Bowman, and Toole (1996) validated and refined the procedure by adding a structured interview component to select the stimuli to be examined. In this concurrent operants choice procedure, 12 to 16 stimulus items are selected either from a standard list (Fisher et al., 1992) or through the use of a structured caregiver interview (Piazza et al., 1996). Each item is then presented in a pair with every other item in a randomized fashion. During each pair presentation, the individual being assessed is allowed to choose between the two stimuli. A choice response is defined as approaching or reaching toward one of the stimuli. The individual is then allowed access to the chosen stimulus for five seconds. Attempts to reach for both stimuli are blocked. If no choice is made, the individual is prompted to sample both stimuli for five seconds and then the two stimuli are presented again. If the individual fails to approach either stimulus following the sampling procedure, both stimuli are removed and the next pair is presented. After all of the presentations are completed, the percentage of times each stimulus was chosen when it was available for selection is calculated. Data from this procedure yield a rank-order of the stimuli according to preference.

Alternate methods of assessing stimulus preference have been developed by other behavior analytic researchers. For instance, Windsor, Piche, and Locke (1994) and De Leon and Iwata (1996) used a method in which multiple stimuli are presented in an array rather than in pairs during the stimulus preference assessment. This multiple stimulus presentation method of assessing stimulus preference has been demonstrated to achieve outcomes comparable to the paired stimulus method while reducing the time required for an assessment by more than half (DeLeon & Iwata, 1996). However, for reasons discussed later, this method is not well suited for use with infants.

Validation of Stimulus Preference Findings

To determine if the more preferred stimuli function better as reinforcers than the less preferred stimuli, a procedure called a "reinforcer assessment" is conducted. Stimuli are divided into categories of high, medium, and low preference based upon the data from choice procedure. Stimulus items from these categories are then compared using a reinforcer assessment procedure involving concurrent operants, where the behavior of sitting in a particular chair or standing in a particular square, for example, results in access to the stimulus associated with that chair or square (Fisher et al., 1992; Piazza et al., 1996). During the assessment, three chairs (or squares) are concurrently available for the individual to sit (or stand) in. The individual is taught which reinforcer is available for each chair before the assessment trial begins. One of the three is designated as a control, and no reinforcement is provided for sitting in it. Thus, two stimuli can be compared during each trial. Results from the reinforcer assessment showed that the high-preference stimuli consistently functioned as reinforcers for all subjects (Piazza et al., 1996). High-preference stimuli were also shown to be more effective reinforcers than either the middle- or low-preference stimuli.

Other, perhaps simpler, types of reinforcer assessments have been conducted to validate preference assessment findings. For example, De Leon and Iwata (1996) used a reversal design methodology to test reinforcer effectiveness. First, baseline rates of behavior were measured for a specific operant response. Then, items from the stimulus preference assessment were provided contingent on the response. Only one stimulus item was used during each phase of the reinforcer assessment and return to baseline phases occurred following each phase change. Changes in response rate compared to baseline levels were then examined to determine reinforcer effectiveness. Data from this reinforcer assessment confirmed the findings of the preference assessment.

Current Preference Procedures in Basic Infant Research

Operant research with infants has involved the contingent provision of a variety of reinforcing stimuli, including infant feed formula, sucrose water, auditory stimuli (e.g., the infant's mother's voice), olfactory stimuli, visual displays (e.g., the movement of a mobile, a video image, or picture

of a human face), tactile and kinesthetic stimuli, and social stimuli (Peláez-Nogueras, 1996). Diverse behaviors have also been used as target responses, including eye-contact and visual fixations, vocalizations and discrete voice sounds, lateral head turns, cries, protests, reaching and grasping an object, arm and leg movements, kicking, and sucking. Several procedures have been used in basic infant research to determine infant preference for various types of stimulation (Peláez-Nogueras, 1996).

Although not a choice procedure per se, the conjugate reinforcement procedure used in studies by Rovee-Collier and her colleagues (e.g., Rovee-Collier and Capatides, 1979) demonstrates the ability of infants to respond differentially to visual cues in the environment. In this procedure, the infant is placed on his/her back in a crib with a mobile suspended above his/her head. A ribbon connects the infant's foot to the mobile so that each time the infant kicks, the mobile moves proportionately. Infants learned to respond (i.e., kick) when reinforcement (movement of the mobile) was made contingent on responding in the presence of a discriminative stimulus and not to respond when that stimulus was absent or other discriminative stimuli were present.

Other methods, which more closely approximate the choice procedures described previously, have also been used. For example, DeCasper and Spence (1986) studied the effect of systematic prenatal auditory exposure on postnatal learning. The behavior they was a non-nutritive sucking response. Infants showed higher rates of nonnutritive sucking when their mothers read a passage that had been recited repeatedly during the last trimester of pregnancy than when a novel passage was read. In a later study, using the same nonnutritive sucking procedure, the mother's voice was shown to more effectively function as a reinforcer than a stranger's voice (Spence & DeCasper, 1987). Thus, rate of nonnutritive sucking was used to determine which of the two stimuli functioned better as a reinforcer with a higher rate of sucking indicating a greater reinforcing effect.

Recently, a procedure has been developed that is more directly aimed at determining infant preference for various kinds of stimulation. This method, the synchronized reinforcement procedure, was developed by Peláez-Nogueras and her colleagues to investigate infants' preferences for different types of tactile stimulation (Peláez-Nogueras, Field, Gewirtz, Cigales, Gonzales, Sanchez, & Clasky, 1997; Peláez-Nogueras, Gewirtz, Field, Cigales, Malphurs, Clasky, & Sanchez, 1996). In this procedure, the infant is seated facing an adult caregiver. Each time the infant makes eye contact, the adult continuously provides a specific type of stimulation (e.g., stroking the infant's leg) until the infant looks away. When the infant again makes eye contact, the adult again provides stimulation for the duration of the eye contact. The procedure is repeated with different types of stimulation. The amounts of eye contact given during each condition is then compared, with more eye contact indicating greater reinforcer efficacy.

Although these three procedures yield information about infant preference for various kinds of stimulation, each has some limitations. For example, the conjugate reinforcement procedure, although allowing the infant to respond differentially, does not directly compare the reinforcing effects of different stimuli. Also, both the nonnutritive sucking and the synchronized reinforcement procedure have been used to compare the reinforcing effects of only one type of stimulation. A further limitation of the latter procedures is that stimuli are presented one at a time, so a comparison of several stimuli may be time consuming. A procedure that would allow the reinforcing effects of multiple stimuli to be compared in a relatively brief period of time would overcome these limitations and is described in what follows.

Stimulus Preference Assessment with Infants

A methodology to be used with infants for evaluating stimuli as potential reinforcers draws upon the research findings in the area of stimulus preference assessment with adults and children with disabilities. Certain variations of the stimulus preference model could be more easily adapted for use with infants. Although the multiple-stimulus method is less time consuming, the paired stimulus method is likely be more effective with infants, given their inability to attend to many stimuli at once. Even if infants were able to attend to and differentiate among

multiple stimuli, determining what behavior constitutes a "choice" would be difficult. Thus, a variation on the paired stimulus method seems more appropriate.

One way to determine preference would be to use a head-turn response in a variation of the synchronized reinforcement procedure. The infant being tested would have to be able physically to make the head turn response and to sit in an infant chair (e.g., a car seat). The infant would be placed on its back in an infant chair and a head turn in either direction would result in one of the two stimuli being presented. For example, if the two stimuli being compared were stroking the infants leg and providing an auditory stimulus, each time the infant turned its head to the left, the auditory stimulus would be provided continuously until the infant turned its head away. If the infant turned its head to the right, its leg would be stroked until it turned away. After a pre-determined period (e.g., 5 minutes), the amount of time spent with the head turned in each direction could be compared. The stimulus associated with the side where the infant's head was turned more would be considered the "chosen" stimulus. Each stimulus would be presented in random order with every other stimulus as described above. When all stimulus presentations were complete, the percentage of time each stimulus was chosen when it was available would be calculated. The stimuli would then be ranked according to this percentage score yielding a rank order of preference. The amount of time required for conducting the assessment could be reduced significantly by limiting the number of stimuli to 4 or 5, rather than the 12 to 16 used in assessments with older participants. Behaviors other than the head-turning response could also be used to indicate preference as long as they were easily observable and distinguishable one from the other.

To validate, experimentally, the results of the stimulus preference assessment, a reinforcer assessment would be conducted. Since infants are, for the most part, non-ambulatory, the concurrent operants procedure described previously would not be feasible. The reversal procedure, which serves the same purpose, would be much easier to perform. The reversal procedure could be conducted in the same manner as described previously. Each stimulus could be delivered contingent on a response (e.g., a leg kick) on some schedule (probably continuous) of reinforcement until a steady rate of responding is observed. Then the infant's rates of responding for each stimulus could be compared. If the results of the reinforcer assessment matched the results of the stimulus preference assessment, then the latter would be validated.

Conclusion

Knowledge about potential reinforcers would be of great value to practitioners who work with infants with disabilities. The proposed procedure would provide a systematic and efficient method of reinforcer identification. These reinforcers could then be used to increase desirable behaviors (e.g., positive interactions with caregivers, so-called "attachment behavior," vocalizations) and decrease maladaptive behaviors (e.g., food refusal, avoidant behavior, protesting behavior).

Stimulus preference assessment has many practical advantages which make it ideal for use in applied settings. First, its administration does not require a great deal of skill. Practically anyone can easily be trained to perform it. Second, it would not require much time. Four to five stimuli could likely be assessed in an hour or less. Third, it increases the likelihood of success. Interventions using reinforcers identified by the procedure would have a much higher probability of being successful than interventions using arbitrarily chosen stimuli.

Although operant procedures have been used to determine infant preferences among social stimuli (e.g., Peláez-Nogueras, et al., 1996; 1997) none have been designed specifically to identify nonsocial reinforcers. A procedure, stimulus preference assessment, has been developed to serve this purpose and has been demonstrated to be effective with adults and children with disabilities. An adaptation of this procedure for use with infants was proposed. If demonstrated effective through research, this procedure could have a substantial positive impact on applied interventions with at risk and infants with disabilities.

References

DeCasper, A.J., & Spence, M.J. (1986). Prenatal

maternal speech influences newborns' perception of speech sounds. Infant Behavior and Development, 9, 133-150.

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. Journal of Applied Behavior Analysis, 29, 519-533.

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. Journal of Applied Behavior Analysis, 25, 491-498.

Gewirtz, J.L., & Peláez-Nogueras, M. (1992). B.F. Skinner's legacy to human infant behavior and development. American Psychologist, 46, 1411-1422.

Green, C. W., Reid, D. H., White, L. K., Halford, R. C., Brittain, D.P., & Gardner, S. M. (1988). Identifying reinforcers for persons with profound handicaps: Staff opinion versus systematic assessments of preferences. Journal of Applied Behavior Analysis, 21, 31-43.

Lamm, N., & Greer, R.D. (1988). Induction and maintenance of swallowing responses in infants with dysphagia. Journal of Applied Behavior Analysis, 21, 143-156.

Matthews, J.R., Friman, P.C., Barone, V.J., Ross, L.V., & Christophersen, E.R. (1987). Decreasing dangerous infant behaviors through parent instruction. Journal of Applied Behavior Analysis, 20, 165-169.

Northup, J., George, T., Jones, K., Broussard, C., & Vollmer, T. R. (1996). A comparison of reinforcer assessment methods: The utility of verbal and pictorial choice procedures. Journal of Applied Behavior Analysis, 29, 201-212.

Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T.A. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. Journal of Applied Behavior Analysis,18, 249-255.

Paclawskyj, T. R., & Vollmer, T. M. (1995). Reinforcer assessment for children with developmental disabilities and visual impairment. Journal of Applied Behavior Analysis, 28, 219-224.

Peláez-Nogueras, M. (1996). Recent research using operant-learning procedures. Paper presented at the biannual meeting of the International Society on Infant Studies, Providence, RI.

Peláez-Nogueras, M. (1998). Assessing social and nonsocial reinforcers: Contributions of contemporary conditioning studies with infants. Paper presented at the International Conference of Infant Studies, Atalnta, Ga.

Peláez-Nogueras, M., Field, T., Gewirtz, J.L., Cigales, M., Gonzales, A., Sanchez, A., & Clasky, S. (1997). The effects of systematic stroking versus tickling and poking on infant attention and affective behavior. Journal of Applied Developmental Psychology, 18, 169-177.

Peláez-Nogueras, M., Gewirtz, J.L., Field, T., Cigales, M., Malphurs, J., Clasky, S., & Sanchez, A. (1996). Infants' preference for touch stimulation in face-to-face interactions. Journal of Applied Developmental Psychology, 17, 199-213.

Piazza, C. C., Fisher, W. W., Hagopian, L. P., Bowman, L. G., & Toole, L. (1996). Using a choice assessment to predict reinforcer effectiveness. Journal of Applied Behavior Analysis, 29, 1-9.

Rovee-Collier, C. K., & Capatides, J.B. (1979). Positive behavioral contrast in 3-month-old infants on multiple conjugate reinforcement schedules. Journal of the Experimental Analysis of Behavior, 32, 15-27.

Spence, M.J. & DeCasper, A.J. (1987). Prenatal experience with low-frequency maternal-voice sounds influence neonatal perception of maternal voice samples. Infant Behavior and Development, 10, 133-142.

Windsor, J., Piche, L. M., & Locke, P. A. (1994). Preference testing: A comparison of two presentation methods. Research in Developmental Disabilities, 15, 439- 455.