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Maureen A. Kelly
Western New England University

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Maureen A. Kelly

Western New England College

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The New England Center for Children

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Supervised by:

Eileen M. Roscoe, PhD, BCBA

Correspondence concerning this paper should be addressed to Maureen Kelly, The New England Center for Children, 33 Turnpike Road, Southborough, MA, 01772.

E-mail: mkelly@necc.org

Abstract

Although experimenters have evaluated assessment methods for identifying preferred tangible and edible items for children with developmental disabilities, few have evaluated assessment methods for identifying preferred topographies of attention. In the current study, indirect and direct assessments were conducted to identify seven topographies of attention to include in subsequent preference and reinforcer assessments. Two different assessment methods were evaluated until adequate reliability was achieved with one of the methods. During both methods, a therapist presented photos depicting the topographies of attention included in the stimulus array, and a control card (resulting in no consequence) was included. Following the evaluation of the two assessment formats, a reinforcer assessment was conducted using a socially relevant target behavior (i.e., mands) to determine the predictive validity of high- versus low-preference forms of attention.

Keywords: attention, social reinforcers, preference assessment, reinforcer assessment

Evaluation of Assessment Methods for Identifying Social Reinforcers

In 2009, the Center for Disease Control reported an increase in the prevalence of children diagnosed with an Autism Spectrum Disorder (ASD) in the United States, estimating that an average of one in every 110 children has a diagnosis of an ASD. According to the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text revision, American Psychiatric Association, 2000*)*, children with an ASD have qualitative impairments in social interaction and communication, stereotyped patterns of behavior, and restricted interests and activities. The *DSM-IV-TR* (2000) describes impairments in social interaction that are marked by deficits in nonverbal behavior (i.e., eye-to-eye gaze, facial expressions, and body postures), spontaneous social initiations to share interests or achievements with others, and reciprocal interaction. Similarly, impairments in communication are marked by delay or lack of language development and varied, spontaneous, or social imitative play appropriate to developmental level (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association, 2000). Given the aforementioned social impairments associated with an ASD, developing a systematic and reliable method for identifying social reinforcers for individuals with an ASD seems warranted.

The ubiquitous nature of attention provides further evidence for the need to establish an effective and reliable method for identifying social reinforcers. Experimenters have shown that attention is the most common consequence for problem behavior in both children and adults (McKerchar & Thompson, 2004; Thompson & Iwata, 2001). Developing a technology for reliably identifying social reinforcers for use during intervention may enhance treatment efficacy for individuals with developmental disabilities.

In addition, the use of social stimuli during intervention offers several advantages. First, social consequences are economical, relevant, and natural (Parsonson, Baer, & Baer, 1974).

Second, they are often topographically similar to targeted skills (e.g., social behavior). Third, they may prevent potential side effects (e.g., satiation or weight gain) associated with edibles and tangibles. Finally, social reinforcers can be contacted across different environments, and there is empirical evidence to suggest that social reinforcers may promote maintenance and generalization of trained skills (Durand, 1999; Durand & Carr, 1992; Lancioni, 1982). Given the advantages of social consequences, establishing a reliable and effective technology for identifying social reinforcers may prove valuable in the field of applied behavior analysis.

Although the etiology of social deficits characteristic of an ASD remains unclear, authors have offered explanations for why social reinforcers may be difficult to establish or less effective for individuals with an ASD. Vollmer and Hackenberg (2001) suggested that individuals with an ASD may lack a predisposition to attend to social stimuli, impeding the establishment of conditioned reinforcers. In support of this assertion, experimenters have found that children with an ASD do not differentially attend to social stimuli (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; Jones, Carr, & Klin, 2008; Klin, Jones, Schultz, Volkmar, & Cohen, 2002; Klin, Lin, Gorrindo, Ramsay, & Jones, 2009). Dawson et al. (1998) found that children with an ASD were less likely to orient to social stimuli (i.e., name calling, hand clapping) compared to nonsocial stimuli (i.e., rattle or jack-in-the-box) than were children with Down syndrome or with no diagnosis. In addition, experimenters have used eye-tracking technology to measure eye fixation and have found that when individuals with an ASD attended to social stimuli, they often fixated on irrelevant facial features. For example Jones et al. (2008) and Klin et al. (2002) found that individuals with an ASD fixated for longer durations on an individual’s mouth than on their eyes relative to individuals without disabilities. These findings lend support for the assertion that the social deficits associated with an ASD may be partially phylogenic in origin.

Ferster (1961) noted that children with an ASD emit an overall low level of behavior that subsequently impedes the establishment of conditioned and generalized conditioned reinforcers. Ferster explained that children without disabilities engage in behavior chains that produce repertoires that are differentially reinforced by a child’s verbal community by the delivery of social stimuli (e.g., praise, physical contact, reprimands), and behavior comes under the control of these social stimuli or generalized conditioned reinforcers. In contrast, Ferster commented that children with an ASD emit an overall low level of behavior, resulting in fewer opportunities for stimuli to serve discriminative or reinforcing functions, limiting the emergence of repertoires that are differentially reinforced by the verbal community. As a result, the establishment of generalized conditioned reinforcers is impeded.

Lovaas et al. (1966) posited that because children with an ASD do not attend to social stimuli, these stimuli are less likely to function as reinforcers or serve a discriminative function for the availability of other reinforcers. Lovaas et al. reported being unsuccessful in establishing the word “good” as a conditioned reinforcer for two participants after conducting over several hundred pairing trials (i.e., the word “good” was paired with delivery of edibles) for two participants. Discrimination training was required to ensure that the participants were attending to relevant social stimuli before they functioned as conditioned reinforcers.

Paris and Cairns (1972) suggested that the ambiguous nature of social stimuli may contribute to the difficulty in establishing them as reinforcers for children with an ASD. These authors hypothesized that social positive comments (e.g., “good,” “fine,” and “all right”) are ambiguous because they occur frequently and do not reliably follow specific behavior, making contingencies less discriminable for individuals with disabilities. In contrast, potential social punishers (e.g., "that's wrong") are less ambiguous because they occur less frequently and are more reliably presented contingent on specific behaviors.

Given the aforementioned difficulties in establishing social reinforcers, evaluating a systematic method for identifying social stimuli prior to evaluating their reinforcing effects seems warranted. Although Lovaas et al. (1966) evaluated procedures for enhancing the reinforcing efficacy of social stimuli, they did not conduct systematic assessments for identifying these stimuli. A reliable and effective technology for identifying social reinforcers may help inform the use of particular topographies of social stimuli, potentially increasing the likelihood that they will function as effective reinforcers for increasing and maintaining appropriate behavior.

Despite difficulties identifying or establishing social reinforcers, there is empirical evidence to suggest that attention is valuable to individuals with an ASD or other disabilities. Specifically, authors have reviewed functional analysis outcomes suggesting that attention functions as a reinforcer for problem behavior in children diagnosed with developmental disabilities (Durand & Carr, 1992; Hanley, Iwata, & McCord, 2003; Iwata et al., 1994). In a review of functional analyses, through the year 2000, Hanley et al. (2003) found that 25.3% of analyses showed that problem behavior (e.g., self-injury, aggression, pica, and noncompliance) was maintained by attention.

Additionally, attention has been found to function as an effective reinforcer for increasing a wide range of appropriate behavior, including walking (Harris, Johnston, Kelley, & Wolf, 1964), studying (Hall, Lund & Jackson, 1968), engaging with leisure items (Goetz & Baer, 197), and attending (Kazdin & Klock, 1973) for children with and without developmental disabilities.

Experimenters have also effectively used social reinforcers to increase communicative responses (Piazza et al. 1999) and responses to bids for joint attention (Taylor & Hoch, 2008).

Attention has also been successfully used across various reinforcement-based interventions for decreasing problem behavior, including functional communication training (FCT) (e.g., Durand & Carr, 1992; Hanley, Piazza, Fisher, & Maglieri, 2005), noncontingent reinforcement (NCR) (e.g., Fisher, DeLeon, Rodriguez-Catter, & Keeney, 2004; Hanley, Piazza, & Fisher, 1997) and differential reinforcement of other behavior (DRO) (e.g., Lindberg, Iwata, Kahng, & DeLeon, 1999; Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). Furthermore, there is evidence to support that the quality or content of attention can be an important variable, with idiosyncratic forms of attention functioning as reinforcers for problem behavior (Piazza et al., 1999; Roscoe, Kindle, & Pence, 2010). Given the utility of attention for reducing problem behavior and increasing appropriate behavior, we need to develop a reliable and effective technology for identifying social reinforcers.

The importance of identifying social reinforcers to include in programming to teach appropriate skills is perhaps best highlighted through research for increasing joint attention and for increasing communicative responses and decreasing problem behavior. These two areas are of particular importance given that they may act as behavioral cusps, a behavior change that may result in the emergence of additional behavior that may expose the individual to new stimuli and important consequences (Rosales-Ruiz & Baer, 1997).

Joint attention has been described as a vital skill in terms of social development (Mundy & Newell, 2007). Dube, MacDonald, Mansfield, Holcomb, and Ahearn (2004) described joint attention initiations as a behavioral chain: an interesting event momentarily alters the reinforcing efficacy of adult-attending stimuli (i.e., the adults' eyes orienting toward an interesting stimulus event). Adult-attending stimuli function as conditioned reinforcers for the child's gaze shift and as discriminative stimuli for the delivery of social consequences. The authors noted that the adult-attending stimuli would only function as effective conditioned reinforcers if social consequences function as reinforcers. Therefore, empirically identifying social consequences that may function as reinforcers could facilitate performance gains in the area of joint attention.

Taylor and Hoch (2008) used social reinforcers (i.e., smiles and tickles) for teaching children with an ASD to respond to and initiate bids for joint attention. The authors found that prompting and differential reinforcement increased these skills for two of the three participants. These preliminary findings suggest that identifying social reinforcers could facilitate training programs for increasing pre-requisite skills that may contribute to the acquisition of additional social skills for children with an ASD. A benefit in using social reinforcers for increasing joint attention is that social stimuli are topographically similar to the trained skill and they are readily accessible in the natural environment, potentially promoting maintenance and generalization of performance gains.

Experimenters have also used attention as a reinforcer in functional communication training for increasing communicative responses. During this intervention, experimenters deliver attention contingent on a communicative response (e.g., "Attention please") and withhold the delivery of attention following occurrences of problem behavior (e.g., Carr & Durand, 1985; Durrand & Carr, 1992; Hanley, Iwata, & Thompson, 2001; Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997). Function-based communication is an important target behavior that offers several advantages. Specifically, it may effectively occasion reinforcement across individuals (Durrand & Carr, 1992) and across settings (Durand, 1999), and it may be preferred over other treatment options (Hanley, Piazza, Fisher, Contrucci et al., 1997).

Durand and Carr (1992) evaluated the long-term treatment effects of time-out or FCT for 12 participants' attention-maintained problem behavior. Six participants received time-out as a treatment, and six received FCT as a treatment. Although both interventions decreased problem behavior, a subsequent analysis with naïve trainers, who were unaware of the participants' histories with the two interventions, showed that only the participants who received FCT continued to exhibit low levels of problem behavior. In addition, the participants with prior FCT training engaged in independent requests for attention with the naïve trainers. Expanding this line of research, Durand (1999) evaluated FCT using a voice output device for a participant who exhibited attention-maintained problem behavior. FCT increased communicative responding and decreased problem behavior, and these effects generalized across settings and staff.

Hanley, Piazza, Fisher, Contrucci et al. (1997) used a concurrent-chain procedure to assess the treatment preference of two participants with attention-maintained destructive behavior. The authors evaluated participants' preference across three treatment options: FCT, NCR, and extinction. A noteworthy feature of this study was that the authors ensured that the amount and quality of attention delivery was consistent across treatment conditions. Although both FCT and NCR reduced participants' problem behavior, participants selected the FCT initial link more often than the NCR initial link, suggesting that FCT was a preferred treatment. The authors noted that FCT may have been preferred because it is response-dependent, allowing the individual to control the rate of reinforcement, compensating for fluctuations in establishing operations.

Luczynski and Hanley (2009) evaluated typical children's preference for different schedules of social interaction delivery: differential reinforcement of an alternative response (DRA), NCR, and extinction. During DRA, the authors delivered attention contingent on a communicative response, and they yoked the frequency and temporal distribution of social interactions across the DRA and NCR schedules. Seven out of eight participants showed a preference for DRA sessions, providing further support that individuals prefer contexts in which social interactions are response dependent. A technology that allows clinicians and experimenters to identify social stimuli that function as reinforcers could prove valuable for increasing communication skills that may serve as pre-requisites for more complex social skills and interactions while recruiting new communities of reinforcement.

Given the core social deficits of an ASD noted previously, it may be difficult to identify preferred forms of attention for these children. However, there is substantial evidence that attention is valuable to children with developmental disabilities and can be used effectively to change behavior. Given this evidence and the ubiquitous nature of attention, it is critical to identify an effective and reliable method for identifying social reinforcers that can be utilized in programming to establish new behaviors or increase appropriate behaviors.

The preference assessment literature may inform the development of an assessment method for identifying preferred forms of attention. In the field of applied behavior analysis, a comprehensive technology has emerged for identifying preferred edible and tangible stimuli for use as reinforcers among individuals with developmental disabilities. Numerous studies have described empirically-based methods for systematically identifying preferred items for use during skill acquisition programs (Bourret, Vollmer, & Rapp, 2004; Hernandez, Hanley, Ingvarsson & Tiger, 2007; Volkert, Lerman, Trosclair, Addison, & Kodak, 2008). For example, items identified during a preference assessment have been used to increase communication skills (e.g., Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002), academic skills (e.g., Cummings & Carr, 2009), and maintain vocational skills (e.g., Graff, Gibson, & Galiatsatos, 2006). In addition, authors have conducted preference assessments to identify reinforcers for use during the treatment of problem behavior, including self injury and aggression (e.g., Fisher et al., 2004; Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003; Vollmer, Marcus, & LeBlanc, 1994). Given this well established technology, using similar procedures to identify an effective method for identifying social reinforcers is a logical next step.

Although direct stimulus-preference assessments are frequently used in applied behavior analysis, clinicians and educators may use indirect stimulus-preference assessments (interviews and surveys) as an alternative because they require minimal staff training and are time efficient. Authors have compared outcomes of indirect and direct assessment methods for individuals with developmental disabilities and have found that indirect assessments may have limited validity. For example, Green et al. (1988) and Green, Reid, Canipe, and Gardner (1991) compared a staff survey with a systematic direct assessment method and found that items ranked as highly preferred across both methods functioned as reinforcers, whereas items ranked as highly preferred on only the indirect method did not function as reinforcers. Reid, Everson, and Green (1999) compared open-ended indirect assessments and a direct preference assessment method to identify preferences for individuals with developmental disabilities. For the four participants, only eight of 24 stimuli identified as highly preferred through the indirect method were also identified as highly preferred on the direct preference assessment.

Cote, Thompson, Hanley, and McKerchar (2007) found poor correlations between outcomes from teacher report and a direct preference assessment with typically-developing children. Specifically, the authors showed that for five of the nine participants, stimuli identified by the direct assessment method were more potent reinforcers, but that all stimuli functioned as reinforcers when assessed in the absence of competing sources of reinforcement during reinforcer assessments. In summary, research comparing the outcomes of indirect and direct stimulus-preference assessments has shown that indirect methods alone may have limited validity and are best used to complement direct assessment formats.

Numerous studies have documented direct assessment methods for identifying preferred tangible and edible items for children with developmental disabilities (DeLeon & Iwata, 1996; Fisher et al., 1992; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Roane, Vollmer, Ringdahl, & Marcus, 1998). Pace et al. (1985) and Fisher et al. (1992) conducted two of the seminal studies documenting direct assessment methods for identifying preferred tangible and edible items. Pace et al. evaluated the utility of a single-item stimulus preference assessment. In this assessment, the therapist singly presented items, and observers collected data on item approach. Following the preference assessment, a single-operant reinforcer assessment was conducted to determine whether preferred (approached on at least 80% of trials) and nonpreferred (approached on fewer than 50% of trials) stimuli functioned as reinforcers. Higher rates of responding were obtained when items identified as preferred were delivered contingent upon an arbitrary response than when items identified as nonpreferred were delivered.

A potential limitation of the single stimulus-method is that participants may approach most or all of stimuli, making it difficult to determine relative preference. Fisher et al. (1992) evaluated whether the paired-stimulus preference assessment may more accurately predict relative reinforcement effects than the single-stimulus method. They conducted both paired-stimulus and single-stimulus methods with four participants with developmental disabilities. During the paired-stimulus method, items were presented in pairs, and each item was paired with every other item in the array. Based on the results obtained, two types of items were identified, high-preference items (those ranked high across both assessment methods) and low-preference items (those ranked high according to the single-stimulus method but low according to the paired-stimulus method). During a subsequent concurrent-operant reinforcer assessment, one response option was associated with the high-preference stimulus, whereas the other response option was associated with the low-preference stimulus. The paired-stimulus assessment method resulted in greater differentiation across stimuli than did the single-stimulus method. Results of the reinforcer assessment showed that the paired-stimulus method better predicted which stimuli would function as reinforcers relative to the single-stimulus method.

Although Fisher et al. (1992) found that items identified according to the paired-stimulus method better predicted which stimuli would function as reinforcers when a concurrent-operant schedule of reinforcement was used, a study by Roscoe, Iwata, and Kahng (1999) indicated that different reinforcing effects may be obtained depending upon the schedule used for evaluating reinforcer effects. In this study, the absolute and relative reinforcing effects of items identified according to single-stimulus and paired-stimulus preference assessments were evaluated. High-preference and low-preference items were determined based on the outcomes obtained across the two methods. High-preference items were those approached most often during both the single-stimulus and paired-stimulus assessment methods, whereas low-preference items were defined as those that were frequently approached during the single-stimulus method but rarely approached during the paired-stimulus method. When high-preference and low-preference stimuli were evaluated using a concurrent-schedule arrangement, results showed that high-preference items resulted in higher levels of responding than did low-preference items for seven of the eight participants. However, when these stimuli were evaluated using a single-operant reinforcer assessment, similarly high levels of responding to those observed for the high-preference stimulus were observed for the low-preference stimulus. These findings extended the Fisher et al.

study by showing that different reinforcer assessment methods may yield different outcomes with respect to reinforcer efficacy.

Although Roscoe et al. (1999) found that high-preference and low-preference items (based on the paired-stimulus method) resulted in similar rates of responding during a single-schedule arrangement, Graff et al. (2006) observed differences in absolute reinforcer effects across high- and low-preference stimuli when using a single-schedule arrangement. One explanation for why Graff et al. observed a difference between high- and low-preference stimuli is because the reinforcer assessment tasks (e.g., stamping envelopes and letter writing) may have required greater response effort or complexity. These results suggest that high and low-preference stimuli may have different absolute reinforcement effects when a higher effort response is required.

In the studies noted above, the specific items assessed (i.e., edible or leisure items) were presented in the stimulus array. However, certain stimuli, such as delayed recreational activities and topographies of attention, cannot be readily presented in a stimulus array. To circumvent this problem, authors have evaluated preference assessments that include pictorial or vocal representations of stimuli. For example, Hanley, Iwata, & Lindberg (1999) assessed participants' preference for delayed activities using pictorial representations (photographs) and found that when selections resulted in differential consequences (access to items depicted in the photograph), a clear preference hierarchy emerged. Tessing, Napolitano, McAdam, DiCesare, and Axelrod (2006) compared vocal paired-stimulus preference assessments when selections did and did not result in different consequences and found that different preference hierarchies emerged across the two assessments for six of the seven participants. In addition, results of a subsequent reinforcer assessment showed that items identified from the preference assessment associated with different consequences were more effective reinforcers for two of the participants, suggesting that the delivery of consequences may affect outcomes of vocal preference assessments

In addition to the use of vocal and pictorial preference assessments, authors have also evaluated the reliability of preference assessment outcomes (Carr, Nicolson, & Higbee, 2000; Hanley, Iwata, & Roscoe, 2006; Layer, Hanley, Heal, & Tiger, 2008). Carr et al. (2000) assessed preference stability of the multiple-stimulus without replacement (MSWO) preference assessment (similar to that described by DeLeon and Iwata, 1996) for three participants. After an initial MSWO and reinforcer assessment, the authors conducted eight additional MSWO assessments and assigned ranks to the stimuli based on selection percentages. The authors used a Spearman rank correlation to evaluate both preference changes and the predictive validity of the first session when compared to all three sessions for each of the eight MSWO assessments. Two of the three participants had relatively stable preferences, and overall correspondence based on Spearman rank correlations was high between the first session and the three-session assessment.

Hanley et al. (2006) evaluated preference stability of the paired-stimulus preference assessment (similar to that described by Fisher et al., 1992) by conducting multiple assessments over a 3 to 6 month period. The authors calculated mean-rank order correlation coefficients across assessments and compared the mean ranks of the first and subsequent assessments to determine predictive validity. The authors' criterion for determining stability or predictive validity was a correlation coefficient exceeding a critical *r* value of .58. The authors report selecting this criterion because it was suggested in a statistical textbook (Salkind, 2001), it was similar to results obtained from visual inspection, and it was suggested to be an appropriate cutoff for a good test-retest reliability coefficient according to Cicchetti and Sparrow (1981).

Results of the analyses showed that the majority of participants had stable preferences. The authors also evaluated the effects of manipulating environmental variables that may strengthen (i.e., pairing continuous attention and edibles with an item) or weaken (i.e., providing free access to an item) participants' preferences for particular stimuli. Results showed that satiation and conditioning procedures altered preferences (i.e., items that were previously ranked as high preference were no longer preferred following satiation and items that were previously ranked as low preference received a higher rank following the conditioning procedure).

Layer et al. (2008) examined preference stability within and across two stimulus-preference assessments, a single arrangement and a concurrent-chains group arrangement, in preschool children. First, the authors conducted multiple single-arrangement preference assessments with the same four items to obtain preference rankings for participants. Four items were presented simultaneously and items received a rank and were restricted across trials if (a) a child chose the same food item four times consecutively, (b) a particular food was selected four more times overall, and (c) two foods were selected equally compared to each other and four more times overall. Then, the authors paired the four food items with arbitrary stimuli that would be presented during the group-arrangement. During the group arrangement, the experimenter presented four colored cards (each representing one of four food items) to one of three children in a group and instructed the child to point to the one that he or she liked the best. A barrier in the form of a poster board was used to allow selections to be made in private. The therapist placed each child's selection in a voting box, drew one of the cards out of the box, and delivered the edible associated with that card to all the children. The same criteria used to assign ranks and restrict items during the single-arrangement were also used during the group arrangement.

The authors evaluated agreement within and across assessment types using Spearman's rank order correlations and a critical *r* value of 0.6 (Cicchetti & Sparrow, 1981). Analyses within the same assessment type were conducted by comparing one assessment to subsequent assessments (e.g., the first single arrangement assessment to the second single arrangement assessment and the second single assessment arrangement to the third single arrangement assessment, etc.). The authors also compared correlations across assessment types (single versus group arrangement and found reliable outcomes within and across assessment types. The statistical analyses (i.e., generating correlations within and across assessment formats based on rankings) used in this study provide a method that can be used to determine the reliability of an assessment method, a necessary pre-requisite for establishing validity.

Although authors have evaluated assessment methods for identifying preferred edible and tangible items, few experimenters have evaluated systematic methods for identifying preferred topographies of attention or social reinforcers. Piazza et al. (1999) conducted a series of evaluations with two participants after initial functional analyses suggested that their problem behavior was maintained by reprimands. For the first participant, the authors conducted a concurrent-operant reinforcer assessment to evaluate the relative reinforcing effects of reprimands versus praise. During this assessment, the therapist presented two different colored toys sets (e.g., blue cars and red cars), and the therapist delivered differential consequences (either reprimands or praise) contingent on toy contact with one of the toy sets. The participant never manipulated the toy set associated with praise and spent the majority of sessions engaged with the toy set associated with reprimands. These data suggest that when both forms of attention were concurrently available, reprimands functioned as a more effective reinforcer than did praise. During a subsequent treatment analysis, the therapist delivered praise contingent on mands and ignored problem behavior. This intervention produced near-zero levels of problem behavior and high levels of mands, suggesting that praise was a reinforcer for mands when problem behavior no longer resulted in reprimands.

For the second participant, the authors evaluated the absolute reinforcing effects of tickles and reprimands. The authors used a reversal design during which sitting in one of two chairs resulted in differential consequences. In the first phase, sitting in one chair resulted in tickles while sitting in the other chair resulted in no consequences (control), and in the second phase, the therapist delivered reprimands or no consequences for sitting in one of the two chairs. High levels of sitting occurred in only the chair associated with tickles during the first phase, and little sitting occurred in either chair during the second phase, suggesting that tickles and not reprimands functioned as a reinforcer for sitting. During a subsequent treatment assessment, the authors compared FCT without extinction when communicative responses resulted in either tickles or praise and observed adequate reductions in problem behavior only when communicative responses resulted in tickles.

There were a number of noteworthy contributions of this paper. First, the findings provided preliminary empirical support that not all forms of attention are functionally equivalent. For example, tickles was a more effective reinforcer than praise in the second participant's treatment analysis. These data are important because they have implications for how we select forms of attention for use during assessment and treatment. Second, the authors evaluated the relative reinforcing efficacy of different forms of attention when problem behavior continued to produce reprimands. Third, the authors' findings that reprimands functioned as a reinforcer for only problem behavior and not for an arbitrary response (e.g., in-seat behavior) for one participant suggests that different forms of attention may have different behavioral effects within an individual. The authors commented that the participant's reinforcement history or the stimulus context associated with different forms of attention may have accounted for the differential effects obtained across responses. In addition, the authors noted that reprimands may have served as a reinforcer for problem behavior but not in-seat behavior due to the historical relation between problem behavior and reprimands experienced by this individual.

Kodak, Northup, and Kelley (2007) conducted functional analyses of two participants' problem behavior and found that their problem behavior was maintained by attention (reprimands). In subsequent analyses, the authors used a multielement design to evaluate the reinforcing efficacy of a large array of social stimuli, including reprimands, unrelated comments, tickles, eye contact, praise, and physical attention when presented contingent on problem behavior. For one participant, reprimands resulted in the highest rates of problem behavior and physical attention resulted in the lowest rates of problem behavior. For the second participant, unrelated comments and reprimands resulted in high rates of problem behavior and tickles, physical attention, and eye contact resulted in lower levels of problem behavior. These findings suggest that different topographies of attention may have different effects on behavior. A noteworthy feature of this study is that the authors provided precise descriptions of the different forms of attention assessed. A potential limitation as noted by the authors was that they did not include a control (no consequence) condition in their analysis of different forms of attention.

Smaby, MacDonald, Ahearn, and Dube (2007) evaluated an assessment for identifying the reinforcing efficacy of three social consequences: tickles, head rubs, and praise. During this assessment, the therapist evaluated each social consequence individually, using a multiple-schedule design that included a baseline (no consequence) component followed by a contingent social-consequence component. In the baseline component, the target response (i.e., passing a chip) resulted in no consequences, and sessions continued until 1 min with no responding or 5 min. During the 1-min social consequence component, the therapist delivered one of the three social consequences contingent on the target response. For all three participants, higher levels of responding were observed with one of the social consequences whereas lower levels of responding occurred with the other two social consequences, suggesting that they were less effective reinforcers.

A noteworthy feature of this study was that the authors illustrated an assessment procedure for identifying the reinforcing effects of multiple social consequences. However, a potential limitation was that participants were frequently exposed to extinction. In addition, because the authors compared levels of the target behavior in the 1-min social consequence component to only the last minute of the preceding extinction component, it was unclear whether similar levels of responding occurred during the first minute of the extinction component to that observed in the social consequence component. If high levels of responding occurred during the first minute of extinction, and similar levels occurred during the 1-min social consequence component, then a false positive identification of a reinforcer may result. For example, if a participant emitted 10 responses in the first minute of both the extinction and social consequence components, the level of responding during the social consequence component would be higher relative to the extinction component because only the extinction component was extended in duration until 1 min elapsed with no responding. Furthermore, only the last min of extinction was used when evaluating reinforcement effects. Thus, the longer duration of extinction and use of only the last min of this component may have accounted for the differential response levels observed across extinction and reinforcement components.

In summary, few studies have evaluated preference or reinforcer assessments that include multiple topographies of attention. Therefore, the purpose of this study was to extend previous work in this area by (a) developing a systematic method for identifying topographies of attention to include in the stimulus array, (b) evaluating the reliability of two different assessment methods (pictorial paired-stimulus preference assessment and a single-stimulus reinforcer assessment) for identifying social reinforcers, and (c) conducting a reinforcer assessment to assess the relative predictive validity of items identified by the reliable assessment methods.

Method

Participants and Setting

Four individuals enrolled at a school for children with an ASD participated in the study. Sessions were conducted in a classroom or partitioned area with a table and two chairs. A therapist conducted sessions three-to-five times per week. Roy was a 16-year-old male diagnosed with Pervasive Developmental Disorder (PDD). Roy communicated in one-to-three word sentences and followed simple directions. Arron was a 12-year-old male diagnosed with Autism who communicated with one or two word utterances, rarely emitted sentences, and often spoke at a low volume. Dee was a 19-year-old female diagnosed with Autism who communicated using gestures and words. However, her words were often unintelligible and difficult to understand. Mace was a 9-year-old male diagnosed with Autism who emitted vocal approximations of words and used a speech generating device.

Response Measurement

Graduate students pursuing a master's degree in behavior analysis or board certified behavior analysts served as data collectors during the course of the study. During descriptive assessment sessions, observers recorded the frequency of different topographies of attention (operationally defined for each participant) in 10-s bins across 15-min sessions. Data were summarized by totaling the frequencies of the different topographies of attention across the four descriptive assessment sessions. During the pictorial paired-stimulus preference assessment, observers recorded participants' photo selections (defined as touching or pointing) during each trial. Data were summarized as percentage selection across trials. During the single-stimulus reinforcer assessment, observers recorded the frequency of a simple arbitrary response, target touching, during 10-s intervals. Data were summarized as responses per minute across sessions. During the final reinforcer assessment, observers recorded the frequency of mands in 10-s intervals and data were summarized as responses per minute.

Reliability

For the descriptive analysis, we calculated exact-count-per-interval (response intervals only) interobserver agreement (IOA) data during 25% of sessions by dividing the total number of response intervals with exact agreement by the total number of response intervals and multiplying this number by 100. Mean interobserver agreement across participants was 87.9% (range, 85% to 91.6%).

For the paired-stimulus preference assessment, trial-by-trial IOA was collected across 52% of sessions and calculated by totaling the number of trials with agreement, dividing by the total number of trials, and then multiplying by 100. Mean interobserver agreement across participants was 99.8% (range, 98% to 100%).

During the single-stimulus reinforcer assessment, mean count-per-interval IOA data was collected across 52% of sessions by aggregating the percentage of agreement across all the intervals and dividing by the total number of intervals. Mean interobserver agreement across participants was 94.8% (range, 89.6% to 100%).

During the reinforcer assessments, mean count-per-interval IOA data was collected across 35% of sessions by aggregating the percentage of agreement across all the intervals and dividing by the total number of intervals. Mean interobserver agreement across participants was 96.6% (range, 85% to 100%).

Procedural Integrity

During the paired-stimulus preference assessment, we collected procedural integrity data on 43% of trials. For this measure, observers recorded the occurrence of the therapist correctly placing the photos in front of the participant and correctly delivering the appropriate form of attention contingent on participants' photo selections. These data were summarized by dividing the total number of trials with a correct occurrence by the total number of trials, and multiplying this number by 100. Procedural integrity averaged 99.5% across participants (range, 98 % to 100%). During the single-stimulus reinforcer assessment, we collected procedural integrity data during 43% of sessions. For this measure, observers recorded the occurrence of the therapist delivering the appropriate form of attention contingent on participants' target touching. These data were summarized by dividing the total number of target touches with a correct consequence by the total number of target touches, and multiplying this number by 100. Procedural integrity averaged 99.1% across participants (range, 95.5% to 100%).

Pre-Assessment

Social Stimuli Questionnaire (SSQ). We developed a questionnaire to identify topographies of attention to include in the stimulus array for the pictorial paired-stimulus preference assessment and the single-stimulus reinforcer assessment. The therapist presented the questionnaire to one or more respondents who had directly worked with the participant on a daily basis for at least 3 months. The respondents were asked to fill out the questionnaire but not given any further information with regards to the purpose of the study. The respondents were not given a time limit but rather asked to return the questionnaire upon completion. The questionnaire included closed-ended and open-ended sections (see Appendix). The closed-ended section included various stimulus categories (similar to those used by Dempsey, Iwata, & Hammond, 2007) including physical and vocal forms of attention. In the closed-ended component, respondents were first asked whether the participant came into contact with specific forms of attention and then asked whether or not these forms of attention were preferred. Respondents answered the first question using a Likert scale (1 indicated never, 2 indicated sometimes, and 3 indicated always) and the second question by circling the word “yes” or “no”. The open-ended section was used to further identify idiosyncratic topographies of attention and asked the respondents to list other forms of attention and answer the same two questions in the same manner as in the closed-ended component. The final portion of the questionnaire required the respondents to rank participants’ preference for eight topographies of attention identified from the open and closed-ended sections from most- to least-preferred.

Descriptive Assessment (DA). We also collected video samples to identify topographies of attention to include in the stimulus array for the pictorial paired-stimulus preference assessment and the single-stimulus reinforcer assessment. These data were used to inform selection of stimuli for inclusion in the stimulus array (i.e., topographies of attention that were most often delivered in a participant’s environment were considered for inclusion). Observers collected four 15-min video samples of the participant engaging in different activities (e.g., academic tasks, gym, playground, and structured leisure) that occurred in the context of their daily routines. Upon entering a setting to collect a video sample, the observer explained to the teachers working with a given participant that he or she was there to just observe the participant and did not provide any information regarding the purpose or nature of the study. After video had been collected, videos were viewed and operational definitions specific to that individual and the topographies that he or she received were generated and used for purposes of scoring. This process involved modifying a standard set of definitions for both physical and vocal forms of attention so that they captured the topographies of attention received by that participant. At times, participants received idiosyncratic forms of attention (e.g., nose beeps, cheek pops) and operational definitions for these forms of attention were generated and added to the participant's list of operational definitions. Data collectors first obtained an inter-observer agreement score of 90% with a primary data collector for a DA session prior to scoring subsequent sections. Data collectors recorded the frequency of topographies of attention that were operationally defined for each participant and these frequencies were then aggregated across observation sessions.

Mand Assessment (MA). We also conducted a mand assessment to identify topographies of attention to include in the stimulus array for the pictorial paired-stimulus preference assessment and the single-stimulus reinforcer assessment. Following the descriptive assessment, we conducted two, 5-min mand assessment sessions. During these sessions, the therapist manipulated a putative establishing operation for attention by acting occupied (i.e., back slightly tuned while looking at written material) and presenting no materials to the participant. If the participant independently emitted mands for particular topographies of attention, the therapist delivered the corresponding form of attention. The participant's verbal behavior was recorded during these sessions. Observers recorded participants' mands for different forms of attention and other vocal statements. The topographies of attention associated with the highest number of mands were considered for inclusion in the stimulus array.

Selection Process for Inclusion of Topographies of Attention. We included seven topographies of attention in the stimulus array for both assessment methods. For all participants, we included tickles, head rubs, and praise because authors have used these forms of attention previously during assessments of social consequences (e.g., Smaby et al., 2007). We used the results of the pre-assessments to identify the other four topographies of attention for use in the stimulus array. If a participant did not emit a mand for attention during the mand assessment, then we used the two topographies that were associated with the highest rank on the questionnaire and the two topographies associated with the highest frequency during the descriptive assessment. If a participant emitted independent mands for attention during the mand assessment, we included the most frequently manded form of attention. For the three remaining topographies, we used the topography ranked highest on the questionnaire, the topography observed most often in the descriptive assessment, and the topography indicated across all three components (i.e., questionnaire, descriptive assessment, and mand assessment).

We used a number of decision rules to ensure a consistent method of attention topography selection across participants: (a) we included two of the top three topographies from the questionnaire and descriptive assessment, and (b) if the same topographies of attention were identified by both the questionnaire and descriptive assessment, topographies that received the next highest rank or those that were observed at the next highest frequency were selected. We did not include topographies of attention that could not be restricted outside of sessions (e.g., protective procedures for participants' severe problem behavior). In addition to the seven topographies of attention, we also included a white card (associated with no consequence) as a control.

Experimental Design

During the pictorial paired-stimulus preference assessment and the single-stimulus reinforcer assessment, we included the same set of seven stimuli each associated with a different social consequence and a control stimulus (a blank white index card) associated with no programmed consequences. We conducted the two assessment formats concurrently and conducted the single-stimulus reinforcer assessment sessions in a quasi-random sequence. For example, for the first session, the therapist conducted trials 1-to-14 of the paired-stimulus assessment and two 1-min sessions of the single-stimulus assessment for two topographies of attention. For the second session, the therapist conducted trials 15-to-29 of the paired-stimulus assessment and then two 1-min sessions of the single-stimulus assessment for two additional topographies of attention. One paired-stimulus assessment and one single-stimulus reinforcer assessment were completed within four sessions. To evaluate test-retest reliability within assessment formats, each assessment format was conducted a minimum of three times. During each session, we always conducted paired-stimulus assessment sessions before single-stimulus assessment sessions to prevent potential abolishing operation effects due to the length of the session durations of the single-stimulus assessment.

To calculate test-retest reliability within assessment formats, we generated rank order correlation coefficients and used a critical *r* value of 0.6 (Cicchetti & Sparrow, 1981) as a criterion for good test-retest reliability. This critical *r* value was based on a review of previous research (Hanley et al., 2006; Layer et al., 2008) and relevant sources (Cicchetti & Sparrow, 1981; Salkind, 2001). Topographies of attention were assigned ranks based on percentage of selection (paired-stimulus assessment format) or responses per minute (RPM) (single-stimulus assessment format). More specifically, topographies with the highest percentage of selection or

RPM would be assigned a rank of 1 and those with the lowest percentage of selection or RPM would be assigned an 8.

Correlations were generated by comparing the ranks from the first paired-stimulus (PS1) with the second (PS 2), and then the second (PS 2) to the third (PS 3). Similarly, the first single-stimulus assessment (SS1) was compared to the second single-stimulus assessments (SS2) and then the second (SS 2) was compared to the third (SS 3). After consecutive assessments of the PS and SS assessments were conducted, if either assessment format met the test-retest reliability criteria (i.e., two consecutive correlation coefficients greater than 0.6) and there was no increasing trend in correlation coefficients on the other assessment format, no further assessments were conducted and a reinforcer assessment of mands was initiated.

Pictorial Paired-Stimulus Preference Assessment

We used procedures similar to those described by Fisher et al. (1992). Prior to the start of the assessment, digital photos (10.1 cm by 15.2cm) were created that corresponded with attention topographies included in the array. Each photo depicted the therapist delivering a single topography of attention to the participant (e.g., the therapist giving the participant a hug). Prior to the start of the session, the therapist conducted forced-exposure trials with each of the photos by prompting (using least-to-most prompting) the participant to touch each photo and delivering 2-5 s of the topography of attention depicted in the photo. The eight digital photos were presented in pairs counterbalanced across trials. Photos were placed approximately 0.3 m apart and approximately 0.3 m in front of the participant. Contingent on photo selections, the therapist removed the nonselected photo and delivered the corresponding topography of attention for 2-5 s. The therapist blocked participant attempts to approach both photos simultaneously. If the participant did not select a picture within 5 s, the therapist represented the pictures. If the participant did not select either photo within 5 s, the therapist removed both photos and initiated the next trial. The therapist smiled when delivering each form of attention to approximate how attention is typically delivered in educational or clinical settings. Because certain forms of attention were associated with longer delays or durations (e.g., the therapist had to walk around the participant when delivering back pats but not when delivering praise), we attempted to control for these differences by having the therapist consistently deliver all topographies of attention for a duration of 2-to-5 s following a 2-s delay from photos selections.

Single-Stimulus Reinforcer Assessment

During this assessment, we evaluated each topography of attention singly during 1-min sessions. The same photos used during the paired-stimulus format were also used during this assessment format. The dependent variable measured during this assessment was target touching, defined as moving one or more fingers from one target on one side of the board to the target on the opposing side without interruption. Prior to the start of the session, the therapist conducted two forced exposure trials. During each trial, the therapist prompted (using least-to-most prompting) the participant to emit the target response (i.e., target touching) and then delivered the consequence depicted in the photo. Immediately prior to the session, the therapist placed a 0.2 by 0.4 m board with two targets (approximately .05 m colored squares) on either side of the board in front of the participant and a photo (depicting the therapist delivering a topography of attention to the participant) above the target touching board. At the start of the session, the therapist stated the topography of attention depicted in the photo. During each session, the therapist delivered the topography of attention depicted in the photo for 2-5 s contingent on each target touching response. As in the paired-stimulus format, the therapist smiled when delivering topographies of attention and delivered all attention topographies for equal durations (i.e., 2-5 seconds) and following equal delays (i.e., 2 s) after an occurrence of target touching.

Reinforcer Assessment

After reliability criteria were met for either assessment format (i.e., two consecutive correlation coefficients greater than 0.6 and no ascending trend in correlation coefficients for the other assessment format), we initiated a reinforcer assessment to assess the predictive validity of high- and low-preference stimuli. For the paired-stimulus method, the high-preference (HP) stimulus was the form of attention associated with the highest percentage of selection across the last two assessments and the low-preference (LP) stimulus was the stimulus associated with the lowest percentages of selection across the last two assessments not including the control stimulus. For the single-stimulus method, the high-preference (HP) stimulus was the form of attention associated with the highest rate of responding across the last two assessments and the low-preference (LP) stimulus was the stimulus associated with the lowest rates of responding across the last two assessments not including the control stimulus. We assessed the reinforcing effects of HP and LP forms of attention using a reversal design or a concurrent-operant arrangement with a control condition. Sessions were 5-min, observers measured mands that were defined individually based on the participant's communication repertoire. For example, mands were defined as a framed mand (e.g., "I want head rubs please") for some of the participants or as a statement of the topography of attention followed by the word "please" (e.g., "Head rubs please") for other participants.

Reversal design. Prior to starting sessions, the therapist conducted two forced exposure trials to expose the participant to the contingency in effect. For baseline pre-session exposure trials, the therapist presented the control stimulus (CS) in the form of a white card (216 by 279 mm) and issued a full vocal model prompt for the required mand form to be evaluated in the subsequent reinforcement condition (e.g., “I want back pats please”). After the participant stated the mand, the therapist delivered no consequence. For pre-session exposure in the reinforcement condition, the therapist presented the HP or LP stimulus (216 by 279 mm photo depicting the topography for attention) appropriate for the following condition and issued a full vocal model prompt for the participant to emit the appropriate mand form for the topography of attention depicted in the photo. After the participant stated the mand, the therapist delivered the designated form of attention. During baseline conditions, no consequence was provided contingent on mands for different forms of attention. During the reinforcement condition, the participant received 2-5 s of specified attention contingent on a mand.

Concurrent-Operant Reinforcer Assessment. This assessment was similar to that described by Cote et al. (2007) and consisted of two phases, baseline and reinforcement. During baseline, the therapist placed three cards (blank white index cards as used previously) approximately 0.2 m apart in front of the participant and issued a full vocal model prompt for the HP, LP, and CS stimuli, two times each. For example, if the HP stimulus was head rubs and the LP stimulus was tickles, the therapist prompted the participant to say, “I want head rubs please,” “I want tickles please,” and “I want nothing please” for the HP, LP, and CS stimulus, respectively. At the start of the session, the therapist stated, “You can ask for head rubs, tickles, or nothing as much as you want to.” During baseline, the therapist delivered no programmed consequences for mands. During the reinforcement condition, the therapist placed the HP and LP photos and the control card on the table in front of the participant. The therapist issued the same pre-session exposure trials. After the participant emitted the prompted mand, the therapist delivered 2-5 s of the corresponding topography of attention and rotated the position of the stimuli across sessions. To ensure that the sequence of prompts presented during the pre-session forced exposure trials did not bias responding, the therapists issued full vocal prompts that corresponded with the position placement of the stimuli, from the participant's left to right.

Results

Pre-Assessments

The topographies of attention included in the stimulus array and how they were informed by the pre-assessments are summarized in Table 1, and definitions of each topography of attention included in the stimulus array are listed in Table 2. Additionally, individual DA data is depicted in Figure 1.

Roy. The top three ranked topographies from the questionnaire for Roy were singing, facial expressions, and hugs. Singing and hugs were selected for inclusion based on the results of the questionnaire. The topographies of attention that were observed most often during DA sessions not including topographies already in the stimulus array (i.e., head rubs, tickles, praise, hugs), those that could not be restricted for use as reinforcers (i.e., hand holding, physical redirection, contingency reviews) or involved tangible items (i.e., ball presses) were back pats and high fives. Roy did not independently mand for any forms of attention during the mand assessment. The eight stimuli included in Roy's stimulus array were singing and hugs (from the questionnaire), back pats and high fives (from the descriptive assessment), and head rubs, tickles, praise in addition to the control stimulus.

Arron. The topographies included based on the questionnaire were clapping and smiles ranked fifth and eighth respectively. The topographies ranked higher than clapping and smiles were either already included in the stimulus array or could not be restricted for use as reinforcers. The topographies of attention that were observed most often during DA sessions not including topographies already in the stimulus array (i.e., tickles and praise) and those that could not be restricted for use as reinforcers (i.e., physical redirection, conversation, contingency reviews) were back pats and high fives. Arron did not independently mand for any forms of attention during the mand assessment. The eight stimuli included in Arron's stimulus array were clapping and smiles (from the questionnaire), high fives and back pats (from the descriptive assessment), and head rubs, tickles, praise in addition to the control stimulus.

Dee. Three respondents filled out the questionnaire for Dee and the topography of attention that received the highest mean rank was facial expressions, and this topography was selected for inclusion. The topography of attention observed most often during DA sessions not including topographies already in the stimulus array (i.e., tickles, praise) or that involved tangible items (i.e., attention to object) was nose beeps. During the mand assessments, Dee requested cheek pops most often so this topography was included in the stimulus array. Conversation was selected as the remaining topography because it was observed during the DA sessions, received a high rank on the questionnaire, and Dee emitted a mand for a conversation topic during the mand assessment. The eight stimuli included in Dee's stimulus array were facial expressions (from the questionnaire), nose beeps (from the descriptive assessment), cheek pops (from the mand assessment), conversation (from all three pre-assessments) and head rubs, tickles, praise in addition to the control stimulus.

Mace. Three respondents filled out the questionnaire for Mace and back pats and hugs received a mean rank of second and sixth respectively and were selected for inclusion. The topographies ranked higher than these two topographies were already included in the stimulus array. The topographies of attention that were observed most often during DA sessions not including topographies already in the stimulus array (i.e., tickles, head rubs, and praise) and those that could not be restricted for use as reinforcers (i.e., statements of concern) were hand holding and high fives. Mace did not independently mand for any forms of attention during the mand assessment. The eight stimuli included in Mace's stimulus array were back pats and hugs (from the questionnaire), hand holding and high fives (from the descriptive assessment), and head rubs, tickles, praise in addition to the control stimulus.

Evaluation of Assessment Methods

Roy. Results of Roy's paired-stimulus and single-stimulus assessments are depicted in the top panel of Figure 2. During the paired-stimulus assessments, Roy selected back pats most often (*M* = 96%) and selected the control stimulus and hugs least often (*M* = 1% and 27%, respectively). During the single stimulus assessment, Roy exhibited target touching during all conditions, with slightly lower levels during the control condition relative to social consequence conditions. Results of the test-retest reliability analysis for each of the assessment methods are depicted in the bottom panel of Figure 2. The paired-stimulus assessment often yielded rank-order correlation coefficient values that exceed 0.6 and met the test-retest reliability criteria (i.e., two consecutive correlation coefficients greater than 0.6 and no increasing trend in correlation coefficients on the other assessment format) after six assessments. The single-stimulus reinforcer assessment often yielded correlation coefficient values below 0.6 and did not meet the test-retest criteria after seven assessments. Because only the paired-stimulus assessment method yielded reliable outcomes, we selected the HP topography (back pats) and the LP topography (hugs) from this assessment format for evaluation in the subsequent reinforcer assessment.

Results of the reinforcer assessment using the HP topography (back pats) are depicted in the top panel of Figure 3. During baseline conditions, Roy did not emit mands, and during reinforcement conditions, Roy emitted a high rate of mands (*M* = 6.4 and 7.8 RPM in the first and second reinforcement condition, respectively). Results of 1- and 3-month follow-up probes showed that Roy continued to emit mands for back pats. Results of the reinforcer assessment using the LP topography (hugs) are depicted in the bottom panel of Figure 3. During baseline conditions, Roy emitted very low levels of mands, and during reinforcement conditions, Roy emitted high rates of mands for hugs (*M* = 6.7 and 5.1 RPM in the first and second reinforcement conditions, respectively). Results of 1- and 3-month follow-up probes showed that Roy continued to emit mands for hugs. These results suggest that both the HP and LP attention topographies functioned as reinforcers for Roy's manding.

Arron. Results of the paired-stimulus and single-stimulus assessments are depicted in the top panel of Figure 4. During the paired-stimulus assessment, Arron selected head rubs most often (*M* = 93%) and selected the control stimulus and smiles least often (*M* = 2.3% and 16.3%, respectively). During the single stimulus assessment, Arron exhibited target touching during all sessions and no reliable pattern was observed. Results of the test-retest reliability analysis for each of the assessment methods are depicted in the bottom panel of Figure 4. The paired-stimulus assessment yielded rank-order correlation coefficient values that exceeded 0.6 and met the test-retest reliability criteria (i.e., two consecutive correlation coefficients greater than 0.6 and no increasing trend in correlation coefficients on the other assessment format) after three assessments. The single-stimulus reinforcer assessment yielded correlation coefficient values below 0.6 and did not meet the test-retest criterion after three assessments. Because only the paired-stimulus assessment method yielded reliable outcomes, we selected the HP topography (head rubs) and the LP topography (smiles) from this assessment format for evaluation in the subsequent reinforcer assessment.

Results of the concurrent-operant reinforcer assessment for Arron are depicted in Figure 5. During the no-reinforcement baseline, Arron exhibited very low levels of mands. During the first reinforcement phase, Arron emitted high levels of mands (*M* = 8 RPM) for the HP topography (head rubs) and low levels of mands (*M* = 0.8 RPM) for the LP topography (smiles) and the control stimulus. During the second reinforcement phase, when only the LP stimulus and control stimulus conditions were included, Arron emitted low-to-moderate levels of mands (*M* = 2.2 RPM) for smiles. During one- and three-month follow-up sessions, the rate of manding decreased from that observed previously. These results suggest that both the HP and LP attention topographies functioned as reinforcers for manding. However, the HP attention topography was a more potent reinforcer that the LP stimulus.

Dee. Results of the paired-stimulus and single-stimulus assessments are depicted in the top panels of Figure 6. During the paired-stimulus assessment, Dee selected cheek pops most often (*M* = 87.8%) and the control stimulus and tickles least often (*M* = 8.8% and 41.3%, respectively). During the single stimulus assessment, Dee exhibited target touching during the majority of sessions and no reliable pattern was observed. Results of the test-retest reliability analysis for each of the assessment methods are depicted in the bottom panel of Figure 6. The paired-stimulus assessment yielded rank-order correlation coefficient values that exceeded 0.6 and met the test-retest reliability criteria after four assessments. The single-stimulus reinforcer assessment yielded correlation coefficients below 0.6 and did not meet the test-retest criterion after four assessments. Because only the paired-stimulus assessment method yielded reliable outcomes, we selected the HP topography (cheek pops) and the LP topography (tickles) from this assessment format for evaluation in the subsequent reinforcer assessment.

Results of the concurrent-operant reinforcer assessment for Dee are depicted in Figure 7. During the no reinforcement baseline, Dee did not emit any mands. During the first reinforcement phase, Dee emitted a high level of mands (*M* = 1.9 RPM) for the HP topography (cheek pops) and a lower level of mands (*M* = 0.6 RPM) for the LP topography (tickles). During the second reinforcement phase, when only the LP stimulus and control stimulus conditions were included, Dee emitted high levels of mands (M = 2.7 RPM) for tickles. During a one-month follow-up session, Dee emitted a high level of mands (5.6 RPM) for cheek pops. These results suggest that both the HP and LP forms of attention functioned as reinforcers for manding but that the HP form was a more potent reinforcer when the two forms of attention were concurrently available.

Mace. Results of the paired-stimulus and single stimulus assessment comparisons are depicted in the top panel of Figure 8. During the paired-stimulus assessment Mace selected tickles most often (*M* = 77%) and selected the control stimulus and praise least often (*M* = 2% and 40%, respectively). During the single-stimulus assessment, Mace emitted higher levels of responding in the presence of the white index card (associated with no social consequences) relative to social consequence sessions suggesting that social consequences might be potential punishers. Results of the test-retest reliability analysis for each of the assessment methods are depicted in the bottom panel of Figure 8. The single-stimulus reinforcer assessment yielded correlation coefficient values that exceeded 0.6 and met the test-retest reliability criteria after four assessments. The evaluation was continued after this criterion was met for a number of reasons. We hypothesized that the target response (i.e., target touching) was automatically reinforcing for Mace as he consistently engaged in target touching across sessions when the control stimulus was present and no social consequences were provided. Additionally, the delivery of attention may have momentarily competed with the target response during social consequence sessions. We also hypothesized that the single-stimulus assessment met our test-retest reliability criteria because the control stimulus consistently received a rank of 1 across assessments. This hypothesis was confirmed when we generated correlation coefficients using only the social consequence sessions (depicted by the open circles), and these assessment comparisons yielded correlation coefficient values below 0.6. Important to note, the participant never selected the white index card during the paired-stimulus assessment across the last five assessments. Given these discrepant findings, we felt it was important to continue the investigation until the paired-stimulus assessment was reliable and assess the relative predictive validity of topographies from both assessment formats. The paired-stimulus assessment yielded rank-order correlation coefficient values that exceeded 0.6 and met the test-retest reliability criteria after seven assessments. Based on the result of the last two assessments of the paired-stimulus assessment, we selected the HP topography (tickles) and the LP topography (praise) for evaluation in a subsequent reinforcer assessment. Additionally, the HP topography (control stimulus associated with no consequences) from the single-stimulus reinforcer assessment was included.

Discussion

The results of this study showed that for the three participants with completed data sets, the paired-stimulus assessment was a reliable method with good predictive validity. For these three participants, the paired-stimulus method yielded consistent results across replications and the HP topographies and LP topographies functioned as effective reinforcers for a socially significant response (i.e., mands). Furthermore, for some individuals (e.g., Arron), HP topographies were more effective reinforcers than were LP topographies.

This study contributes to the existing literature in number of ways. First, we describe a systematic method for identifying topographies of attention to include in a stimulus array. Our purpose in using multiple components (i.e., questionnaire, descriptive assessment, and mand assessment) was not to compare components but rather to extract useful information from each component and provide clinicians with potentially valuable methods for identifying stimuli for inclusion in the array. The relevant contributions of each component were examined across participants. For Roy, the HP topography (i.e., back pats) was only identified from the DA assessment. Interestingly, the respondent who answered the questionnaire reported that Roy never came into contact with this form of attention across his day. For Arron, the HP topography (i.e., head rubs) was only identified from the questionnaire (ranked as the second most preferred form of attention). For Dee, the HP topography (i.e., cheek pops) was identified from the DA, the questionnaire, and the mand assessment. For Mace, the HP topography was identified from the DA and questionnaire. These data provide preliminary information to suggest that other methods than indirect interviews including observing the participant across daily activities or conducting a mand assessment with the putative motivating operation in place might prove valuable for clinicians. Although the DA sessions used to inform the stimulus array for our participants were lengthy (i.e., total of 60 min of observation), perhaps valuable information could be obtained by much shorter time samples (e.g., 5 min) across different teachers.

Second, we evaluated the reliability of two assessment methods (a pictorial paired-stimulus preference assessment and a single-stimulus reinforcer assessment) for identifying solely social reinforcers. No studies to the authors' knowledge have evaluated the reliability of an assessment for identifying social reinforcers. For all three participants, the paired-stimulus assessment method yielded consistent results across replications. We viewed reliability as a necessary prerequisite toassessment validity. That is, desired and durable treatment effects would likely only be obtained if the social reinforcer selected for inclusion in treatment packages had been identified via a reliable assessment format. Although all of the participants rarely selected the control stimulus in the paired-stimulus assessment, the majority of participants responded during the control condition of the single-stimulus assessment. One possible explanation for why participants responded during the control condition is that the target-touching task used for the single-stimulus assessment may have been automatically reinforcing and future research evaluating this assessment method could consider using a different task with a higher response effort. Alternatively, it might have been that the sessions of the single-stimulus were so short in duration (i.e., 1 min) that an extinction effect was not observed. However, because this assessment was conducted multiple times and included pre-exposure to the contingencies in effect, this explanation is less plausible.

Third, we assessed the relative predictive validity of the reliable assessment format using a socially relevant response (i.e., mands). We chose this target response for a number of reasons. First, we had spent a number of weeks asking the participants in this study what their most preferred forms of attention were and it seemed necessary to leave them with a communicative response at strength so that they could recruit such forms of attention. Additionally, experimenters who have conducted FCT research (e.g., Durrand, 1999; Durrand & Carr, 1992; Hanley et al., 2001; Hanley, Piazza, Fisher, Contrucci et al., 1997) noted that communicative responses can be effective in the presence of unfamiliar individuals, across a wide array of environments, they can recruit natural communities of reinforcement, they are under the control of the individual, and they may enhance maintenance and generalization. Additionally, communicative responses used to recruit attention have been suggested as a life skill (Hanley, Heal, Tiger, & Ingvarsson, 2007) that can potentially decrease the probability of children using other inappropriate forms of behavior to recruit attention.

Results of the reinforcer assessment showed that social stimuli can serve as effective reinforcers for children with an ASD and that reinforcement effects may vary based on participants' preference for different forms of attention. Because we used a reversal design for Roy's reinforcer assessment, we determined only absolute reinforcement effects and found that both the HP and LP stimuli were effective reinforcers. For Arron, results showed that the HP topography (i.e., head rubs) was a more effective reinforcer relative to the LP topography (i.e., smiles). Results for Dee showed that when both the HP and LP stimuli were concurrently available contingent on mands, she exhibited differentially higher rates of mands for the HP topography (cheek pops) than for the LP topography (i.e., tickles), suggesting that the HP topography (i.e., cheek pops) was a more effective reinforcer. When just the LP topography was evaluated with the control, Dee responded at rates similar to those observed with cheek pops. Dee's results are similar to those obtained in previous research evaluating relative versus absolute reinforcement effects with nonsocial reinforcers (Roscoe et al., 1999). In summary, results of the final reinforcement phase (LP and CS) in the concurrent-operant arrangement reinforcer assessment showed that for one participant (Arron), the LP topography was not as effective as a reinforcer as the HP topography and for another participant (Dee), the evaluation showed that the LP was as effective if no other forms of attention were concurrently available. Additionally, maintenance of the communicative responses was evaluated during one and three month follow-up sessions for participants and provides preliminary evidence that maintenance effects can be observed with the use of social reinforcers.

An important note that is not easily illustrated in the data for these participants is just how different and idiosyncratic forms of attention were across participants. For example, what constituted tickles for one participant was not the same for any other participants (i.e., one participant liked tickles on the upper arm, the other at the forearm, another preferred tickles to a number of areas and would model the location to the therapist after selecting the picture of tickles or completing a target touch). The descriptive assessment and at times the participants themselves (through gestures or models) provided important information regarding these idiosyncratic differences.

Although this study describes a reliable assessment for identifying social reinforcers, further research is warranted in this area. Specifically, we need to replicate reinforcer assessments to evaluate the functional properties of social stimuli for appropriate and inappropriate behavior. Empirical evaluations that systematically assess variables (e.g., proximity, facial expressions, and tone of voice) that affect the reinforcing efficacy of social stimuli, similar to those conducted by Van Houten, Nau, MacKenzie-Keating, Sameoto, and Colavecchia, (1982) would prove valuable in the selection of social stimuli in the treatment of both behavioral deficits and excesses. Experimenters could also evaluate the effects of empirically identifying social reinforcers for use in teaching early critical skills such as joint attention to determine whether inclusion of effective social reinforcers promotes acquisition. Future investigations utilizing empirically derived social reinforcers to address behavioral deficits and excesses would provide valuable information in the field of applied behavior analysis, while further validating a technology for identifying individual’s preference for and the reinforcing efficacy of social stimuli.

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Appendix

Social Stimuli Questionnaire

Date_______ Participant_____________Person filling out the form______________

TOPOGRAPHY	**Does the participant come into contact with the topography of attention in the natural environment?** **1=Never** **2=Sometimes** **3=Always**	**Is this a preferred form of attention for the participant?**
PHYSICAL WITH CONTACT		
Hugs	1 2 3	Yes or No
Tickles	1 2 3	Yes or No
Head rubs	1 2 3	Yes or No
High fives	1 2 3	Yes or No
Back pats	1 2 3	Yes or No
Hand holding	1 2 3	Yes or No
Blocking	1 2 3	Yes or No
Hands down	1 2 3	Yes or No
Physical redirection	1 2 3	Yes or No
Physical restraint	1 2 3	Yes or No
PHYSICAL WITH NO CONTACT		
Clapping	1 2 3	Yes or No
Eye contact	1 2 3	Yes or No
Facial expressions: Please list:	1 2 3	Yes or No
VERBAL		
Reprimands	1 2 3	Yes or No
Statements of concern	1 2 3	Yes or No
Warnings	1 2 3	Yes or No
Unrelated comments	1 2 3	Yes or No
Conversation about a preferred topic	1 2 3	Yes or No
Contingency review	1 2 3	Yes or No
Verbal praise	1 2 3	Yes or No
Additional Forms-please list any other forms of attention not listed above	1 2 3	Yes or No
	1 2 3	Yes or No
	1 2 3	Yes or No
	1 2 3	Yes or No

If you indicated that certain forms of attention were preferred by circling yes, please rank order the forms you circled yes for below (1=most preferred and 8=least preferred):

1	
2	
3	
4	
5	
6	
7	
8	

Table 1

Topographies of Attention Included in the Stimulus Array and How They Were Informed From the Pre-Assessment

	Participants			
	Roy	Arron	Dee	Mace
1	Singing (SSQ)	Clapping(SSQ)	Facial Expressions (SSQ)	Back Pats (SSQ)
2	Hugs (SSQ)	Smiles (SSQ)	Nose Beeps (DA)	Hugs (SSQ)
3	Back Pats (DA)	High Fives (DA)	Cheek Pops (MA)	Hand holding (DA)
4	High Fives (DA)	Back Pats (DA)	Conversation (SSQ, DA, MA)	High Fives (DA)
5	Head Rubs (PR)	Head Rubs (PR)	Head Rubs (PR)	Head Rubs (PR)
6	Tickles (PR)	Tickles (PR)	Tickles (PR)	Tickles (PR)
7	Praise (PR)	Praise (PR)	Praise (PR)	Praise (PR)
8	Control	Control	Control	Control

Note. SSQ = Social Stimuli Questionnaire. DA = Descriptive Assessment. MA = Mand Assessment. PR = Previous Research.

Table 2

Operational Definitions of the Topographies of Attention Included in the Stimulus Array

	Participants			
	Roy	Arron	Dee	Mace
1	High Fives: T. raises both hands and makes contact with the participants palms repetitively so that each contact makes a clapping sound while making eye contact and smiling at the participant	High Fives: T. raises both hands and makes contact with the participants palms and clasps participant's fingers moving hands back and forth while making eye contact and smiling at the participant	Cheek Pops: T. blows air into one cheek making it puff out while making a flicking motion with pointer finger and thumb popping the cheek while moving head away from fingers	High Fives: T. raises both hands and makes contact with the participants palms repetitively so that each contact makes a clapping sound while making eye contact and smiling at the participant
2	Hugs: T. walks around the participant while smiling and making eye contact and from to the side and slightly behind wraps both arms around the participant squeezing gently	Clapping: T. claps hands while making eye contact and smiling at the participants	Nose Beeps: T. moves finger in circular motion while approaching the students nose and then touches the students nose while stating the name of an edible item (e.g., fruit snacks, cottage cheese)	Hugs: T. walks around the participant while smiling and making eye contact and from to the side and slightly behind wraps both arms around the participant squeezing gently
3	Back Pats: T. walks around the participant while smiling and making eye contact and from to the side and slightly behind repetitively patted Roy on the back with open palms	Back Pats: T. walks around the participant while smiling and making eye contact and from to the side and slightly behind repetitively patted Arron on the back with open palms	Conversation: T. engages in one exchange about one of three topic areas (i.e., gym, lunch, surprises) while smiling and making eye contact with the participant.	Back Pats: T. walked around the participant while smiling and making eye contact and from to the side and slightly behind repetitively patted Mace on the back with open palms
4	Singing: T. sings two lines of the song "Someone's in the kitchen with Dinah" while moving her head back and forth to the beat and making eye contact and smiling	Smiles: T. smiles at participant while making eye contact	Facial expressions: T. acts as if they are crying by making sniffling sounds, pouting their lips and squinting. T. move their hand across their face, shifting their facial expression to smiling as their hand crosses their face	Hand Holding: T. holds one of the participant's hands with fingers intertwined and places their other hand on top of the hands that are clasped while smiling and making eye contact
5	Tickles: T. places two hands above the participants hands and moves fingers back and forth in a repetitive motion making contact with nails while smiling and making eye contact	Tickles: T. places two hands above the participants wrists and moves fingers back and forth in a repetitive motion up and down the forearm while smiling and making eye contact	Tickles: T. places two hands at the participants upper arm and moved fingers back and forth in a repetitive motion in one spot while smiling and making eye contact	Tickles: T. moves fingers back and forth in a repetitive motion on either the back of the participant's neck, cheek or stomach while smiling and making eye contact
6	Head Rubs: T. places two hands above the participants head and moves fingers back and forth in a repetitive motion on top of the head while smiling and making eye contact	Head Rubs: T. places two hands above the participants head and moves fingers back and forth in a repetitive motion on top of the head while smiling and making eye contact	Head Rubs: T. places two hands above the participants head and moves fingers back and forth in a repetitive motion on top of the head while smiling and making eye contact	Head Rubs: T. places two hands above the participants head and moves fingers back and forth in a repetitive motion on top of the head while smiling and making eye contact
7	Praise: T. states, "Nice job Roy, you're a superstar!" while making eye contact and smiling after the statement	Praise: T. states, "Nice job Arron, you're a superstar!" while making eye contact and smiling after the statement	Praise: T. states, "Nice job Dee, you're a superstar!" while making eye contact and smiling after the statement	Praise: T. states, "Nice job Mace, you're a superstar!" while making eye contact and smiling after the statement
8	Control: T. provides no consequences and does not provide eye contact or smile	Control: T. provides no consequences and does not provide eye contact or smile	Control: T. provides no consequences and does not provide eye contact or smile	Control: T. provides no consequences and does not provide eye contact or smile

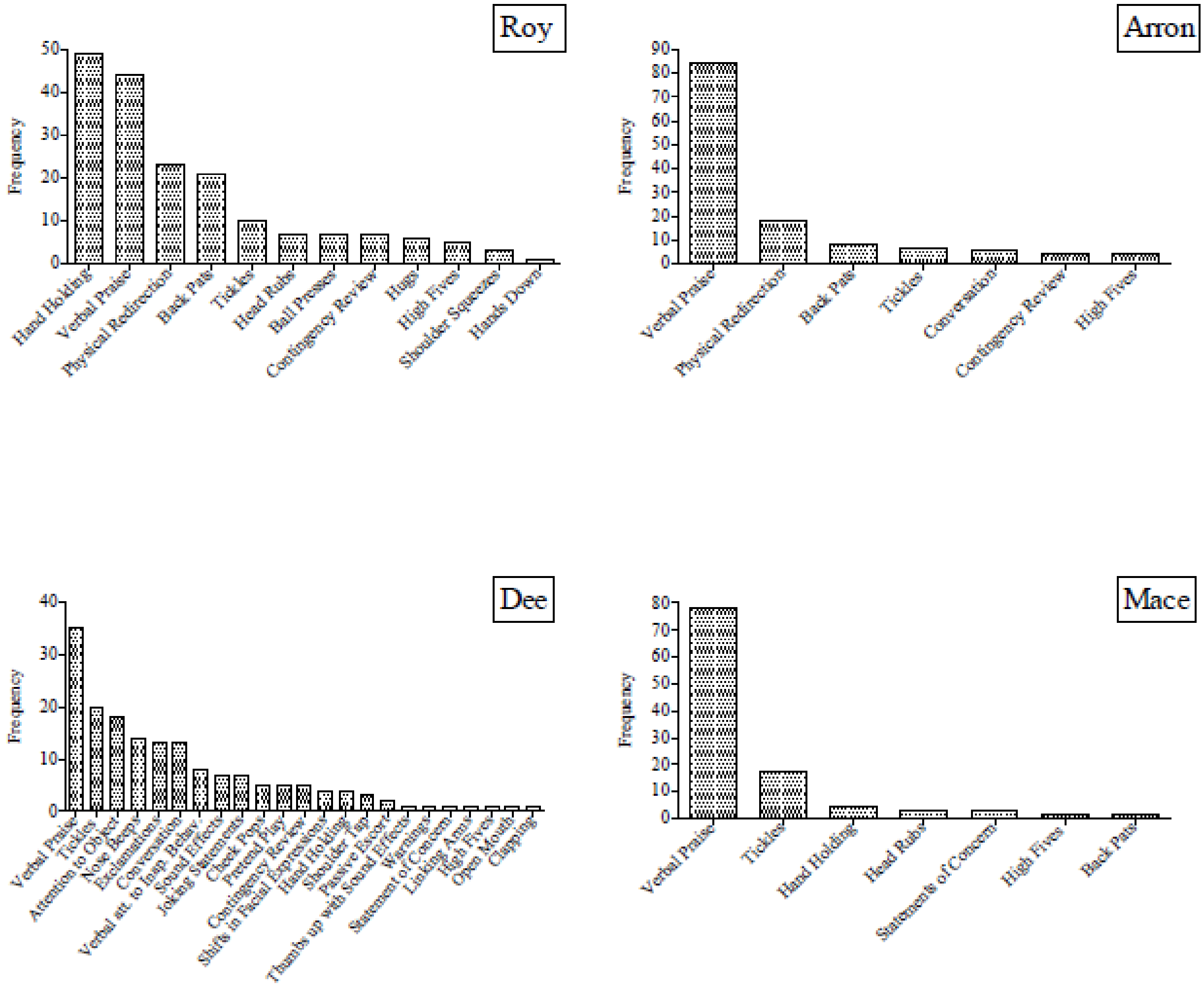

Figure 1. Results of the descriptive assessment component of the pre-assessment.

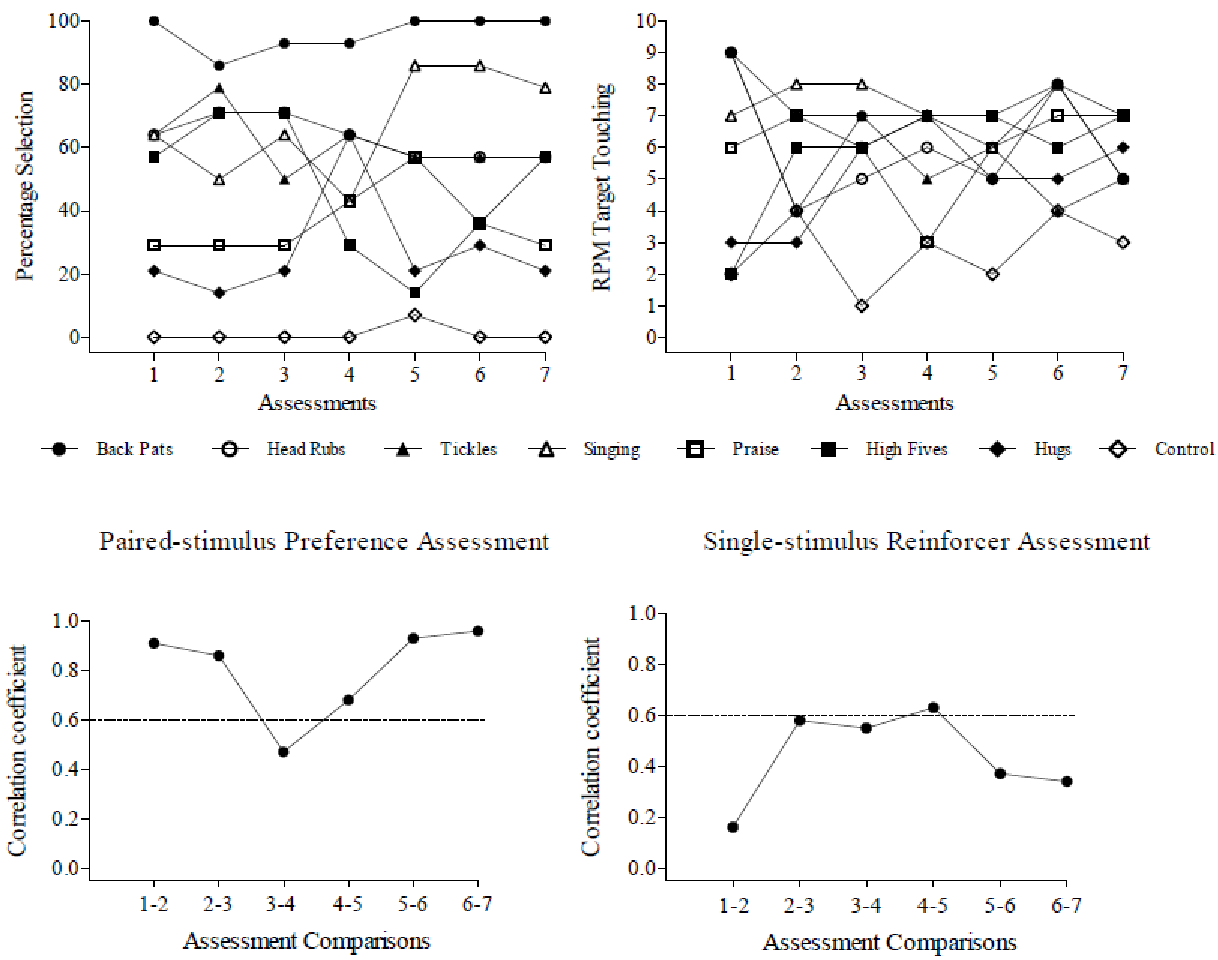

Figure 2. Results of the paired-stimulus preference assessments and single-stimulus reinforcer assessments for Roy are depicted in the top panels. Results of the test-retest reliability evaluation for each assessment format are depicted in the bottom panels.

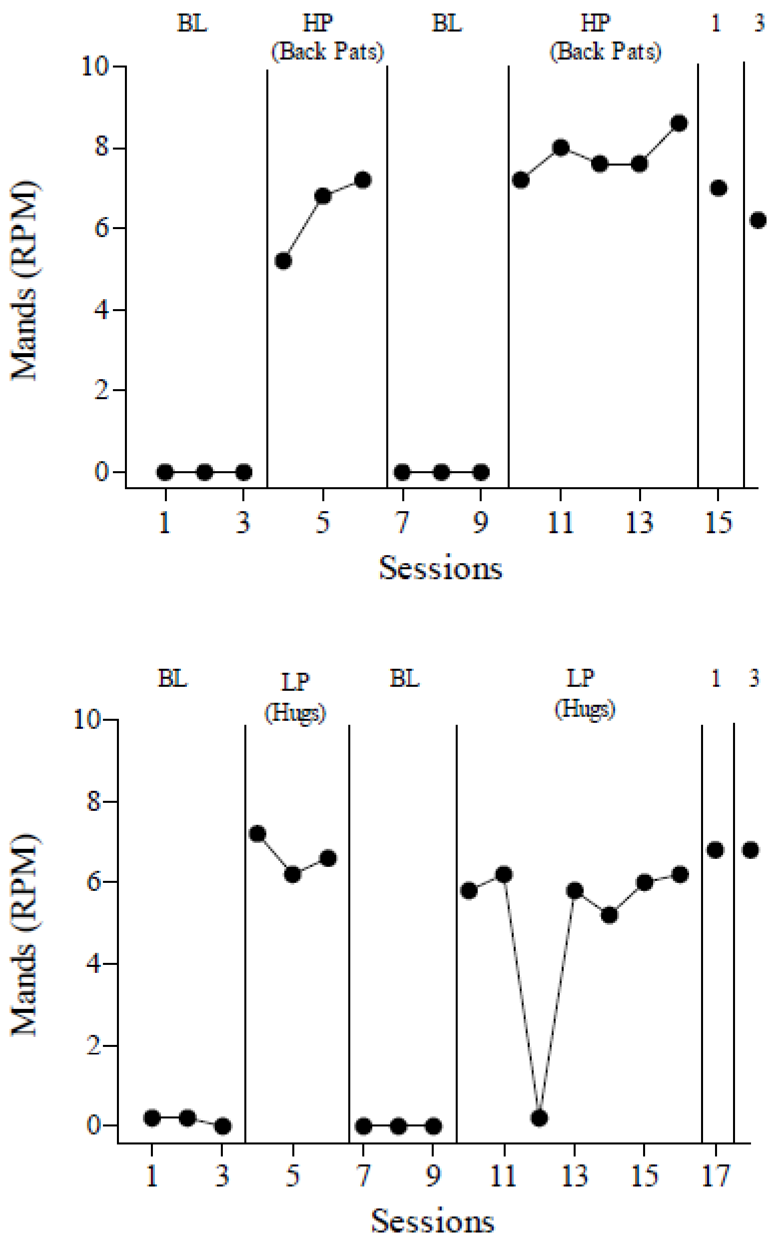

Figure 3. Results of the reinforcer assessment with the HP (back Pats) and LP (hugs) topographies for Roy.

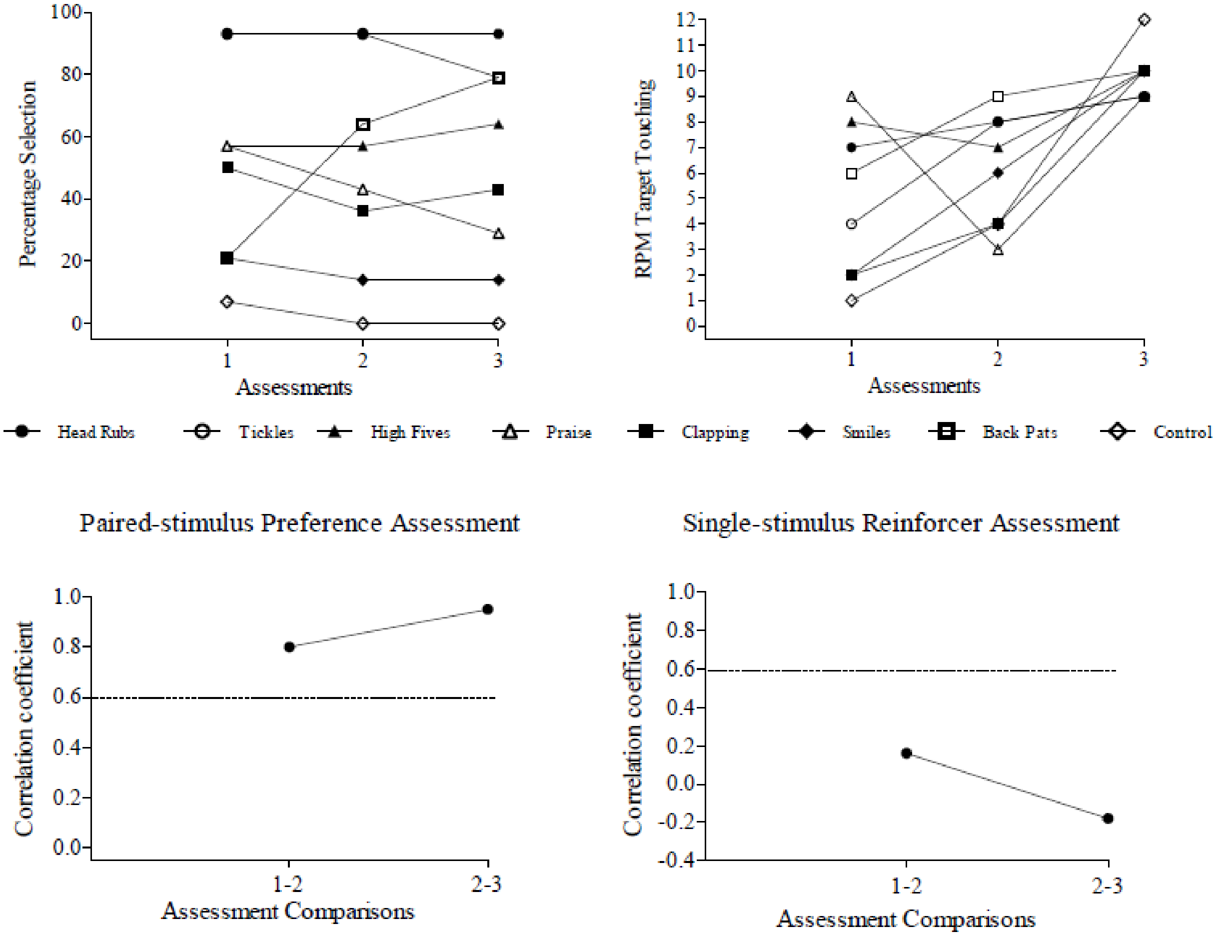

Figure 4. Results of the paired-stimulus preference assessments and single-stimulus reinforcer assessments for Arron are depicted in the top panels. Results of the test-retest reliability evaluation for each assessment format are depicted in the bottom panels.

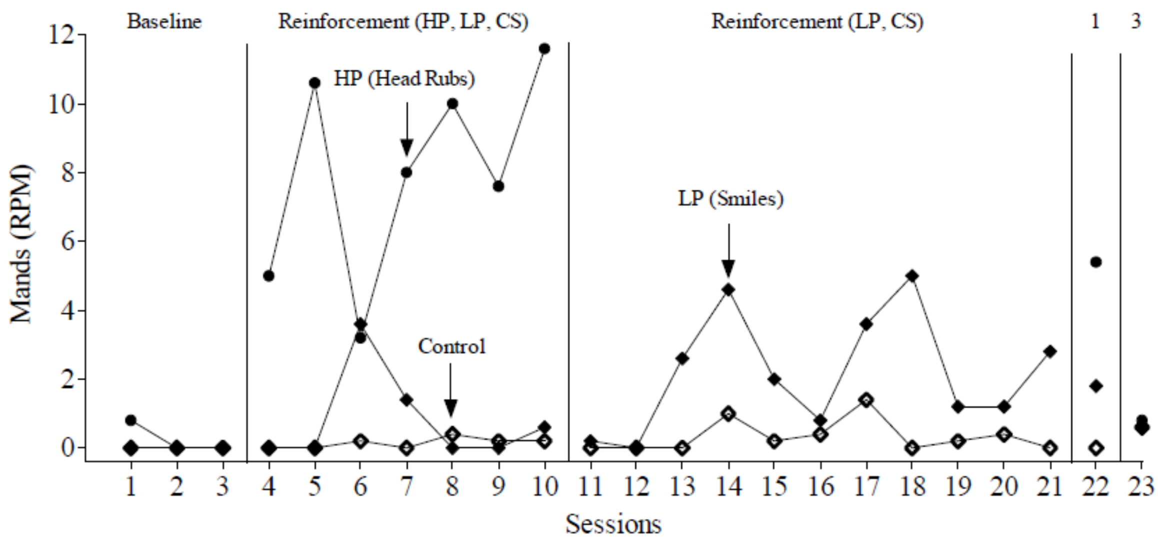

Figure 5. Results of the reinforcer assessment with the HP (head rubs) and LP (smiles) topographies for Arron.

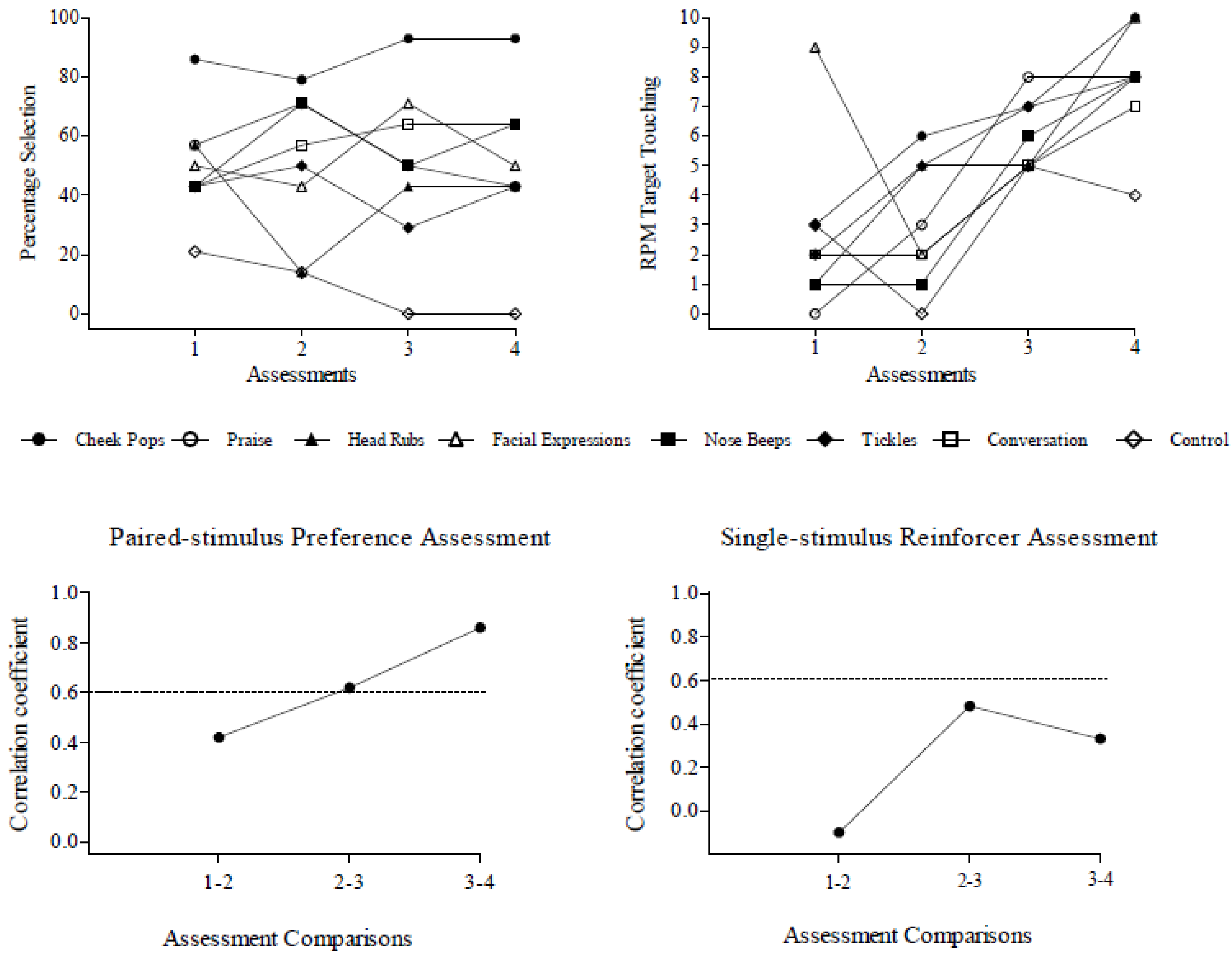

Figure 6. Results of the paired-stimulus preference assessments and single-stimulus reinforcer assessments for Dee are depicted in the top panels. Results of the test-retest reliability evaluation for both assessment formats are depicted in the bottom panels.

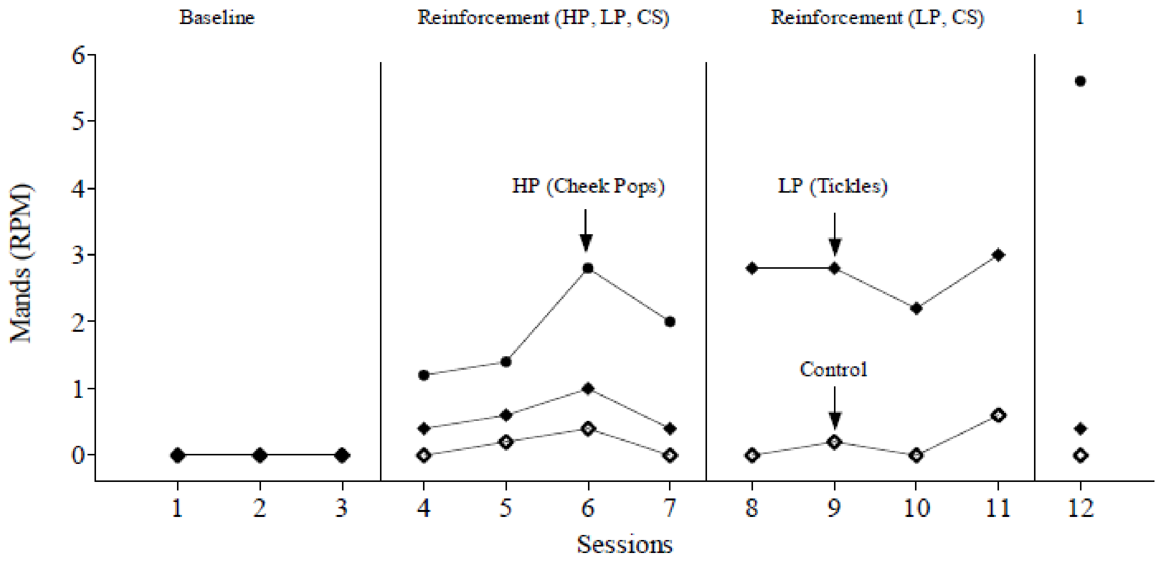

Figure 7. Results of the reinforcer assessment with the HP (cheek pops) and LP (tickles) topographies for Dee.

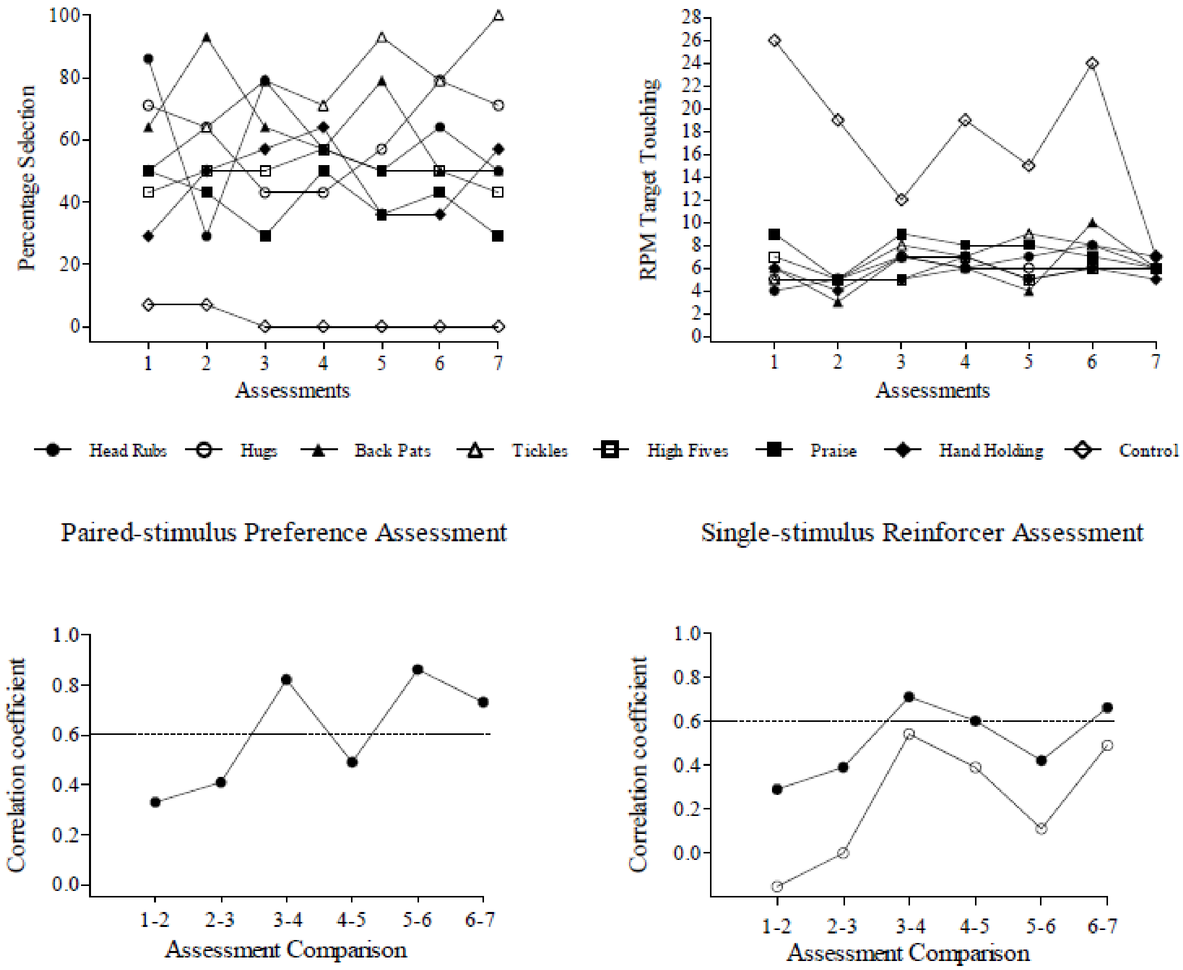

Figure 8. Results of the paired-stimulus preference assessments and single-stimulus reinforcer assessments for Mace are depicted in the top panels. Results of the test-retest reliability evaluation for both assessment formats are depicted in the bottom panels (open circles denote correlation coefficients for assessment comparisons with only the social consequences).