

**A VIDEO-BASED PREFERENCE ASSESSMENT OF SOCIAL STIMULI**

by

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## **Abstract**

Research on social stimuli preference assessments has largely used pictorial depictions of social stimuli (Kelly, Roscoe, Hanley, & Schlichenmeyer, 2014; Lang et al., 2014). However, social stimuli are dynamic and the use of videos may better portray the nuances of social stimuli (Snyder, Higbee, & Dayton, 2012). The purpose of the current study was to evaluate a 3-step process to identify reinforcing social stimuli (i.e., a semi-structured interview, a video-based preference assessment, and a reinforcer assessment). Six children aged 2- to 7-years old participated in the study. Two participants had a diagnosis of Autism Spectrum Disorder, one had a diagnosis of Autism Spectrum Disorder and Attention-Deficit Hyperactivity Disorder, and three were typically developing. The experimenter conducted a video-based, paired-choice preference assessment in which two videos of different social stimuli played simultaneously. The rate of responding for high- and low-preference social stimuli was assessed during baseline and a progressive and/or fixed ratio schedule of reinforcement. Four participant's participation was terminated before full data sets could be collected due to engagement in problem behaviour. Two participants were able to complete full data sets; however, both required modifications to the original method to do so. The results of the study will be discussed in terms of clinical implications and considerations for future research.

## **Lay Summary**

Practitioners and researchers use preference assessments for individuals with autism spectrum disorder to identify hierarchies of preferred stimuli (Cannella, O'Reilly, & Lancioni, 2005). Recently, researchers have assessed the reinforcing capacity of social stimuli (Clay, Samaha, Bloom, Bogoev, & Boyle, 2013; Kelly, Roscoe, Hanley, & Schlichenmeyer, 2014; Smaby, MacDonald, Ahearn, & Dube, 2007). Assessing social stimuli may be particularly useful when the use of edible and/or tangible items is contraindicated or impractical (Clay et al., 2013; Kelly et al., 2014; Rincover & Newsom, 1985).

The current study is an extension of research on systematic preference assessments for social stimuli and video-based preference assessments. To date, no studies have evaluated social stimuli using a video-based preference assessment.

Results of the study have implications for clinicians providing services to individuals with Autism Spectrum Disorders and other developmental disabilities. These include a possible decrease in the use of edible and tangible stimuli for reinforcement.

## **Preface**

The fieldwork conducted in this thesis was approved by The University of British Columbia's (UBC) Research Ethics Board, certificate number H15-02561 and California State University, Fresno Institutional Review Board, Protocol #787. Addison, Isla, and Brody's participation was conducted under UBC's Ethics Board and Amy, Charlie, and Becky's participation was conducted under California State University, Fresno's Institutional Review Board.

The written portion of this thesis is the original work of the author L. Service. The author was lead experimenter for the six children who participated in the study.

## **Table of Contents**

<b>Abstract .....</b>	<b>ii</b>
<b>Lay Summary.....</b>	<b>iii</b>
<b>Preface .....</b>	<b>iv</b>
<b>Table of Contents.....</b>	<b>v</b>
<b>List of Tables.....</b>	<b>viii</b>
<b>List of Figures .....</b>	<b>ix</b>
<b>List of Abbreviations .....</b>	<b>x</b>
<b>Acknowledgements .....</b>	<b>xi</b>
<b>Dedication.....</b>	<b>xii</b>
<b>Chapter 1: Introduction.....</b>	<b>1</b>
<b>1.1 Indirect Assessments for Identifying Potential Reinforcers.....</b>	<b>1</b>
<b>1.2 Preference Assessments for Identifying Potential Reinforcers .....</b>	<b>2</b>
1.2.1 Duration-based preference assessments.....	2
1.2.2 Selection-based preference assessments .....	4
<b>1.3 Reinforcer Assessments for Identifying Reinforcers .....</b>	<b>5</b>
<b>1.4 Rationale for the Current Study .....</b>	<b>7</b>
<b>Chapter 2: Method .....</b>	<b>11</b>
<b>2.1 Participants and Setting.....</b>	<b>11</b>
<b>2.2 Dependent Variables and Data Collection .....</b>	<b>13</b>

<b>2.3</b>	<b>Interobserver Agreement.....</b>	<b>15</b>
<b>2.4</b>	<b>Treatment Integrity.....</b>	<b>15</b>
<b>2.5</b>	<b>Pre-experimental Assessments .....</b>	<b>16</b>
2.5.1	Social interactions rating form.....	16
2.5.2	Video-based preference assessment of social stimuli.....	17
<b>2.6</b>	<b>Reinforcer Assessment of Social Stimuli.....</b>	<b>18</b>
2.6.1	Responses.....	18
2.6.2	Materials .....	20
2.6.3	General procedure.....	21
2.6.4	Baseline.....	22
2.6.5	Reinforcement.....	22
2.6.5.1	<i>Progressive-ratio schedule of reinforcement condition .....</i>	<i>22</i>
2.6.5.2	<i>Fixed-ratio schedule of reinforcement condition .....</i>	<i>23</i>
2.6.5.3	<i>Other modifications .....</i>	<i>23</i>
<b>2.7</b>	<b>Experimental Design .....</b>	<b>23</b>
<b>Chapter 3: Results .....</b>		<b>25</b>
<b>3.1</b>	<b>Preference Assessment.....</b>	<b>25</b>
3.1.1	SIRF and preference assessment rankings.....	27
<b>3.2</b>	<b>Reinforcer Assessment.....</b>	<b>29</b>
<b>Chapter 4: Discussion.....</b>		<b>36</b>
<b>4.1</b>	<b>Unexpected Findings .....</b>	<b>37</b>
<b>4.2</b>	<b>Methodological Rigor.....</b>	<b>39</b>

<b>4.3</b>	<b>Limitations of the study .....</b>	<b>41</b>
<b>4.4</b>	<b>Clinical Implications .....</b>	<b>42</b>
<b>4.5</b>	<b>Conclusion .....</b>	<b>45</b>
	<b>References.....</b>	<b>47</b>
	<b>Appendices .....</b>	<b>52</b>
	<b>Appendix A Reinforcer Assessment Data Sheet .....</b>	<b>52</b>
	<b>Appendix B Social Interactions Rating Form (SIRF).....</b>	<b>53</b>

## List of Tables

Table 1: SIRF and preference assessment results.....	19
Table 2: SIRF and preference assessment rankings .....	28

**List of Figures**

Figure 1: Preference assessment data ..... 30

Figure 2: Reinforcer assessment results for Isla, Becky, and Amy ..... 32

Figure 3: Reinforcer assessment results for Addison and Charlie..... 35

## **List of Abbreviations**

ADHD – Attention Deficit Hyperactivity Disorder

ASD – Autism Spectrum Disorder

FC – Forced choice

FR – Fixed ratio

HP – High preference

IOA – Interobserver agreement

LP – Low preference

M - Mean

MSWO – Multiple-stimulus-without-replacement preference assessment

PECS – Picture Exchange Communication System

PR – Progressive ratio

SIRF – Social Interaction Rating Form

SSQ – Social Stimuli Questionnaire

UBC – The University of British Columbia

VI – Verbal instructions

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For Bowen

## **Chapter 1: Introduction**

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that is characterized by deficits in social communication and excesses in restricted and/or repetitive behaviour, activities, or interests (American Psychiatric Association, 2013). Examples of deficits in social communication may include avoidance of eye contact during social interactions, difficulty with interpreting nonvocal communication (e.g., facial expressions and gestures), and/or lack of sufficient spoken language to address basic wants and needs. Excesses in restricted and/or repetitive behaviour, activities, or interests may include lining up objects, an insistence on sameness, and/or stereotypic behaviour (e.g., body flapping or spinning in circles).

Instructors implement behavioural interventions to teach new social and communication skills and reduce repetitive behaviour, activities, and interests (Green, 1996). For example, a child who has a limited verbal repertoire would benefit from interventions focused on reinforcing their use of functional language in a skill acquisition program. One component of successful behavioural interventions is the effective use of reinforcers. Instructors use reinforcers to teach, maintain, and generalize skills (Anderson, Taras, & O'Malley Cannon, 1996). A variety of stimuli are used as reinforcers in behavioural intervention programs such as edibles, toys, activities, and social interactions. Given the role of reinforcement in behaviour interventions, it is important for instructors to accurately identify possible reinforcers for their clients on an ongoing basis (Anderson et al.).

### **1.1 Indirect Assessments for Identifying Potential Reinforcers**

Interviewing caregivers, teachers, and other people who are familiar with the individual is important and necessary for identifying potentially reinforcing stimuli (Kelly, Roscoe, Hanley, & Schlichenmeyer, 2014). Examples of semi-structured interviews for identifying potentially

preferred stimuli include questionnaires such as the Reinforcer Assessment for Individuals with Severe Disabilities (Fisher, Piazza, Bowman, & Amari, 1996) and the Social Stimuli Questionnaire (SSQ; Kelly et al., 2014). It should be noted that there are discrepancies between the reported preferences of individuals with developmental disabilities by their caregivers and the results of systematic preference and reinforcer assessments (e.g., Fisher et al., 1996). Therefore, while interviews are an important component of identifying preferred stimuli, interviews alone are insufficient for identifying preferred stimuli or reinforcers for behaviour intervention programs.

## **1.2 Preference Assessments for Identifying Potential Reinforcers**

Preference assessments play an important role in developing effective behavioural interventions for individuals with developmental disabilities. Instructors conduct preference assessments with individuals with developmental disabilities to identify highly preferred stimuli that may function as reinforcers (Hagopian, Long, & Rush, 2004). Systematic, formal preference assessments are used to gather information about preferences for social, tangible, and activity-based reinforcers for individuals who are unable to communicate their preferences through vocal verbal behavior (Fisher et al., 1992; Kodak, Fisher, Kelley, & Kisamore, 2009; Pace, Ivancic, Edwards, Iwata, & Page, 1985). There are two general categories of preference assessments: duration- and selection-based assessments.

### **1.2.1 Duration-based preference assessments**

The purpose of a duration-based preference assessment is to determine the amount of time an individual will engage with stimuli. The total amount of engagement time is considered a measure of preference (Hagopian et al., 2004). Examples of duration-based preference assessments include the free operant preference assessment (Roane, Vollmer, Ringdhal, &

Marcus, 1998) and the single-stimulus preference assessment (DeLeon, Iwata, Conners, & Wallace, 1999). Duration-based preference assessments are clinically indicated for individuals who are unable to make choices among stimuli and/or individuals who engage in problem behaviour when preferred stimuli are removed or taken away (Hagopian et al., 2004).

During the free operant preference assessment, instructors provide noncontingent access to multiple stimuli simultaneously and measure the amount of time in which an individual interacts with each stimulus (Roane et al., 1998). The free operant preference assessment is indicated for individuals that engage in problem behaviour when highly preferred activities are terminated. That is, the free operant preference assessment reduces the likelihood of evoking tangibly maintained problem behaviour because the assessment does not involve removing preferred activities after brief periods of access such as in selection-based preference assessments (Kodak et al., 2009). The free operant preference assessment takes a relatively short amount of time to conduct compared to other preference assessments (Roane et al., 1998). One concern with the free operant preference assessment is that an individual may only interact with one stimulus throughout assessment. One problem with this pattern of behaviour is that the instructor is unable to obtain a hierarchy of preference across stimuli making the outcomes of the assessment potentially less clinically useful.

During a single-stimulus, duration-based preference assessment, the instructor presents one stimulus at a time and measures the amount of time an individual interacts with each item or activity included in the assessment (DeLeon et al., 1999). The single-stimulus, duration-based preference assessment is useful for clarifying vague results of selection-based preference assessments. One potential limitation of the assessment is that an individual may interact with a

stimulus because it is the only stimulus available during the assessment rather than for its reinforcing value (i.e., a false positive; DeLeon et al.).

### **1.2.2 Selection-based preference assessments**

The purpose of a selection-based preference assessment is to determine the stimuli chosen by the individual over time. The selection of a stimulus over other stimuli in an array is considered a measure of preference (Hagopian et al., 2004). Selection-based preference assessments include the single-stimulus preference assessment (Pace et al., 1985), the paired-stimulus preference assessment (Fisher et al., 1992), and the multiple-stimulus-without-replacement preference assessment (MSWO: DeLeon & Iwata, 1996). Selection-based preference assessments are clinically indicated for individuals who make selections among multiple stimuli and individuals who do not engage in problem behaviour and transition easily when a preferred stimulus is removed after a brief period of access (Kodak et al., 2009).

A paired-stimulus preference assessment is a selection-based assessment in which an instructor presents stimuli in pairs and provides opportunities for an individual to select among the stimuli (Fisher et al., 1992). The instructor presents each stimulus in pairs with every other stimulus and provides 5 to 10 s of access to the stimulus after the individual selects one of the stimuli. The paired-stimulus preference assessment is clinically indicated for individuals who can select among multiple stimuli and do not engage in problem behavior when stimuli are removed (Fisher et al., 1992). If an individual is unable to reliably select among stimuli, a selection-based assessment is contraindicated and a duration-based preference assessment may be more appropriate (Hagopian et al., 2004). One benefit of the paired-stimulus preference assessment is that the assessment yields information about the relative preference of a hierarchy of stimuli.

Another selection-based preference assessment is the MSWO (DeLeon & Iwata, 1996). The instructor presents an array of several stimuli (usually 6 to 8 stimuli) to an individual and provides an opportunity to select one stimulus from the array. The instructor provides the individual with approximately 30 s to interact with the selected stimulus. After the reinforcement interval elapses, the instructor retrieves the stimulus from the individual and removes it from subsequent array presentations. Thus, the array becomes smaller until the array consists of one stimulus (DeLeon & Iwata, 1996). The results obtained from the MSWO correspond to results from other preference assessments, such as the paired-choice preference assessment, with the added benefit of taking less time to conduct (DeLeon & Iwata, 1996). Similar to the paired-stimulus preference assessment, MSWOs are clinically contraindicated for individuals that cannot select among two or more stimuli. A brief MSWO is similar to an MSWO except that fewer sessions are conducted to identify the hierarchy of preferred stimuli (Carr, Nicolson, & Higbee, 2000). In the study by Carr and colleagues, the experimenter conducted three sessions instead of five sessions. The results of the study demonstrated that 1- and 3-session MSWOs might yield similar results to a 5-session MSWO. Brief MSWOs may be useful in educational settings due to how quickly the assessment can be conducted.

It is important to note that preference assessments do not necessarily identify stimuli that function as reinforcers during instructional programs. While preference assessments yield useful information, it may be important to assess the reinforcing quality of stimuli that will be used for skill acquisition procedures (Hagopian, et al., 2004).

### **1.3 Reinforcer Assessments for Identifying Reinforcers**

Reinforcement is the process by which a stimulus is added or removed immediately following a behaviour, which results in an increased likelihood of that behaviour in the future

(Cooper, Heron, & Heward, 2007). Instructors of individuals with developmental disabilities use reinforcers during skill acquisition programs to teach new skills. The identification of effective reinforcers is a critical component of effective program development for skill acquisition programs (Karsten et al., 2011).

Instructors can conduct reinforcer assessments to evaluate the reinforcing quality of stimuli by presenting different stimuli contingently on a response to evaluate its effect on behaviour (Cooper et al., 2007). For example, if a toy truck is endorsed as highly preferred by a caregiver, an instructor might provide the truck contingently on a simple response (e.g., pushing a button) to determine if the contingent presentation of that stimuli results in a future increase in the behaviour.

During a reinforcer assessment, it is common for an instructor to provide access to a stimulus on a fixed ratio one (FR 1) schedule of reinforcement contingent on a response (DeLeon, Iwata, Goh, & Worsdell, 1997). The response included in the assessment is typically a relatively simple, mastered response that can be performed quickly. Thus, reinforcer assessments provide information about the reinforcing value of a stimulus for reinforcing simple, mastered responses.

In clinical practice, instructors use reinforcers for a variety of reasons such as increasing complex new skills and maintaining mastered skills (Cooper et al., 2007). Thus, it is important for instructors to design the reinforcer assessment based on the context in which the reinforcer will be used. For example, if an instructor will use a potential reinforcer to teach a new, relatively simple response, a reinforcer assessment with continuous reinforcement may be appropriate. If, however, a potential reinforcer is used to thin the schedule of reinforcement for a mastered response or will be used to teach a new and complex skill, information about the

capacity for a stimulus to function as a reinforcer under increasing work requirements may be useful.

Instructors can evaluate the reinforcing value of stimuli under increasing work requirements using a progressive-ratio (PR) reinforcement schedule (Roane, Lerman, & Vorndran, 2001). During a PR reinforcement schedule, an instructor increases the schedule of reinforcement after each time the schedule requirement is met. For example, at the start of a session, the instructor reinforces the first response (i.e., FR 1). Next, the instructor increases the schedule requirement (e.g., FR 3) and reinforces the response that completes the schedule requirement. The instructor continues to increase the schedule requirement within the session until the session elapses or the client stops responding. A break point refers to the highest schedule completed within a single session with a PR schedule (Roane, 2008). The break point is used as a metric of reinforcer strength under increasing work requirements. In clinical practice, an instructor can use break points to inform treatment decisions regarding the selection of reinforcers (Wilson & Gratz, 2016). For example, an instructor may analyze the break points for several types of reinforcers to select consequences for difficult tasks to increase the likelihood of obtaining an immediate reinforcement effect at the start of intervention.

#### **1.4 Rationale for the Current Study**

To date, the majority of research on preference assessments has focused on identifying preferred edible, tangible, and leisure stimuli (Cannella, O'Reilly, & Lancioni, 2005). However, tangible and edible stimuli have potential drawbacks such as health concerns, portability challenges, and satiation issues (Clay, Samaha, Bloom, Bogoev, & Boyle, 2013; Rincover & Newsom, 1985; Kelly et al., 2014). One potential benefit of using social stimuli as reinforcers is that caregivers and educators frequently use social stimuli in everyday interactions. Thus, the use

of social stimuli as reinforcers may produce higher ratings of social validity compared to tangible stimuli among caregivers and teachers (Clay et al., 2013).

There is a small but growing body of literature on assessing preferences for social stimuli among individuals with ASD (Call, Shillingsberg, Bowen, Reavis, & Findley, 2013; Clay et al., 2013; Kelly et al., 2014; Lang et al., 2014; Nuernberger, Smith, Czapar, & Klatt, 2012; Smaby, MacDonald, Ahearn, & Dube, 2007). Social stimuli such as attention functions as a reinforcer for some individuals with ASD, although the forms may be idiosyncratic compared to typically developing individuals (Kelly et al., 2014; Smaby, MacDonald, Ahearn, & Dube, 2007).

Attention from adults and peers is a frequent function of problem behaviour (Thompson & Iwata, 2001; Piazza, Bowman, Contrucci, Delia, Adelinis, & Goh, 1999). For example, Kodak, Northup, and Kelley (2007) evaluated the reinforcing quality of six different topographies of attention for problem behaviour. Reprimands resulted in the most problem behaviour across all participants. Thompson and Iwata (2001) observed consequences of problem behaviour and identified attention as the most frequently provided consequence of problem behaviour.

Although these studies demonstrated that attention functioned as a reinforcer for problem behaviour, the studies also demonstrated that social stimuli frequently function as reinforcers, albeit for problem behaviour, for some individuals with developmental disabilities.

There are some drawbacks in the methods used in previous research studies to evaluate preference for social stimuli. Techniques ranged from researchers choosing three everyday forms of attention (Smaby et al., 2007) to more detailed selection processes including questionnaires, observations, and manding sessions (Kelly et al., 2014). The SSQ was developed to identify preferred social stimuli for problem behaviour among individuals with developmental disabilities. Although the SSQ is one of few questionnaires about components of potentially

reinforcing social stimuli, the questionnaire may better assess components of attention for problem behaviour (e.g., reprimands). Thus, additional questionnaires to identify preferred social interactions for skill acquisition programs might be needed.

Current research on preference assessments of social stimuli is limited in terms of how best to depict the stimuli in the preference assessment. Most preference assessment studies have used two-dimensional images to depict the forms of social stimuli (Kelly et al., 2014; Lang et al., 2014). However, the use of pictures to represent social interactions comes with limitations. Social stimuli are dynamic, not static. Thus, the most salient features of attention may not be depicted in pictures (Brodhead, Al-Dubayan, Mates, Abel, & Brouwers, 2016; Snyder, Higbee, & Dayton, 2012). One potential way to remediate this limitation is to use a video-based preference assessment. There is a correspondence between the outcomes from video-based preference assessments and picture-based preference assessments for both the paired and MSWO pictorial preference assessments for tangible items (Brodhead et al. 2016; Snyder et al., 2012).

Research on video-based preference assessments to date has focused on tangible stimuli only; however it would seem a natural extension to use a video-based preference assessment for social stimuli (Brodhead et al., 2016; Snyder et al., 2012). Social stimuli are dynamic and the use of videos would allow for many of the dynamic properties of social stimuli to be depicted (Snyder et al., 2012).

The purpose of the current study was to extend the research on video-based preference assessments by including social stimuli. The use of videos has some potential advantages over pictures; including comprehension of the social stimuli (Snyder et al., 2012) and ease of use for the instructor (Brodhead et al., 2016). The current study addressed the following research question: Is there a functional relation between the level of preference for social stimuli

identified in a video-based preference assessment and the rate of responding and/or break points for high-preference (HP) and low-preference (LP) social stimuli?

## **Chapter 2: Method**

### **2.1 Participants and Setting**

Six children between the ages of 2- and 7-years old participated in the study. Three participants lived in the Lower Mainland of British Columbia and three lived in central California. The experimenter conducted sessions in either the participant's home or early intervention centre. The experimenter conducted sessions two to three times per week. Inclusion in the study required that all participants and their family spoke and understood English and that participants did not engage in significant problem behaviour during one-on-one instruction. The experimenter obtained approval from the University of British Columbia's Behavioural Research Ethics Board and the California State University, Fresno Institutional Review Board before recruiting participants for the study.

Isla, a typically developing female, was 3-years old at the time of the study. Isla used age-appropriate vocal verbal behaviour to communicate. She lived with her mother, father, and younger sister. Isla attended a part-time daycare program. The experimenter conducted sessions with Isla on the floor of her living room.

Brody, a typically developing male, was 3-years old at the time of the study. Brody used age-appropriate vocal verbal behaviour to communicate. He lived with his mother and father. Brody attended a part-time daycare program. The experimenter conducted sessions with Brody at a child-sized table in the living room of his home.

Becky was 2-years old at the time of study. She had not been formally diagnosed with a developmental disability, but a previous comprehensive evaluation suggested a high likelihood of a diagnosis of Autism Spectrum Disorder. Becky used the Picture Exchange Communication System (PECS) as her primary mode of communication. She had three vocal mand

approximations for highly preferred foods. Becky attended a university-based early intervention center for approximately 25 hours per week and a part-time preschool program for 8 hours per week. The experimenter conducted sessions with Becky in a session room at her early intervention center.

Amy, a typically developing female, was 4-years old at the time of the study. Amy used age-appropriate vocal verbal behaviour to communicate. She lived with her mother, father, and younger sister. Amy attended a part-time preschool program. The experimenter conducted sessions with Amy on the floor of her living room.

Addison was 7-years old at the time of the study. She had a previous diagnosis of both ASD and Attention Deficit Hyperactivity Disorder (ADHD) provided by a licensed clinical psychologist. She lived with her mother, father, and older brother. At the time of the study, Addison had completed Grade 1 and was entering Grade 2 the next school year. Addison spoke in full sentences and primarily used vocal verbal behaviour to communicate. The experimenter conducted sessions with Addison on the floor of her living room.

Charlie was 6-years old at the time of the study. He had a previous diagnosis of ASD by a licensed clinical psychologist. At the time of the study, Charlie attended a university-based early intervention center for approximately 25 hours per week. He lived with his mother. Charlie spoke in full sentences and used vocal verbal behaviour as a primary means of communicating. The experimenter conducted sessions with Charlie in a session room at his early intervention center.

## 2.2 Dependent Variables and Data Collection

The primary dependent variable was the rate of responses during the reinforcer assessment. The experimenter calculated the rate of responses by dividing the total number of target responses by the duration of the session. The experimenter calculated rate of responses each session.

The experimenter calculated break points for the HP and LP social stimuli during sessions in which the experimenter implemented a PR schedule of reinforcement. A break point was defined as the highest ratio requirement completed for the HP and LP social stimuli during the PR schedule in a session (Roane, 2008). The experimenter did not measure breakpoints during extinction because there are no schedule requirements for extinction.

The experimenter trained graduate- and undergraduate-level research assistants to collect data for the study using behavioural skills training (i.e., instruction, modeling, and rehearsal with feedback). Each research assistant received training until she achieved 100% agreement for two consecutive sessions with a primary data collector using mock videos and/or videos from the study before collecting data for the study.

The experimenter and research assistants collected data using a paper-and-pencil procedure (see Appendix A for a copy of the data sheet). Each response was tally marked on the data sheet under the appropriate column (e.g., HP, LP, or extinction). When a PR schedule of reinforcement was implemented, the data sheet was divided into rows based on the increasing schedule requirements. When an FR 1 schedule of reinforcement was implemented, the data sheet was divided into columns for HP and LP and a tally was kept based on responses per session.

The experimenter selected target responses for each participant based on their current repertoire. The participant needed to be able to complete the task relatively quickly and without prompts. The target response for Isla, Addison, and Charlie, was a beading task. Beading was defined as pushing a string through a bead and sliding the bead down the string. The experimenter scored one response when the participant beaded two beads at the same time (e.g., pushed the string through two beads and pulled them down together).

For Charlie, the experimenter made the decision to switch from a beading task to manding during the reinforcer assessment. This change was made because Charlie was vocally manding for the available forms of social stimuli throughout each experimental session, and the experimenter was concerned about the potential consequences of ignoring Charlie's vocal mands (e.g., extinction-induced behavior). Mands were defined as Charlie vocally requesting either the HP or LP social stimulus within 5 s of the experimenter-delivered choice, "Do you want tickles or chasing?"

Brody did not participate in the reinforcer assessment because his participation was terminated due to concerns of problem behaviour during the preference assessment continuing into the reinforcer assessment (e.g., elopement and verbal refusal).

For Becky, the experimenter selected a PECS exchange as the target response. A PECS response was defined as selecting and placing a picture of either the HP or LP social stimuli in the hand of the experimenter.

For Amy, the experimenter chose pinching a clothes peg onto the edge of a square container as the target response. A response was defined as pinching a clothes peg open and clipping it onto the edge of a square container.

### **2.3 Interobserver Agreement**

Interobserver agreement (IOA) was calculated by comparing the data collected by a primary and secondary observer during the reinforcer assessment. Two independent observers scored the number of responses and the session duration on a session-by-session basis and the measures were converted to a rate. The experimenter calculated IOA for rate of responses by dividing the smaller rate by the larger rate and multiplying the proportion by 100 (i.e., total agreement).

For Isla, Amy, Becky, and Charlie, IOA was assessed for 100% of sessions. Mean IOA was 100% for Isla, Amy, Becky, and Charlie. For Addison, IOA was assessed for 70% of HP versus LP sessions (sessions 1 to 10) and 93% of HP versus extinction and LP versus extinction sessions (sessions 11 to 26). Mean IOA for sessions 1 to 10 was 94% and 99% for sessions 11 to 26. Interobserver agreement was not assessed for Brody, as he did not participate in the reinforcer assessment.

### **2.4 Treatment Integrity**

An independent observer collected data on the degree to which the experimenter followed the protocol for the reinforcer assessment. The data collector scored the experimenter's implementation of the schedule of reinforcement specified by the research protocol during each experimental session of the reinforcement conditions. Correct implementation of the reinforcement schedule was the experimenter delivering the reinforcer within 3 s of the participant engaging in a response that met the schedule requirement in place at the time. The experimenter did not include a measure of treatment integrity for the correct implementation of extinction, which is a limitation of the study. The experimenter calculated treatment integrity by

dividing the number of correct reinforcer deliveries by the total number of reinforcer deliveries in a session and multiplying the proportion by 100.

For Isla, Amy, Becky, and Charlie, treatment integrity was assessed for 100% of sessions during the reinforcement conditions and the mean treatment integrity score was 100%. For Addison, treatment integrity was assessed for 78% of sessions. Mean treatment integrity was 98% (range: 85% to 100%). Treatment integrity was not assessed for Brody, as he did not participate in the reinforcer assessment.

## **2.5 Pre-experimental Assessments**

### **2.5.1 Social interactions rating form**

The experimenter completed the Social Interaction Rating Form (SIRF) with the primary caregiver(s) and/or early intervention staff of each participant (Pastrana et al., under review; see Appendix C for the SIRF). The purpose of the SIRF was to identify several preferred social stimuli to evaluate in a subsequent video-based preference assessment. The SIRF consists of 22 social stimuli grouped into three categories: interactions with physical contact (e.g., high five), interactions without physical contact (e.g., eye contact), and verbal interactions (e.g., praise). Raters ranked the social stimuli using a 5-point Likert scale. Raters used a rating of 1 to indicate that he/she considered the social stimulus aversive from the perspective of the participant. Raters used a rating of 5 to indicate that he/she considered the social stimulus highly preferred from the perspective of the participant. Together with the primary caregiver(s) and/or early intervention staff, the experimenter selected the six highest ranked social stimuli from the questionnaire for inclusion in the subsequent video-based preference assessment of social stimuli. The second column of Table 1 shows the highest and lowest ranked social interactions from the six social

stimuli selected for inclusion in the video-based preference assessment of social stimuli for each participant.

### **2.5.2 Video-based preference assessment of social stimuli**

The experimenter conducted a video-based, paired-choice preference assessment of social stimuli with each participant. The procedure was similar to the procedure described by Fisher et al., 1992. The purpose of the preference assessment was to identify a hierarchy of preferred social stimuli and to select two social stimuli to include in the subsequent reinforcer assessment. The preference assessment was presented to participants using the Keynote application on the iPad®. During each trial, the experimenter presented choices between two social stimuli by playing two, 10-s video clips of different social stimuli in a side-by-side format. Immediately after the 10-s video clips ended, the experimenter delivered the instructions, “Pick one” and provided 5 s for the participant to select one of the social stimuli. Selections were defined as pointing to, touching, or vocally naming the social stimulus. Immediately after the participant made a selection, the experimenter delivered the selected social stimulus for 10 s. If a participant did not select a social stimulus within 5 s of the instruction, the experimenter arranged a social stimulus sampling with the two stimuli by playing both video clips one at a time and briefly delivering each social stimulus. The experimenter re-presented the trial immediately following the sampling procedure. If the participant still did not make a selection within 5 s after the videos finishing playing, the trial was discontinued and the next trial was presented. The experimenter repeated these steps until each social stimulus was paired with every other social stimulus (i.e., 15 trials). Anecdotally, the participants made choices for the overwhelming majority of the trials and the experimenter rarely used the sampling procedure, if at all.

## **2.6 Reinforcer Assessment of Social Stimuli**

The experimenter selected the social stimuli for the reinforcer assessment based on the results of the preference assessment. The experimenter chose the social stimulus selected most often as the HP stimulus and the social stimulus that was selected least often as the LP stimulus. The purpose of the reinforcer assessment was to assess the relative reinforcing value of the HP and LP social stimuli. Therefore, a concurrent-operants arrangement was used for the reinforcer assessment. That is, the experimenter presented choices between two social stimuli to evaluate the relative preference between the social stimuli. Thus, the experimenter compared the relative reinforcing value of the HP social stimulus and extinction as well as the LP social stimulus and extinction.

### **2.6.1 Responses**

The responses assigned to the HP social stimulus, LP social stimulus, and extinction varied across participants. Across all participants, the responses were held constant across conditions for each participant but not across participants. Responses selected were previously mastered tasks, as reported by caregivers and/or staff who worked directly with participants.

The experimenter selected a beading task for Isla, Addison, and Charlie. Isla, Addison, and Charlie had acquired beading in the past as reported by their caregivers. The beads for the beading task were placed on two white trays approximately 1 m apart. The experimenter held the string color for the beading task constant for the HP, LP, and extinction conditions. Red was assigned to HP, green to LP, and yellow for extinction. For Addison, the experimenter made a modification to the general procedure. Starting at session 20, the experimenter placed the trays side by side instead of 1 m apart. The purpose of this change was to decrease the likelihood of the side-bias observed between sessions 13 and 19. For Isla, Addison, and Charlie, the

**Table 1: SIRF and preference assessment results**

The results of the SIRF and preference assessment for each participant. Note: SIRF = Social Interactions Rating Form, HP = high-preference social stimulus, LP = low-preference social stimulus.

Participant	SIRF Ranking		Preference Assessment (HP)		Preference Assessment (LP)	
	<u>Highest</u>	<u>Lowest</u>	<u>Stimuli</u>	<u>Percentage</u>	<u>Stimuli</u>	<u>Percentage</u>
Isla	Blanket	Talking	Blanket	80	Talking	0
Brody	Chase	Singing	Dinosaurs	100	Singing	0
Becky	Pick up and twirl	Singing	Hide and seek	100	Singing	0
Amy	Tag	Head rubs	Singing	80	Talking	40
Addison	Back rubs	Dancing	Back rubs	80	Dancing	20
Charlie	Chase	Tickling arms	Chase	100	Tickling arms	0

experimenter semi-randomly rotated the position of the trays across the right- and left-hand side of the table on a session-by-session basis. During the sessions 7 to 11 for Charlie, the experimenter changed the response from beading to manding because Charlie vocally manded for the HP and LP social stimuli during the sessions. The experimenter changed the response and switched from a PR schedule to a FR 1 schedule of reinforcement. The experimenter provided Charlie with a choice between the HP and LP social stimuli using vocal instructions. The experimenter semi-randomly rotated the position of the HP and LP social stimuli such that each social stimulus was presented a similar number of times in the first and last position of the instructions.

During the reinforcer assessment for Becky, the experimenter placed two pictures depicting the HP and LP social stimulus on her PECS board. The pictures consisted of still shots from the video-based preference assessment that best depicted the social interaction from the perspective of the experimenter. The experimenter semi-randomly rotated the position of the pictures of the HP and LP social stimuli across the right- and left-hand side of the PECS board and reinforced responses on an FR 1 schedule of reinforcement.

During the reinforcer assessment for Amy, the experimenter placed two containers filled with clothes pegs approximately 1 m apart on the floor. The experimenter assigned a colour to the containers associated with the HP and LP social stimuli, and held the colours constant across the sessions. The experimenter semi-randomly rotated the position of the containers across the right- and left-hand side of the floor and reinforced responses on a PR schedule of reinforcement.

### **2.6.2 Materials**

The experimenter used minimal materials during the preference assessment. The experimenter provided an iPad® with the Keynote application already loaded with a slide show

that was used for the video-based preference assessment. The experimenter used a simple timer to track the duration of social stimuli delivery after each selection. The experimenter provided any materials that were required for the specific forms of social stimuli (e.g., music for dancing).

During the reinforcer assessment, the experimenter used two simple timers: one to track duration of social stimuli delivery and another to track session duration. The experimenter collected data using pencil and paper and video recorded sessions using an iPad®. If other materials were required for the specific forms of social stimuli (e.g., music for dancing), the experimenter provided these as well.

Materials used during the reinforcer assessment varied by participant. For beading, large wooden beads were used and strung onto a shoelace. For attaching clothes pegs, plastic clothes pegs were used with small square plastic containers. For PECS exchanges, the experimenter provided a PECS board and icons for the LP and HP social stimuli

### **2.6.3 General procedure**

Before each session for all participants, the experimenter delivered instructions that described the reinforcement contingencies (e.g., “If you put beads on the red string you will get tickles and if you put beads on the green string we will sing”). Before each participant’s first session of baseline and reinforcement, the experimenter conducted an exposure trial in which the experimenter prompted the participant to engage in a target response for each operant and briefly presented the social stimuli available (or not in the case of extinction) for responding to that operant. The experimenter did not conduct exposure trials after the first session of baseline and reinforcement with the exception of Addison. The experimenter counterbalanced the position of the task materials associated with the HP and LP stimuli and extinction across left- and right-hand positions across sessions.

After the participant met the schedule requirement, the experimenter started a timer and delivered the relevant form social stimulus for 10 s. After 10 s elapsed, the experimenter withdrew the social stimulus. Sessions were 5 min in duration. The experimenter terminated a session if the participant did not engage in a target response for 1 min. At the conclusion of each session, the experimenter presented the instructions, “Go play”, or “Take a break” and provided a 5-min break between each session. During the break, the experimenter minimized interactions with the participant and provided access to a moderately preferred toy or activity.

#### **2.6.4 Baseline**

During baseline, the experimenter did not provide access to the HP or LP stimulus based on participant responses (i.e., extinction). The experimenter conducted at least three baseline sessions with each participant and baseline continued until there was stability in the data. One exception is with Isla in which the experimenter introduced reinforcement despite variable responding in baseline.

#### **2.6.5 Reinforcement**

During reinforcement, the experimenter provided 10-s access to either the HP or LP stimulus after the participant met the schedule requirement. The specific schedule of reinforcement varied based on the response used during the reinforcer assessment.

##### ***2.6.5.1 Progressive-ratio schedule of reinforcement condition***

At the start of each session, the first schedule requirement was an FR 1 schedule. The experimenter increased the schedule by two responses (i.e., FR 1, FR 3, FR 5...) after each instance in which the participant met the schedule requirement.

### ***2.6.5.2 Fixed-ratio schedule of reinforcement condition***

This condition was similar to the PR schedule with one exception. The schedule of reinforcement was an FR 1 instead of a PR schedule. The experimenter used an FR 1 schedule for Becky and Charlie due to the type of response used for both participants. The rationale for using an FR 1 schedule is because exposing communication to a PR schedule may produce less-than ideal behavior patterns. For example, if the PR schedule reached an FR 5 schedule, the participant would be required to engage in five communication responses in a row to gain access to a reinforcer, which is a less-than ideal way to provide reinforcers for communication. For Becky's evaluation, the experimenter reinforced PECS exchanges on an FR 1 schedule of reinforcement. For Charlie's evaluation, the experimenter started reinforcing vocal mands on an FR 1 schedule starting session 7.

### ***2.6.5.3 Other modifications***

For Addison, the experimenter made several modifications during the reinforcer assessment. After the baseline phase and the initial verbal instructions (VI) phase, the experimenter moved to a forced choice (FC) phase where the experimenter conducted an exposure trial for each response option prior to the start of each session. The experimenter also switched from a comparison of HP and LP stimuli to a comparison of HP versus extinction and LP versus extinction.

## **2.7 Experimental Design**

The experimenter used a reversal design to compare the reinforcing value of HP and LP social stimuli. The goal of the current study was to demonstrate differentiated responding across phases (e.g., baseline to intervention) and within intervention phases (e.g., HP versus LP). The purpose of selecting a concurrent-operants arrangement was to demonstrate differentiated

responding between the available HP and LP social stimuli, with the goal of demonstrating experimental control. The experimenter hypothesized that rate of responses would be higher for the HP social stimulus compared to the LP social stimulus when available concurrently. During each phase, the experimenter compared the rate of responding and/or break points for the available HP and LP social stimuli.

## **Chapter 3: Results**

### **3.1 Preference Assessment**

The middle and right-hand columns of Table 1 display the social stimuli selected most and least often during the video-based preference assessment of social stimuli for each participant. The experimenter included the most- and least-selected social stimuli in the subsequent reinforcer assessment. Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Isla: blanket ride, chasing, picking up and twirling, noodle arms, playing horsey, chase, and talking about favorite television shows. The top panel of column 1 in Figure 1 depicts the results of the video-based preference assessment of social stimuli for Isla. Based on the results during the preference assessment, the experimenter selected blanket ride as the HP stimulus (selected on 80% of trials) and talking about favorite television shows as the LP stimulus (selected on 20% of trials) for the reinforcer assessment.

Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Brody: pretending to be dinosaurs, picking up and twirling, joke reprimands, chasing, dancing, and singing. The middle panel of column 1 in Figure 1 depicts the results of the video-based preference assessment for Brody. During the preference assessment, Brody engaged in problem behaviour such as elopement and verbal refusal. In an attempt to reduce the likelihood of problem behaviour, the experimenter provided 5-min breaks every three to four trials, or at Brody's request. Despite this change, problem behavior continued but the experimenter was able to complete the preference assessment. At the conclusion of the preference assessment, the experimenter discussed Brody's participation in the study with his

family and both the family and experimenter agreed to terminate participation due to concerns of the previously mentioned problem behaviours continuing during the reinforcer assessment.

Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Becky: hide and seek, tickles, verbal praise, holding hands and jumping, picking up and twirling, and singing. The bottom panel of column 1 in Figure 1 depicts the results of the video-based preference assessment of social stimuli for Becky. Based on the results during the preference assessment the experimenter selected hide and seek as the HP stimulus (selected on 100% of trials) and singing as the LP stimulus (unselected during the assessment).

Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Amy: singing, playing tag, dancing, talking about letters, hide and seek, and head rubs. The top panel of column 2 in Figure 1 depicts the results of the video-based preference assessment of social stimuli for Amy. Based on the results during the preference assessment, the experimenter selected singing as the HP stimulus (selected on 80% of trials) and talking about letters as the LP stimulus (unselected during the assessment).

Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Addison: back rubs, tickles, hugs, piggyback rides, chasing, and dancing. The middle panel of column 2 in Figure 1 depicts the results of the video-based preference assessment of social stimuli for Addison. Based on the results during the preference assessment the experimenter selected back rubs as the HP stimulus (selected on 80% of trials) and dancing as the LP stimulus (selected on 20% of trials).

Based on the results of the SIRF, the experimenter included the following social stimuli in the preference assessment for Charlie: chasing, noodle arms, vocal praise, making farting

sounds, holding hands and spinning, and tickling arms. The bottom panel of column 2 in Figure 1 depicts the results of the video-based preference assessment of social stimuli for Charlie. Based on the results during the preference assessment, the experimenter selected chasing as the HP stimulus (selected on 100% of trials) and tickling arms as the LP stimulus (unselected during the assessment).

### **3.1.1 SIRF and preference assessment rankings**

Table 2 displays the rankings of the top six preferred social stimuli identified by the SIRF compared to those of the preference assessment. For all participants the same stimulus was ranked in the sixth position on both the SIRF and the preference assessment and for 3 of 6 participants the same stimulus was ranked in the first position on both the SIRF and the preference assessment. For Isla, the rankings of all social stimuli from the SIRF and the subsequent preference assessment were identical. For Brody, 2 of the 6 rankings of social stimuli from the SIRF and preference assessment were identical. For Becky, 1 of the 6 rankings of social stimuli from the SIRF and preference assessment was identical. For Amy, 2 of the 6 rankings of social stimuli from the SIRF and preference assessment were identical. For Addison, 3 of the 6 rankings of social stimuli from the SIRF and preference assessment were identical. Last, for Charlie, 4 of the 6 rankings of social stimuli from the SIRF and preference assessment were identical. For Amy, Addison, and Charlie, although the SIRF and preference assessment rankings were not identical, the results were similar across both rankings. For Brody and Becky, there was relatively little correspondence between the SIRF and preference assessment rankings.

**Table 2: SIRF and preference assessment rankings**

The rankings of the top six social stimuli on the SIRF and preference assessment for each participant. Note: SIRF = Social Interactions Rating Form.

Participant	Stimuli	SIRF ranking	PA ranking
Isla	Blanket ride	1	1
	Chase	2	2
	Pick up and twirl	3	3
	Noodle arms	4	4
	Horse rides	5	5
	Conversations	6	6
Brody	Chase	1	4
	Joke reprimands	2	3
	Dinosaurs	3	1
	Pick up and twirl	4	2
	Dancing with music	5	5
	Singing	6	6
Becky	Pick up and twirl	1	5
	Jump	2	4
	Tickles	3	2
	Praise	4	3
	Hide and seek	5	1
	Singing	6	6
Amy	Tag	1	2
	Sing	2	1
	Dance	3	3
	Hide and seek	4	5
	Chat	5	4
	Head rubs	6	6
Addison	Back rubs	1	1
	Tickles	2	2
	Chasing someone	3	5
	Hugs	4	3
	Piggy back ride	5	4
	Dancing	6	6
Charlie	Chase	1	1
	Praise	2	3
	Noodle arms	3	2
	Noises	4	4
	Jump	5	5
	Tickles	6	6

### 3.2 Reinforcer Assessment

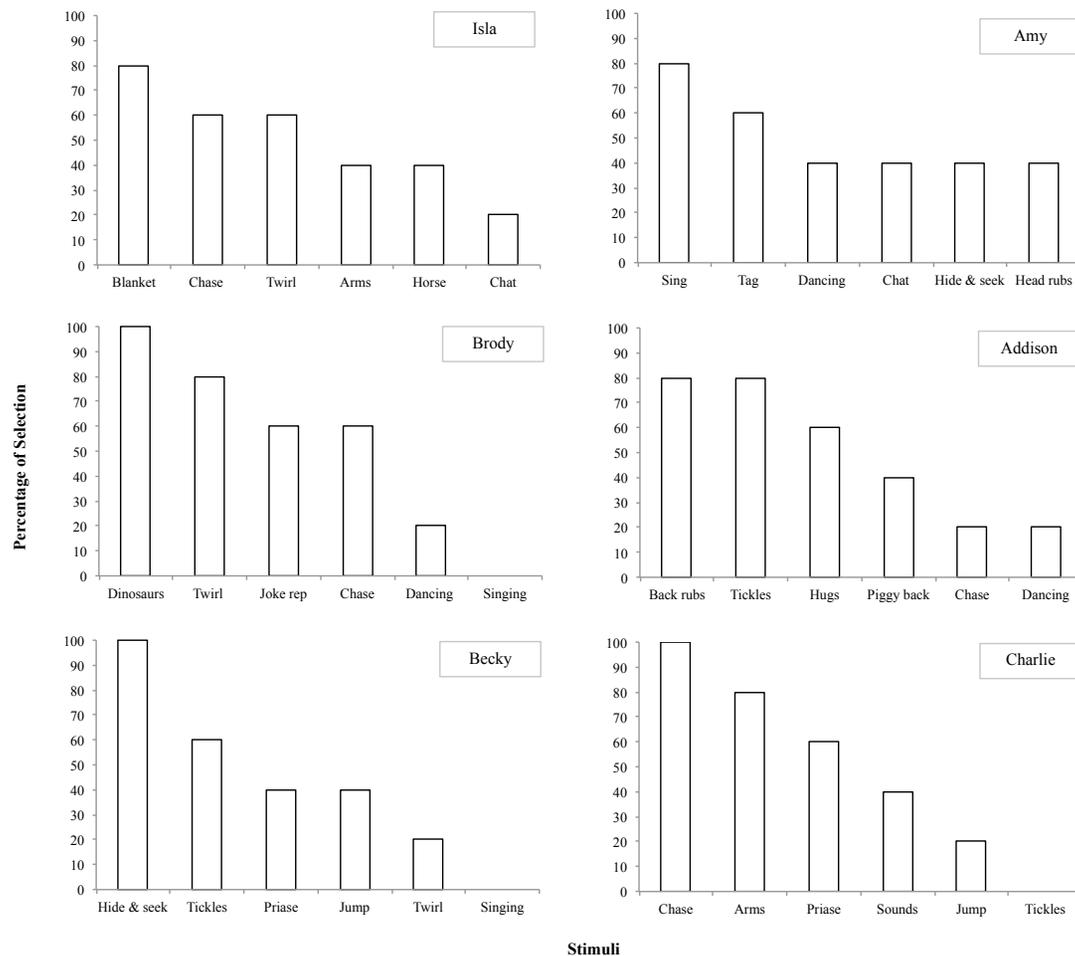
The top panel in Figure 2 shows the results of the reinforcer assessment for Isla. During baseline, Isla engaged in zero or near-zero levels of responding across three sessions ( $M = 0.67$  responses per minute). During the reinforcement, Isla engaged in a single response to each operant in the initial session, but responses remained relatively low compared to baseline (i.e., blanket ride (HP);  $M = 1.33$  responses per minute and talking about TV shows (LP);  $M = 0.67$  responses per minute). In addition to little responding, Isla engaged in problem behaviour in the form of verbal refusal (e.g., saying “No”), running away from the experimenter, and manding for attention from the experimenters during sessions (e.g., saying the experimenter’s name repeatedly). After six sessions, the experimenter discussed Isla’s participation in the study with her family and both the family and experimenter agreed to terminate participation.

Brody did not participate in the reinforcer assessment due to concerns of the problem behaviour he engaged in during the preference assessment continuing into the reinforcer assessment.

The middle panel in Figure 2 shows the results of the reinforcer assessment for Becky. During baseline, Becky engaged in no responding across three sessions and the experimenter terminated all sessions after 1 min. Next, the experimenter moved to the reinforcement condition. During session four, Becky continued to engage in zero levels of responding and sessions were terminated after 1 min elapsed. Due to zero levels of responding and Becky engaging in problem behaviour (e.g., crawling under the table), the experimenter discussed Becky’s participation in the study with her family and both the family and experimenter agreed to terminate participation.

### Figure 1: Preference assessment data

Preference assessment data for Isla (top left), Brody (middle left), Becky (bottom left), Amy (top right), Addison (middle right), and Charlie (bottom right). Data are depicted as a percentage of selection.



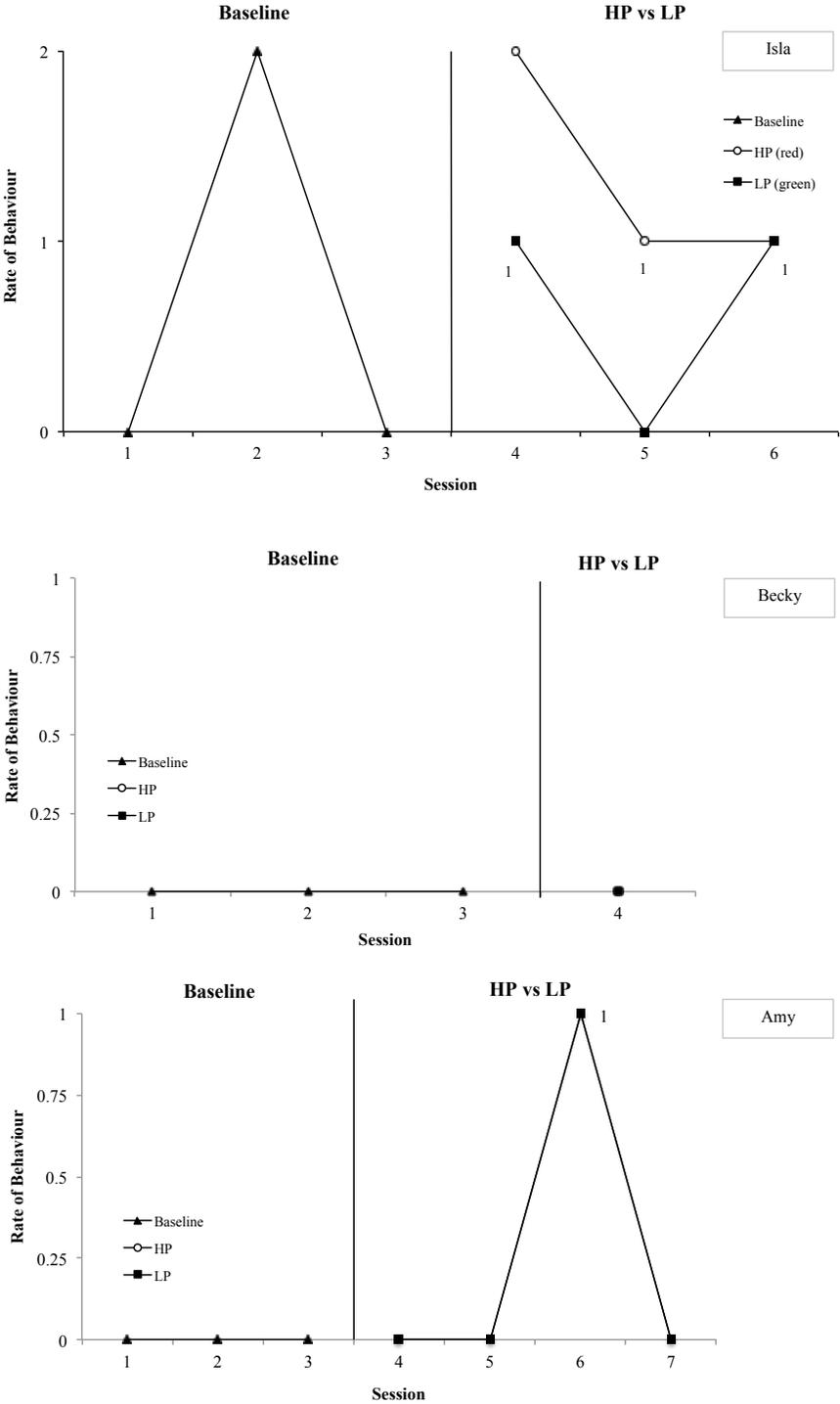
The bottom panel in Figure 2 shows the results for the reinforcer assessment for Amy. During baseline, Amy engaged in no responding across three sessions. Next, the experimenter moved to the reinforcement condition. During the next four sessions, Amy continued to engage in near-zero levels of responding (i.e., singing (HP);  $M = 0.25$  responses per minute and talking about letters (LP);  $M = 0.25$  responses per minute). Amy manded for alternative forms of social stimuli and play activities that were unavailable during the experimental sessions. Due to the near-zero levels of responding and persistent manding for social interactions and play activities outside of the research context, the experimenter discussed Amy's participation with her family and both the family and experimenter agreed to terminate participation.

The top panel in Figure 3 shows the results of the reinforcer assessment for Addison. During baseline, Addison did not engage in any target responses and all sessions were terminated after 1 min. Next, the experimenter moved to the reinforcement condition. During the first intervention phase the experimenter included VI before each session as with the other participants. With the goal of gaining greater separation between the HP and LP conditions, the experimenter next implemented a FC phase to increase the salience of the contingencies available during the condition. The FC phase resulted in undifferentiated responding (i.e., back rubs (HP);  $M = 3.0$  responses per minute and dancing (LP);  $M = 3.13$  responses per minute).

Next, the experimenter reversed back to the VI condition and undifferentiated responding continued (i.e., back rubs (HP);  $M = 3.2$  responses per minute and dancing (LP);  $M = 3.13$  responses per minute). Due to the undifferentiated responding in the FC and VI phases, the experimenter switched to comparing the HP and LP social stimuli each with extinction using a reversal design.

**Figure 2: Reinforcer assessment results for Isla, Becky, and Amy**

Reinforcer assessment data for Isla (top), Becky (middle), and Amy (bottom). Data are depicted as rate of responding with break points added beside data points when applicable. Note: HP = high-preference social stimulus, LP = low-preference social stimulus.



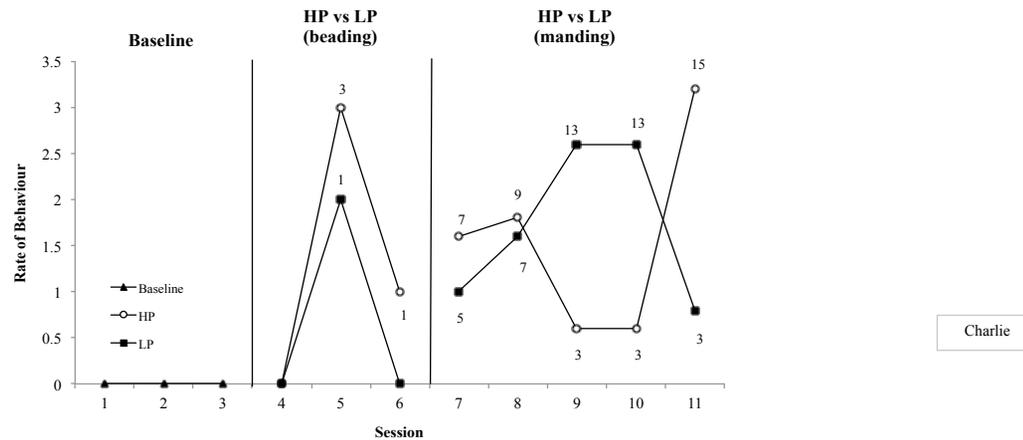
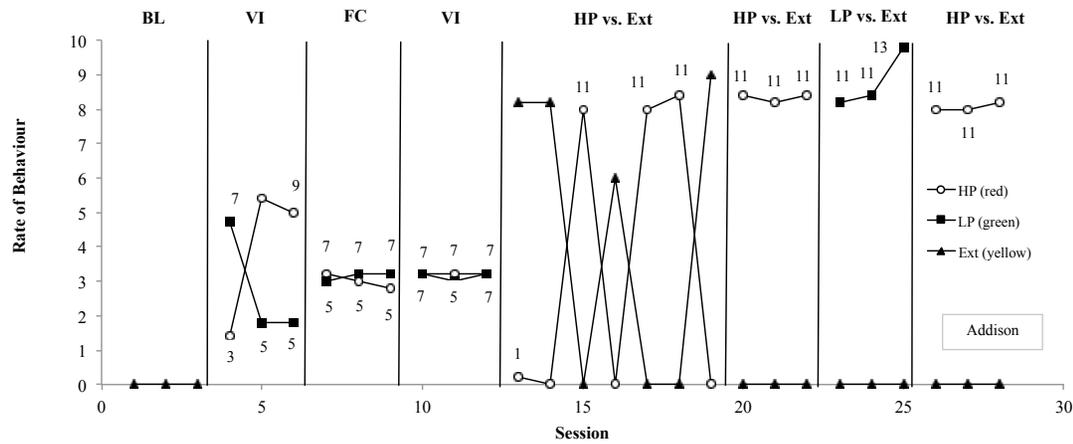
During sessions 13 to 19, Addison's selection responses were variable (i.e., back rubs (HP);  $M = 3.51$  responses per minute and extinction  $M = 4.49$  responses per minute). The experimenter analyzed the data and identified that the participant was allocating 100% of selection responses to the operant on the right-hand side regardless of the reinforcement contingency assigned to that position. At session 20, the experimenter changed the preparation and eliminated the space between the trays, thereby decreasing the effort to switch between operants. After the change to the arrangement, Addison engaged in differentiated responding across the final three phases. During sessions 20 to 22 and 26 to 28, Addison allocated all responses to the HP stimuli, demonstrating that the HP social stimulus was more reinforcing than the extinction condition (i.e., back rubs (HP);  $M = 8.2$  responses per minute and extinction  $M = 0$  responses per minute). During sessions 23 to 25, Addison allocated all responses to the LP social stimulus, demonstrating that the LP stimulus was more reinforcing than the extinction condition (i.e., dancing (LP);  $M = 8.8$  responses per minute and extinction;  $M = 0$  responses per minute). Overall, Addison's results demonstrated that access to either the HP or the LP social stimulus was more reinforcing than extinction. However, the manner in which the experimenter assessed the reinforcing value of the HP and LP social stimuli does not provide a comparison of the relative reinforcing value.

The bottom panel in Figure 3 shows the results of the reinforcer assessment for Charlie. During baseline, Charlie engaged in no responding across three sessions and the experimenter terminated all sessions after 1 min. Next, the experimenter transitioned to a concurrent-operants arrangement with a PR schedule of reinforcement. During this condition, Charlie engaged in near-zero levels of responding for both the HP and LP stimuli (i.e., chase (HP);  $M = 1.33$  responses per minute and tickles (LP);  $M = 0.67$  responses per minute). Due to Charlie's

behaviour of manding for the social stimuli before engaging in the beading task, the experimenter moved to a manding phase using a FR 1 schedule of reinforcement. During Sessions 7 and 8, Charlie engaged in a higher rate of responding for the HP social stimulus compared to the LP social stimulus (i.e., chase (HP);  $M = 3.4$  and tickles (LP);  $M = 2.6$  responses per minute). During session 9 and 10, Charlie engaged in a higher rate of responding for the LP stimulus compared to the HP social stimulus (i.e., chase (HP);  $M = 1.2$  responses per minute and tickles (LP);  $M = 5.4$  responses per minute). During the last session, Charlie again engaged in a higher rate of responding for the HP stimulus (i.e., chase (HP);  $M = 3.2$  responses per minute and tickles (LP);  $M = 0.8$  responses per minute). Anecdotally speaking, Charlie exclusively manded for chasing during the first three opportunities. After three trials with chasing during both sessions, Charlie appeared winded, laid down on the floor, and manded for tickles exclusively for the remainder of the session. It is possible that running temporarily decreased the value of chasing as a reinforcer (abolishing and abative effect) and/or temporarily increased the reinforcing value of tickles (establishing and evocative effect). Charlie transitioned to another service provider following the second phase of Charlie's evaluation. As a result, the experimenter is unable to make conclusions about the absolute or relative reinforcing value of tickles and chasing during Charlie's evaluation. However, it should be noted that Charlie manded for either tickles or chasing throughout the second phase of the evaluation suggesting that it is possible that those social stimuli functioned as reinforcers.

**Figure 3: Reinforcer assessment results for Addison and Charlie**

Reinforcer assessment data for Addison (top) and Charlie (bottom). Data are depicted as rate of responding with break points added beside data points when applicable. Note: BL = baseline, VI = verbal instructions, FC = forced choice, HP = high-preference social stimulus, Ext = extinction, LP = low-preference social stimulus. Note: For Addison the response materials were 1m apart in Phases 1 through 5 and side-by-side for Phases 6 through 8.



## **Chapter 4: Discussion**

The purpose of the current study was to evaluate a 3-step process for identifying reinforcing social interactions. The 3-step process included conducting the SIRF, a semi-structured interview, with a caregiver, a video-based preference assessment of social stimuli, and a reinforcer assessment. In the current study, the SIRF-informed, video-based preference assessment was effective for identifying a hierarchy of preferred stimuli for all participants. The experimenter conducted a subsequent reinforcer assessment, which yielded interpretable results for 1 of the 5 participants in which a reinforcer assessment was conducted.

The present study contributes to the current body of research in at least two ways. First, the experimenter used the SIRF, a semi-structured interview, to identify several social interactions to include in a subsequent preference and reinforcer assessments. The SIRF may be more useful than methods used in previous studies for identifying potentially preferred social interactions (Pastrana et al., under review). For example, Clay et al. (2013) selected three commonly delivered forms of social interactions without consulting caregivers. Selecting stimuli without collaborating with key stakeholders eliminates the opportunity to identify potentially more reinforcing social interactions and for caregivers to exclude certain social interactions from consideration based on their preferences and history with their child (e.g., hugs). The current study expanded on previous methods by utilizing the SIRF for identifying preferred topographies of social interaction. Another benefit of using the SIRF rather than informal methods is that the assessment is replicable by other researchers and clinicians in the future.

Second, the current study contributes to the literature by demonstrating an alternative method for assessing the preference for different social interactions. In previously published studies, the experimenters assessed preference for social interactions by (a) presenting several

pictures of social interactions and measuring selection responses (Kelly et al., 2014; Nuernberger et al., 2012), (b) using a single-operant arrangement in which participants engaged in a simple response to gain access to social interaction from the experimenter (Smaby et al., 2007), and (c) using a concurrent-operants arrangement in which participants engaged in a selection response when presented with pairs of therapists who delivered different social interactions (Clay et al., 2013). There are several drawbacks to the methods that experimenters have used in the past to evaluate preference for social interactions. One drawback of using pictures similar to that of Kelly et al., 2014 is that still shots of social interactions may not best portray the dynamic properties of social interactions. An alternative to pictures is presenting brief video clips of social interactions as used in the current study. The video-based preference assessments used in the current investigation were effective for producing a hierarchy of preferred social interactions.

A drawback of the method used by Clay et al., 2014 is that arranging pairs of therapists to be available for a preference or reinforcer assessment may be infeasible or impossible to arrange in home- or school-based settings in which personnel resources are limited. An alternative to using live models to deliver social interactions is to film brief-video clips of multiple social interactions. The videos can be stored and used in multiple assessments over time without requiring any additional personnel resources. Overall, the video-based preference assessment used in the current investigation yielded similar hierarchical results to other studies while addressing some of the methodological and practical limitations of methods used in previously published studies.

#### **4.1 Unexpected Findings**

There were a few unexpected findings in the study that are worth discussing. First, there was not a relative difference in the reinforcing value of the LP and HP social stimuli during

Addison's reinforcer assessment. There are a few possible reasons for this finding. One possible reason for both stimuli functioning as reinforcers is the manner in which the experimenter selected the social stimuli for inclusion in the preference assessment. It should be noted that the stimuli included in the reinforcer assessment were restricted to those included in the preference assessment. The experimenter selected social stimuli for the preference assessment based on the top six ranked caregiver-endorsed social stimuli from the SIRF regardless of the reported preference rating. For Addison, the social stimuli included in the preference and reinforcer assessments were endorsed by caregivers as "highly preferred". While a hierarchy in the percentage of selection responses was obtained during the preference assessment, it is possible that there was relatively little difference in the reinforcing value of the two stimuli assessed in the reinforcer assessment due to the experimenter's process for selecting stimuli for the preference assessment. In the future, researchers may consider including one or more neutral or non-preferred social stimuli to increase the likelihood of differentiation and achieving experimental control more quickly. A second reason there may not have been differentiation between the HP and LP social stimuli during the reinforcer assessment is the LP social interaction was likely more reinforcing than extinction when in competition with each other. Even LP stimuli can function as reinforcers in some contexts. For example, Francisco et al. (2008) found that participants' LP stimuli functioned as a reinforcer when evaluated separately from the HP stimuli, as well as when evaluated under an increasing PR schedule. Glover et al. (2008) obtained similar results, however, only under single-operant arrangement. The results of Francisco et al. (2008) and Glover et al. (2008) can be compared to the results obtained in the current study for Addison. Addison's LP stimulus functioned as a reinforcer under increasing

work requirements when paired with an extinction condition, demonstrating that her LP stimulus has some ability to maintain a previously mastered skill.

Similar to past studies, the current study found that, for some participants, both the HP and LP forms of social stimuli functioned as a reinforcer (Francisco et al., 2008, Glover et al., 2008). In both Francisco et al., 2008, Glover et al., 2008, and the current investigation, the experimenter evaluated the LP stimuli in isolation (i.e., a single operant preparation) or in comparison to extinction in some contexts. One possible explanation for the finding that the LP functioned as a reinforcer in those case is that accessing a LP stimulus is more reinforcing than contacting extinction (i.e., accessing something is more reinforcing than getting nothing at all).

The second unexpected finding was the identification of a position bias during Addison's reinforcer assessment. A position bias is a form of responding that is controlled by the position of a stimulus in relation to another stimulus or stimuli rather than the contingency in place (Bourret, Iwata, Harper, & North, 2012). Addison's position bias maintained over several sessions. To address the position bias, the experimenter modified the procedure by moving the response areas from 1 m apart to directly side-by-side. By eliminating the space between the two response areas, the experimenter decreased the response effort required to switch between the two options. The modification resulted in the elimination of the position and helped to obtained interpretable results.

## **4.2 Methodological Rigor**

The experimenter used a reversal design to conduct the reinforcer assessment in which different conditions are implemented and withdrawn across a series of phases. The goal is to establish a functional relation between the independent and dependent variables (i.e., establish experimental control). In the current study, the rate of response (dependent variable) was

measured for each participant and compared for available HP and LP social stimuli (independent variables). High preference and LP stimuli were available concurrently and participants were free to respond for either HP or LP stimuli during each session. The current study is unique because rather than being interested in if a particular treatment was more effective in changing a single behaviour, it investigated if rates of responding would be higher for a LP or a HP form of social stimuli.

A reversal design must consist of at least three successive phases: (a) baseline, (b) intervention, and (c) return to baseline. If possible four phases is favored, with an additional intervention phase where the treatment effects are repeated. For Isla, Becky, and Amy a reversal design was attempted, but abandoned due to their termination from the study. For Charlie, a reversal design was also attempted, but abandoned due to his leaving the centre-based program and experimental sessions no longer being possible. Addison started with a baseline phase (A) and next moved to a VI phase (B), with the goal of gaining greater separation a FC (C) phase was introduced, and then reversed back to another VI phase (B). Next the experimenter introduced a HP versus extinction phase (D) where a side-bias was discovered, then transitioning to another HP versus extinction phase (E) where the space between the response areas was eliminated. Last the experimenter introduced a LP versus extinction phase (F) and finally reversed back to a HP versus extinction phase with no space between the response areas (E). Thus, for Addison an ABCBDEF E multiple-treatment reversal design was implemented.

In a reversal design it is important that the dependent variable is truly reversible and that there are no carryover effects (e.g., the effects of one treatment carrying over into the next treatment). The current study reduced this concern by having the ‘treatments’ (e.g., availability of HP and LP social stimuli) available concurrently for most participants. For Addison, phases

were introduced where her HP stimulus was compared to extinction without her LP stimulus and vice versa. For these phases an argument could be made that there was potential for carryover effects of her HP stimulus to the phase with the LP stimulus and vice versa; however, keeping the extinction condition constant decreased the potential for any carryover effects, as well as there being 2-dimensional photos of the form of social stimuli available or a blank card for extinction clearly displayed above the response areas showing what was available for responding in that area. Additionally, verbal instructions were presented at the start of each session outlining what was available for responding in each area (e.g., “If you put beads on the red string you get back rubs and if you put beads on the yellow string nothing will happen”), again reducing the risk of carryover effects.

For a reversal design, it is also important to determine that removal of the independent variable does not raise any ethical (e.g., safety concerns around a problem behaviour), educational (e.g., withdrawing an intervention that increased learning), or social (e.g., reversing an intervention that made an individual socially successful) concerns that could place either the participant(s) or experimenter(s) at risk. In the current study, the behaviour being measured was rate of response to a previously mastered task and withdrawal of exposure to reinforcement (e.g., HP and LP social stimuli) was unlikely to pose any of these concerns.

### **4.3 Limitations of the study**

There is at least one major limitation of the study that warrants discussion. In retrospect, the experimenter selected social stimuli for inclusion in the preference assessment using a less-than-ideal process. Caregivers selected and ranked the top six preferred forms of social stimuli after scoring each social stimulus included on the SIRF. The experimenter included the top six ranked social stimuli during the subsequent preference assessment. For Addison and Charlie, all

six social stimuli included in the preference assessment were rated by caregivers as “highly preferred”, which may have contributed to the lack of differentiation for the LP and HP social stimuli during the reinforcer assessment. The method for selecting stimuli for the preference assessment may have made it more challenging for the researcher to demonstrate a relative difference in the reinforcing effect of the HP and the LP stimuli. In future research studies, researchers might consider including at least one social interaction endorsed as less preferred to increase the likelihood of obtaining differentiated results.

Another limitation of the study is that the experimenter did not include a measure of treatment integrity for baseline and extinction. Some videos of sessions were unavailable to score treatment integrity for baseline and extinction. Researchers should include a measure of treatment integrity for extinction in future research studies with similar preparations.

#### **4.4 Clinical Implications**

There are at least three implications that clinicians should consider based on the results of the current study. First, a researcher or clinician should consider the number of caregiver-endorsed social stimuli identified using the SIRF to determine if a preference assessment will likely yield clinically helpful results. In the current study, all of the social stimuli included in the preference and reinforcer assessment for 5 of the 6 participants were endorsed as either “somewhat preferred” or “highly preferred”. In contrast, Becky’s caregivers endorsed only two social interactions on the SIRF as “highly preferred” (i.e., tickles and peek-a-boo). Thus, caregivers rated 4 of the 6 social stimuli “neutral” or “somewhat preferred”. The family rated the majority of social stimuli as “somewhat non-preferred” or “neutral” and nine social stimuli as “aversive”. Furthermore, there was disagreement in the ratings of social stimuli between the parents and behavior interventionists. Becky did not engage in the target response (i.e., PECS

exchange) across four sessions during the reinforcer assessment. Therefore, participation in the study was terminated. In contrast, Charlie's family endorsing nine social stimuli as "highly preferred" and ten social stimuli as "aversive" on the SIRF. Therefore, all of the stimuli included in the preference and reinforcer assessment were endorsed as "highly preferred". Charlie readily mandated for both social stimuli during the reinforcer assessment. Based on the results obtained from Becky in relation to the other participants, clinicians should evaluate the results of the SIRF to determine the appropriateness of evaluating the preference for and reinforcing value of social stimuli. Rather than moving forward with a preference and reinforcer assessment, clinicians who obtain SIRF results similar to those obtained from Becky may consider implementing a behavioral intervention to increase the value of social interactions (e.g., response-contingent stimulus pairing, operant discrimination training). After such interventions are implemented, a clinical may revisit the SIRF to determine if caregivers' and interventions' endorsements change over time. If the perceived value of social interactions has increased, a clinical may consider moving forward with systematic preference and reinforcer assessments.

Second, a clinician should consider the current language repertoire of the learner to determine if systematic preference and reinforcer assessments are needed to identify reinforcers. In the current study Isla, Brody, and Amy were all typical learners with age-appropriate communication skills. All three participants readily interacted with the experimenter and spontaneously requested for the experimenter to engage in various activities (e.g., Amy asked to read a book with the experimenter). For typical learners who engage in age-appropriate communication and social behavior, the current protocol may be unnecessary and clinically contraindicated. In the future, researchers could investigate having typical learners choose the form of social stimuli they would like to engage in upon schedule completion, rather than relying

on the results of a previously conducted preference assessment. The reason this may be a useful option is because the typical child's language skills allow them to mand for social interactions based on momentary changes in motivation. Also, the typical learners who participated in this study were quite young (e.g., 3 years old) and had not been exposed to either a preference or a reinforcer assessment previously. In a future study, researchers could present a selection of social stimuli to participants upon schedule completion and have them choose the form of social stimuli that they would like to engage in at that moment. Researchers could track each participant's schedule completion and which form of social stimuli they select in order to determine if a particular form of social stimuli is more preferred over others. Researchers may also consider teaching new skills and reinforcing behavior on an FR 1 schedule when working with typical individuals. This could reduce confusion if participants have not been exposed to a preference or reinforcer assessment before, where access to stimuli is delayed.

Preference is continuously changing and momentary changes in establishing operations may be better identified in the moment, rather than in preference assessments conducted earlier in time (Leaf et al., 2015). For example, Leaf et al. (2015) found that reinforcing value of the stimuli identified from in-the-moment preference assessments functioned were as or more potent compared to a more comprehensive paired-choice preference assessment conducted beforehand. This finding warrants further investigation into the reliability of in-the-moment preference assessments, as paired-choice preference assessments can be time consuming. However, until there is further evidence that in-the-moment preference assessments reliably identify reinforcing stimuli it is important that clinicians continue to use evidence-based methods to identify reinforcing stimuli.

Finally, a clinician should take the purpose of using the reinforcer (e.g., teaching a new skill or maintaining a previously mastered skill) into account when choosing the schedule of reinforcement to include in a study. In the current study, a PR schedule was implemented to approximate a schedule of reinforcement that is being thinned or a skill that is reinforced on a maintenance schedule. Skills included in reinforcer assessments are commonly mastered skills that are reinforced on a FR1 schedule of reinforcement (DeLeon et al., 1997). However, in clinical practice, it may be more functional to identify stimuli that function as reinforcers under increasing work requirements as this more closely mimics the natural environment.

#### **4.5 Conclusion**

Preference assessments are used to identify stimuli, which may function as reinforcers (Fisher et al., 1992; Kodak et al., 2009; Pace et al., 1985). In the past, preference assessments have primarily been conducted to identify preference for tangible and food stimuli. However, there are drawbacks to both of these classes of stimuli as tangible stimuli may be inconvenient to transport and use of food stimuli raises health concerns for some clients (Clay et al., 2013). Social stimuli are portable, may be less stigmatizing in community- and school-based settings than tangibles and edibles, and raise no health concerns. The current study extended the current literature by using a 3-step process for identifying reinforcing social interactions for children with ASD and by demonstrating the effectiveness of a more practical and feasible way to conduct preference assessments of social interactions.

The current study was not successful in identifying a functional relation between the level of preference for social stimuli identified in a video-based preference assessment and the rate of responding and/or break points for HP and LP social stimuli. Future research should pursue the

3-step process introduced in the current study, while also addressing the limitations discussed above.

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**Appendices**

**Appendix A Reinforcer Assessment Data Sheet**

Date/Data collector initials: \_\_\_\_\_ Session length (minutes): \_\_\_\_\_

Participant number: \_\_\_\_\_ Session number: \_\_\_\_\_

Circle one: Primary      Reliability Integrity Circle one: Baseline      Intervention

Schedule	HP (tally)	SR	LP (tally)	SR
FR1				
FR3				
FR5				
FR7				
FR9				
FR11				

Rate/break point calculation

IOA calculation (break point and rate)

## Appendix B Social Interactions Rating Form (SIRF)

Date: \_\_\_\_\_

Participant: \_\_\_\_\_

Recorder: \_\_\_\_\_

### General Instructions for Interviewer:

The purpose of the SIRF is to identify preferred social interactions for use in your students' educational programs. Caregivers will be asked to rate their child's preference for each interaction on a scale of 1 to 5. At the end of the interview, ask caregivers to provide information about preferred social interactions not included on the SIRF, if applicable. The purpose of the open-ended questions is to ensure a sufficient sample of potential reinforcers in case the standard set of social interactions included in the SIRF did not capture participant preferences.

Ask caregivers to describe the conditions under which each social interaction is preferred (e.g., specific information about preferred topics or jokes, how and where their child enjoyed being chased, whether the gender of the person delivering the interaction affected its reinforcing value). It is also important to ensure the social interactions are both appropriate and feasible for teachers or behavior interventionists to deliver (e.g., considering age, size, and setting).

### General Information:

Gender: Does the gender of the person providing attention affect the reinforcing value of attention?	Yes or No	Details:
Are there physical features of a person that make them less or more reinforcing? Examples – Hair color or cut/style, scents/smells, clothing, etc.	Yes or No	Details:
Peers: Is attention from peers reinforcing? If so, what types of attention are reinforcing when delivered by peers?	Yes or No	Details:
Other:		

### Please rank order the top six forms of attention identified below.

(1 = most preferred and 6 = least preferred):

1	4	
2	5	
3	6	

Use the following rating scale to assist caregivers in rating their child's preference for each interaction:

1 = Aversive 2 = Somewhat non-preferred 3 = Neutral 4 = Somewhat preferred 5 = Highly preferred

Interactions with Physical Contact		
Topography	Preference Level	Additional Information
Hugs	1 2 3 4 5	
Tickles	1 2 3 4 5	
Head rubs	1 2 3 4 5	
High fives	1 2 3 4 5	
Back pats or rubs	1 2 3 4 5	
Noodle arms	1 2 3 4 5	
Pick up and twirl	1 2 3 4 5	
Hold hands and spin	1 2 3 4 5	
Interactions without Physical Contact		
Topography	Preference Level	Additional Information
Clapping	1 2 3 4 5	
Eye contact	1 2 3 4 5	
Thumbs up	1 2 3 4 5	
Dancing	1 2 3 4 5	
Facial expressions Please list:	1 2 3 4 5	
Chasing games	1 2 3 4 5	
Peek a Boo	1 2 3 4 5	
Imitation game	1 2 3 4 5	
Hide and seek	1 2 3 4 5	
Verbal		
Topography	Preference Level	Additional Information
Verbal praise	1 2 3 4 5	
Jokes	1 2 3 4 5	
Singing	1 2 3 4 5	
Conversation about a preferred topic	1 2 3 4 5	
Funny sounds	1 2 3 4 5	
Humming	1 2 3 4 5	
Please list any other preferred forms of attention not listed above		
Topography	Preference Level	Additional Information
	1 2 3 4 5	
	1 2 3 4 5	