Evaluating Preference Stability Across Psychotropic Medication Changes in Persons with Intellectual and Developmental Disabilities

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Abstract

Research in applied behaviour analysis evaluating psychotropic medication impact on persons with intellectual and developmental disabilities (IDD) is relatively limited (Cox & Virués-Ortega, 2016). Even though evidence supporting the efficacy of psychotropic medication in treating challenging behaviour has been described as controversial, an Ontario study reported between 39% to 56% of adults with IDD are prescribed at least one psychotropic medication (Lunksy et al., 2018). The overall prevalence of medication use within this population, combined with the lack of research showcasing efficacious outcomes, suggests that further evaluation of psychotropic medication impacts is required. Behaviour analytic researchers have hypothesized that psychotropic medications may function as motivating operations (Conine & Vollmer, 2019). Therefore, it may be important to systematically monitor clinically indicated medication changes for their effect on an individuals preference stability, as well as on stimulus class displacement. Two participants with IDD who engage in challenging behaviour and were undergoing medication changes (e.g., medication increases, decreases, addition, and removal) took part in repeated weekly preference assessments (edible-item, leisure-item, and combined-class). Analysis included a Spearman rank correlation analysis, a non-parametric partial correlation analyses, and visual analysis to these data. Results indicated that psychotropic medication changes appeared to affect non-selection, preference stability, and class displacement differentially across the two participants. Clinical implications, limitations, and future directions are discussed.

Keywords: intellectual and developmental disability, psychotropic medication, behavioural medicine, preference assessment, motivating operations

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Demographic research reports that up to 50% of persons with intellectual and developmental disability (IDD) engage in challenging behaviour (Sheehan et al., 2015). Treatment options often include psychopharmacological interventions, behavioural interventions, or combined approaches. Psychopharmacological interventions include the prescription of psychotropic medications; described as chemical substances that cross the blood-brain barrier and act upon the central nervous system which can alter mood, thought processes and behaviour (Kolb & Whishaw, 2009). Behavioural interventions may be described as the systematic manipulation of environmental variables to produce effective and reliable behaviour change (Cooper et al., 2020). Finally, combined interventions are often described as the concurrent application of psychopharmacological and behavioural interventions (Sawyer et al., 2014).

Some behaviour analytic researchers have suggested that psychotropic medications may act as motivating operations, in that they can alter the effectiveness of stimuli as reinforcers or punishers (Carlson et al., 2012; Zarcone et al., 2004). Thus, an individual's experience with environmental variables and stimuli, such as foods, toys, items, or activities, may change (i.e., preference instability) in accordance with a psychotropic medication adjustment (i.e., medication increases, medication decreases, medication introduction, or medication discontinuation). In fact, early research initiatives exploring the impact of stimulant medications (e.g., methylphenidate [MPH]) demonstrated that stimuli reinforcer effectiveness, and related individual preference, may change in association with medication adjustments (Northup et al., 1997; see also Dicesare et al., 2005; Neef et al., 2005; Northup et al., 1999).

From a behaviour analytic perspective, it is important to continue exploring whether psychotropic medications affect preference because the effectiveness of function-based behavioural interventions and skill training rely heavily on whether practitioners have correctly identified clients' preferred stimuli (e.g., activity, item, food) (Sawyer et al., 2014). Beyond stimulant medications, researchers have yet to explore whether psychotropic medication adjustments affect preference stability (Carlson et al., 2012; Valdovinos & Kennedy, 2004; see also Valdovinos, 2019). The current project investigated the effects of psychotropic medication adjustments on preference stability, stimulus class displacement, and non-selection on individuals with IDD who engage in challenging behaviour and are undergoing "clinically indicated" psychotropic medications adjustments[1].

Challenging Behaviour and Intellectual and Developmental Disability

Intellectual disability (ID) is characterized as a neurodevelopmental disorder present during childhood that is marked by deficits in intellectual and adaptive functioning that significantly impact the persons quality of life (American Psychiatric Association [APA], 2013). Developmental disability is characterized as a cognitive and adaptive impairment that impacts an individual's learning and language ability, as well as their behaviour regulation (APA, 2013). Often both can negatively affect an individual's development in a variety of capacities. I used IDD as an inclusive term to capture both intellectual and developmental disabilities.

As alluded to above, multiple studies have reported up to 50% of persons with IDD also engage in challenging behaviour (Benson & Brooks, 2008; Poling et al., 2017; Sheehan et al., 2015). As per Ontario's Quality Assurance Measures (2008), challenging behaviour can be defined as "behaviour that is aggressive or injurious to self or to others or that causes property

[1] All medication changes including increases, decreases, additions, and withdrawals were at the discretion of the prescribing physician and was not influenced by the research team.

damage or both that limits the ability of the person with a developmental disability to participate in daily life activities and in the community or to learn new skills" (p. 6). Challenging behaviour topography can vary. Some examples include (a) self-injurious behaviour, (b) sexually inappropriate behaviour, (c) physically aggressive behaviour, and (d) property destruction. It may also present at various levels of severity (Fahmie & Iwata, 2011; Lowe et al., 2007; Poppes et al., 2010). For example, some individuals engage in mild self-injury in the form of slapping their arms and chest or biting their hands and ankles resulting in negligible tissue damage (Lindgren et al., 2020). By contrast, severe self-injury may result in deep lacerations to the head or cause internal injuries to vital organs requiring immediate medical attention (Foxx, 2003).

Treating Challenging Behaviour with Behavioural Interventions

In behaviour analysis, best practice recommendations suggest researchers, and clinicians, start by conducting an experimental functional analysis (EFA) to determine the contingencies maintaining challenging behaviour (also called "behaviour function"; Beavers et al., 2013). In this assessment, a clinician will conduct test conditions that evoke the challenging behaviour (test conditions) and control conditions that do not evoke the challenging behaviour. This approach affords the demonstration of experimental control and confirms maintaining variables (i.e., behaviour function; Beavers et al., 2013; Iwata et al., 1982/1994). Typically, there are three assessment test conditions often referred to as alone (or ignore condition), demand, and attention. In the alone condition, the client (participant) is monitored in a room without access to preferred items, minimal sensory stimulation, and minimal interaction from the researcher (clinician). The researcher will then record data on instances of challenging behaviour. The demand condition consists of the researcher delivering instructions presented consecutively. If the participant does not initiate task completion within 3 s to 5 s, the researcher will use least to most prompting to

assist the participant in task completion. If the participant engages in the challenging behaviour the researcher will remove all tasks and provide a 30 s break before re-administering an instruction. During the attention condition, the participant will have access to two or three moderately preferred items while the researcher tells the participant that they are going to do some work and will not be interacting with them. If the participant engages in the target behaviour, the researcher will provide 30 s of attention before returning to their work. Typically, the control condition consists of providing the participant with free access to preferred items, no instructions are delivered, and researcher attention is provided at least every 30 s. This condition is set to produce low rates of challenging behaviour. Running test and control conditions in a multi-element format typically illuminates behaviour function (Iwata et al., 1982/1994).

Researchers use EFA outcomes to select an intervention that matches behaviour function; also referred to as a "function-based" intervention (Cooper et al., 2020). In fact, research suggests that using information gathered from an EFA to inform an intervention can result in better treatment outcomes (i.e., reduced challenging behaviour) compared to non-function-based interventions. That is, interventions that were not developed in response to EFA outcomes (Beavers et al., 2013; Hanley, 2012; Hanley et al., 2003). Namely, Heyvart et al. (2014) conducted a meta-analysis of published behavioural interventions from 1999 to 2012 to decipher key intervention aspects contributing to challenging behaviour reduction. The authors found a statistically significant relationship between function-based intervention and challenging behaviour reduction. Function-based interventions typically aim to reduce challenging behaviour while simultaneously increasing alternative appropriate responding. For example, in a case where an individual appears to engage in challenging behaviour to access preferred activities or items, a function-based intervention may target teaching functional communication responses to

access the preferred outcome (Greer et al., 2016). If events, such as psychotropic medication changes alter participant experiences with environmental stimuli (e.g., shifting preferences unbeknownst to the researcher/practitioner) behavioural treatment efficacy may be compromised.

Treating Challenging Behaviour with Psychotropic Medications

Psychotropic Medication Treatment Efficacy

Existing research examining psychotropic medication efficacy in the treatment of challenging behaviour reports inconsistent outcomes. For example, Tyrer and colleagues (2008) recruited 86 participants who displayed challenging behaviours and were diagnosed with intellectual disabilities. Participants were randomly assigned to placebo, atypical antipsychotic (risperidone), and typical antipsychotic (haloperidol) groups for challenging behaviour reduction. Researchers measured challenging behaviour by having blind raters administer the Modified Overt Aggression Scale (Ratey & Gutheil, 1991) and the Aberrant Behaviour Checklist (Aman et al., 1985) to participant caregivers. Notably, the largest decrease from baseline by a 79% reduction in challenging behaviour was the placebo group, followed by a 65% reduction from baseline for haloperidol, and a 58% reduction from baseline for risperidone. The authors suggested re-evaluating the routine procedure of prescribing psychotropic medication early in treatment for challenging behaviour due to the indication that aggressive challenging behaviour appears to decrease regardless of medication status (Tyrer et al., 2008).

By contrast, Shea et al. (2004) showed that atypical antipsychotics were effective in producing lower rates of challenging behaviour in children with a pervasive developmental disorder. The authors employed a randomized, double blind, placebo-controlled trial to evaluate the efficacy of risperidone compared to placebo using the Aberrant Behaviour Checklist in 79 children. Notably, the largest change from baseline by a 64% improvement on the irritability

subscale was observed in those receiving the atypical antipsychotic (risperidone), compared to a 34% improvement of those in the placebo group. Additionally, 87% of those who received risperidone showed a marked improvement across all subscales of the Aberrant Behaviour Checklist (Aman et al., 1985) compared to 40% of those in the placebo group.

These results, along with others, do not corroborate the conclusions drawn by Tyrer et al. (2008) and thus fuel the debate regarding psychotropic medication efficacy in addressing challenging behaviour in persons with IDD (Aman et al., 2002; Deb et al., 2015; Fallah et al., 2019; Singh et al., 2005; Shea et al., 2004; Valdovinos et al., 2016). This debate is further amplified by widely variable methodological design rigour employed across studies. For example, Shedlack et al. (2005) evaluated psychotropic medication impact retrospectively, used raters who were not blinded to medication condition, and relied on the Aberrant Behaviour Checklist (Aman et al., 1985) and the Global Assessment of Functioning Scale (Goldman et al., 1992) to evaluate psychotropic medication impact. The authors concluded that there were significant differences between medication groups as identified by the indirect assessments conducted. These authors showcased an inherently weaker design compared to those studies described above.

Although randomized clinical trials are observed in the literature, their methodological rigour has been questioned regarding their applicability in the psychological disciplines (Slade & Priebe, 2001; Wykes et al., 2008). Further, randomized control trials featuring polypharmacy (taking more than one psychotropic medication concurrently) for the purpose of challenging behaviour reduction are extremely scarce, which calls into question their efficacy and utility as they are the gold standard to which researchers evaluate medication efficacy (Wykes et al., 2008). Thus, the evidence-base for the efficacy of polypharmacy in the treatment of challenging

behaviour in persons with IDD has been described as relatively poor (Lunsky et al., 2018; Snyder et al., 2002). The lack of research may be problematic given that 4 to 70% of individuals with IDD who are taking psychotropic medications are receiving more than one (i.e., polypharmacy; Fleischhacker & Uchida, 2014; Ito et al., 2005). One inherent issue with systematically evaluating polypharmacy includes the combined effects from multiple antipsychotic medications making it difficult to discern reliable effects on challenging behaviour. Taken together, the likelihood of polypharmacy combined with the lack of evidence-base for the efficacy of polypharmacy makes further evaluating psychotropic medication effects extremely important. However, the possibility of evaluating and recruiting participants with similar individual characteristics with all possible medication combinations prescribed to persons with IDD to treat challenging behaviour is extremely difficult.

Single-case Experimental Design Research. Single-case experimental designs (SCED) are characterized by experimentally manipulating an independent variable and conducting repeated measurements of the dependent variable before and after introducing the independent variable (Baer et al., 1968; Ledford & Gast, 2018). Data collected in research featuring SCED can be analyzed by both visual analysis and statistical methods, where appropriate (Kumar De et al., 2020). Visual analysis has been described as a systematic process to facilitate evaluating data trends and patterns to determine if the manipulation of the independent variable produced reliable responding in the dependent variable (Ledford & Gast, 2018). Given methodological flexibility and reduced sample size requirements, SCED may offer a viable solution to barriers associated with group design (e.g., finding a large enough, uniform sample of participants) in the current context. Unfortunately, research featuring SCED to explore medication impact on challenging behaviour in persons with IDD are rarely published (i.e., approximately 56 articles in

the last 20 years) and, are typically of poor methodological quality (Khokhar & Cox, in press). Further exemplifying the general absence of research exploring psychotropic medication effects on challenging behaviour in persons with IDD.

Psychotropic Medication Prevalence

Psychotropic interventions continue to be commonly used in practice to address challenging behaviour in persons with IDD, despite psychotropic medication research suggesting equivocal outcomes (Bowring et al., 2017; Sheehan et al., 2015; Valdovinos, 2019). Unfortunately, evolving technology, increased research demonstrating the efficacy of behavioural interventions, and increased access to behaviour analytic support for some clinical populations have done little to reduce psychotropic medication reliance. In fact, some researchers have reported that up to 90% of individuals with IDD are receiving psychotropic medication as a treatment for challenging behaviour (Deb et al., 2015). In addition, it appears psychotropic medication use has been on an upward trajectory (Valdovinos et al., 2003). That is, Valdovinos et al. (2003) reported a prevalence rate of 30% to 56% in the 1990s, while more recent estimates of 49% to 71% have been reported.

In Canada, Dr. Yona Lunksy and her colleagues (2018) evaluated the prescription practices of psychotropic medications in 51, 881 adults with IDD between 2010 and 2016 residing in Ontario, Canada. Of the adults featured in the study, approximately 39% (roughly equating to two in five adults with IDD) were dispensed at least one antipsychotic medication, with numbers reaching 56% in those living within residential settings. These medication trends in this study reflected prescription practices similar to those reported by Valdovinos et al. (2003). Unfortunately, Lunksy et al. (2018) also indicated that there was is a slight increase of psychotropic medication prescriptions from 2010 to 2016. That is, antipsychotic prescriptions for

adults with IDD was reported as 29% of the population in 2010 and increased to 31% in the population in 2016, with antipsychotic prescriptions for those who live in residential settings increasing from 48% to 51%, respectively. Of those who were prescribed antipsychotics, the median of polypharmacy in these adults was seven psychotropic medications. The authors reported that 84% of all medication prescriptions were for atypical antipsychotics, with quetiapine (29%), risperidone (25%), and olanzapine (21.8%) being some of the most common prescriptions (Lunsky et al., 2018).

The reliance on psychotropic medications to treat challenging behaviour in persons with IDD means that behaviour clinicians will almost certainly be supporting individuals who are taking psychotropic medication as a form of treatment. In fact, Li and Poling (2018) recently surveyed 253 Board Certified Behaviour Analysts (BCBA®) and found that respondents indicated that nearly 90% of their clients were taking one or more psychotropic medication(s). So, it is imperative that researchers conduct empirical study on the behavioural affects of psychotropic medications in this population.

Psychotropic Medication Properties

Psychotropic medications exert many effects produced via interaction through bodily systems (Poling & Byrne, 2000a). Among others, neurotransmitter activity is impacted by psychotropic medication, which may affect how an individual experiences their environment. It is possible to suggest that the way we experience reward, punishment, satiation, and deprivation may be directly influenced by psychotropic medication administration because the same neurotransmitter systems targeted by psychotropic medications are involved in the basic human reward and punishment pathways (Couppis & Kennedy, 2008). In fact, a large body of basic literature suggests the dopaminergic and serotoninergic neurotransmitter systems impacted by

psychotropic medications may directly affect the pathophysiology of these neurotransmitter systems (Tielbeek et al., 2018). Specifically, it has been suggested that the D2-D4 receptors within the dopaminergic system have a moderate to high affinity for antipsychotic medication (Abi-Dargham & Guillin, 2007; Laruelle, et al., 2005). Further, Couppis and Kennedy (2008) examined dopamine receptors within the nucleus accumbens in relation to the reinforcing effects of aggressive behaviour in mice. The authors found that different dosage injections of D1 and D2 antagonists (medication) decreased responding in aggressive behaviour that was previously reinforcing (examples of aggressive behaviour included boxing, biting, tail rattles, and sideways threat). This basic research demonstrates that the dopamine receptors in the mesocorticolimbic areas of the brain, which are involved in reward processes, can be impacted by psychotropic medication administration (Couppis & Kennedy, 2008).

Large concentrations of receptors with a mild to high affinity for antipsychotic medication are found in the orbitofrontal cortex, medial prefrontal cortex and the dorsal anterior cingulate (O'Doherty et al., 2002). All three of these parts of the brain have been associated with punishment and reward pathways (O'Doherty et al., 2002). Specifically, it has been suggested that the magnitude of dopamine activations is directly related to the size of the rewarding or punishing stimuli (O'Doherty et al., 2002). If this is true, it may be reasonable to hypothesize that psychotropic medication may influence the way in which individuals interact with everyday stimuli. This hypothesis is important when considering the application of preferred and punishing stimuli within a behaviour intervention plan as stimuli that were once effective reinforcers or punishers may no longer be.

Psychotropic Medications, Motivating Operations, and Preference

The basic research outcomes described above may be corroborated by qualitative research conducted with human participants examining the subjective effects of psychotropic medication. Specifically, at times human participants have indicated they no longer enjoy engaging in activities they once did after initiating or adjusting a psychotropic medication regime (Carrick et al., 2004; Larsen & Gerlach, 1996; Rogers et al., 1998). In considering this qualitative research, behaviour analytic researchers have been examining the theory that psychotropic medications may act as a motivating operation – and thus may shift preference or possibly affect stimuli reinforcer effectiveness (Carlson et al., 2012). For example, Northup et al. (1997) indicated that MPH status (presence or absence) may temporarily increase (or decrease) the reinforcing effectiveness of stimuli. Specifically, the authors evaluated the reinforcing effectiveness of previously neutral stimuli (i.e., math problems) paired with a highly preferred reinforcer (edibles or activities) in three young boys with autism and attention deficit hyperactivity disorder (ADHD). Participants were either administered MPH or a placebo pill. Northup et al. conducted repeated reinforcer assessments. When the placebo was administered to one participant, they were more likely to complete math problems to earn edible reinforcers as opposed to the MPH condition. In contrast, the other participant when administered MPH, completed more math problems to earn activity reinforcers compared to the placebo condition. They concluded that MPH (stimulant) may have altered stimuli reinforcer effectiveness, as the participants were more or less likely to select edible versus activity reinforcers depending on medication condition. Dicesare et al. (2005) replicated and extended Northup et al. (1997, 1999) results in a young adult with autism and ADHD. The authors conducted multiple EFAs during medication administration of MPH and no-MPH and found that MPH administration was associated with a decrease in responding during the attention condition. They concluded that

MPH may be associated with a decrease in the relative reinforcing effectiveness of attention (Dicesare et al., 2005). In general, literature evaluating the impact of psychotropic medications on reinforcer effectiveness is scarce (e.g., Cox & Virues-Ortega, 2016), while research on preference stability in the context of psychotropic medication adjustments is essentially non-existent (Carlson et al., 2012).

Preference Assessments and Variables that Impact Outcomes

In applied behaviour analysis, research assessing preferred and reinforcing stimuli has been an area of interest for many years. Fisher et al. (1992) were among some of the early researchers systematically evaluating preference in individuals with IDD. Since then, researchers have worked diligently to refine these processes to improve assessment accuracy (e.g., Conine & Vollmer, 2019; Hagopian et al. 2004; Hanley et al. 2003; Karsten et al., 2011), as well as explore how environmental and physiological variables may differentially impact outcomes (Leaf et al., 2019). For example, Sy et al. (2009) explored how pre-session access to edible and non-edible reinforcers impacted response rates during sessions. These authors manipulated motivating operations by establishing different states of deprivation across participants to determine whether preference was impacted by this momentary manipulation. This situation may approximate how psychotropic medication may impact preference. Although psychotropic medication may impart more lasting effects on motivating operations compared to Sy et al. (2009) temporary effect (i.e., pre-session access) when considering medication "half-life" (i.e., the length of time it takes for medication to be reduced by half in the bloodstream; Broder et al., 2012).

Reinforcer Displacement Theory

As noted above, Sy et al. (2009) offered an example of a study demonstrating the temporary effects of motivating operations on reinforcer effectiveness. In their experiment,

different durations of presession exposure differentially affected a stimulus' effectiveness as a reinforcer. This information may suggest participant preference selections informed by preference assessment, used by clinicians and researchers in behaviour analysis, may be impacted by motivating operations. Hence, if psychotropic medications do function as motivating operations one may see lasting effects on preference selection responses, which may be captured by conducting repeated preference assessments across medication phases. In the context of assessing preference, additional factors may influence preference selection such as the type of stimuli in the array (Carter & Zonneveld, 2020). For example, a concept formally referred to as stimuli class displacement, or displacement, can be described as the extent to which an individual's preferred items are from one class of stimuli over another (Carter & Zonneveld, 2020; DeLeon et al., 1997). DeLeon et al. (1997) was one of the first to explore the extent to which food items might displace leisure items in humans by separately assessing food and leisure items—then combining all items in a final preference assessment (i.e., combined preference assessment). They found that food displaced leisure items in twelve of the fourteen participants with IDD.

This phenomenon was further evaluated by Bojak and Carr (1999). These authors also explored motivating operation impact on displacement. They aimed to discern a possible reason for displacement. Namely, if mild food deprivation impacted the selection of edible stimuli. Bojak and Carr conducted two preference assessments (multiple stimulus without replacement) with eight edible stimuli, two with eight leisure stimuli, and one final assessment using the top four stimuli from each stimulus class (edible and leisure). All four participants displaced food items with leisure items. Interesting, pre and post mealtimes did not impact displacement patterns. That is, participants continued to displace leisure with edible regardless of food

deprivation status. The authors suggested future research should further investigate motivating operations influencing displacement of leisure stimuli with edible stimuli (Bojak & Carr, 1999).

More recently, Conine and Vollmer (2019) evaluated stimuli class displacement in young children with ASD following similar methodology to DeLeon et al. (1997). Of the 26 participants, 17 displaced leisure stimuli with edible stimuli (65%). However, only six of the 17 participants showed complete displacement (the entire stimuli class displacing another), whereas the remaining 11 participants did not (e.g., 3 of the 4 top ranked stimuli were one class). The authors suggest a few possible explanations for their findings, including psychotropic medication prescription. Specifically, they refer to previous studies that demonstrated food more often displacing leisure stimuli (e.g., Bojak & Carr, 1999) but, that those studies evaluated preference in adult populations where the likelihood of psychotropic medication prescription are typically greater compared to that of children (Valdovinos et al., 2019). Ultimately, Conine and Vollmer (2019) suggested evaluating the effects of motivating operations on displacement in preference assessments due to the possibility of psychotropic medications acting as motivating operations.

Missing Data

Another scarcely discussed phenomenon in behaviour analysis is missing data; often conceptualized as "missing cases of data" and calculated as the percentage of sessions where data was missing (Dong & Peng, 2013). Notably, when authors do report missing data in SCED research, it is commonly observed (Dong & Peng, 2013). In fact, a review of educational research reported that of the studies that recorded missing data, missing case percentages ranged from 1 to 67 (Peugh & Enders, 2004; Dong & Peng, 2013). Specific to behaviour analysis, Peng and Chen (2018) found that 24% of articles in five major behaviour analytic journals reported missing data with another 7% having insufficient information to indicate if missing data was

present or not. Unfortunately, reporting missing data in the context of evaluating drug-behaviour interactions via SCED is essentially non-existent; albeit missing data is not often the focus of a study. However, failing to address, acknowledge, or remedy missing data threatens internal validity and is often a source of bias (e.g., attrition; Ledford & Gast, 2018). That is, study conclusions are rendered less believable, while generalizability is weakened (Peng & Chen, 2018). Presently, SCEDs do not accommodate for missing data well. For example, according to Chen (2015) in the context of experiments featuring SCEDs, "missingness" is often handled by (a) deleting missing data (e.g., deleting cases listwise), (b) omitting missing sessions (or participants with missing data), or (c) replacing missing data with zero. By contrast, statistical analyses for group designs have a myriad of missing data replacement strategies to call on (e.g., mean substitution, last observation carried forward, multiple imputation; Baraldi & Enders, 2010; Dong & Peng, 2013).

By handling missing data through deletion or omission the remaining data may misrepresent the phenomenon being evaluated. That is, resultant conclusions generated may be unreliable. Moreover, the sample datasets may not be representative of the participant population (Peng & Chen, 2018). In other words, the participant pool (i.e., study sample of persons with IDD) may not actually be representative of the targeted clinical population (i.e., all persons with IDD) because participant datasets were excluded based on data 'missingness' rather than any a priori rationale. Research and development in this area are ongoing to promote the most reliable approach to replacing missing data in SCED (Baraldi & Enders, 2010; Dong & Peng, 2013; Grund et al., 2021; Madley-Dowd et al., 2019).

Missing Data and Preference Assessment Literature. Regarding preference assessment research, this topic is also largely neglected with very few articles generating

protocols to address missing data in the form of non-selection (i.e., missing data; Dong & Peng, 2013; Kumar De et al., 2020; MacNaul et al., 2020). Missing data may result from human error or systematic noncompliance (Smith, 2012). While human error is self-explanatory (e.g., forgetting to record data without having the ability to re-record data), systematic noncompliance may be described as an element of the way a protocol is run or developed that cannot effectively account for missing data (Kumar De et al., 2020; Smith, 2012). In the context of preference assessments, systematic noncompliance may be observed when the participant refuses to select an item (i.e., non-selection) from the array of stimuli presented during the assessment, and no a priori protocol has been established to address this issue.

As an example, Melanson (2021) analyzed preference stability of multiple stimulus without replacement (MSWO) assessments in children between the ages of 2-5 years old with ASD. The authors had originally recruited 25 participants. However, 12 (48%) children were excluded due to videos no longer being accessible and "occurrences of non-selection" (i.e., the child did not select a stimulus from the preference assessment array). For some children, challenging behaviour prohibited selection responses. Unfortunately, the authors did not categorize exclusion due to missing videos versus non-selection. Regardless, omitting or excluding up to 48% of the participants based on systematic non-compliance (non-selection) exemplifies the issues described above (Peng & Chen, 2018).

Methodology that cannot incorporate participants who engage in non-selection means a subset of the clinical population (persons with IDD) may not be represented in existing preference literature. If missing data (cases) in SCED is as prevalent as previously mentioned by Peng and Chen (2018), then upwards of a quarter of the target population (i.e., persons with IDD) may be unrepresented. This could mean that what behaviour analysis knows about

preference and preference stability cannot be applied to 25% of the clinical population. Practically, this could mean accurate preference outcomes may remain elusive for clients befitting this population subset (i.e., those who engage in non-selection). Moreover, because this group may be largely excluded, few protocols describing how to address non-selection have been established. That is, MacNaul et al. (2020) conducted a recent review of the preference stability literature. Of the 20 articles meeting their inclusion criteria, only Call et al. (2012) outlined a clear protocol for handling non-selection responses. Specifically, after three trials of non-selection responses in an MSWO assessments, the remaining items were given equal ranking that averaged the remaining rankings. For example, if bubbles, play catch, and read a book were all not selected and there were six items in the MSWO, each stimulus (bubbles, play catch, and read a book) was denoted with a rank of 5 (4 + 5 + 6 = 15, 15 / 3 = 5).

Call et al. (2012) was the only experiment that fully described non-selection from the initial presentation of the stimuli. Further, none of the papers in the review reported on missing data or cases status due to non-selection. Therefore, it is possible their results may have been affected by non-selection (e.g., excluding participants, omitting sessions) (MacNaul et al., 2020).

Study Rationale Summary

It is important to better understand the impact that psychotropic medication adjustments may have on preference because in designing a behaviour analytic treatment program, clinicians and researchers rely on having the correct rewarding and punishing stimuli in place to reduce challenging behaviour and increase alternative appropriate responses. Given the dopaminergic system operates specifically in the areas of the brain associated with the reward and punishment pathways, it is plausible that psychotropic medications operating within these systems may alter the rewarding and punishing effects of stimuli (O'Doherty et al., 2002).

Applied research in behaviour analysis suggests that psychotropic medications may operate as motivating operations, increasing (establishing operation) or decreasing (abolishing operations) the effectiveness of rewarding and punishing stimuli (Valdovinos et al., 2007; Zarcone et al., 2004). Thus, both basic and applied research suggest psychotropic medications may impact preference. Unfortunately, with the exception of stimulant medications, applied behavioral pharmacology research has largely neglected evaluating psychotropic medication adjustment on preference stability in persons with IDD (Carlson, 2012). Additionally, preference displacement research has recommended exploring motivating operations impact on stimulus class preference, offering sound rationale for exploring displacement in the context of psychotropic medication adjustments. Finally, systematic non-compliance (i.e., participant non-selection) may be observed, and in assessing factors influencing preference stability it is prudent to monitor non-selection in this context.

My research project aimed to facilitate monitoring and reporting on the following:

1. Does preference remain stable within a psychotropic medication condition.
2. Does preference remain stable across psychotropic medication conditions.
3. Do displacement patterns shift across psychotropic medication conditions (e.g., edible vs. activity vs. social; displacement) (Bojak & Carr, 1999), and
4. Do psychotropic medication adjustments affect non-selection in preference assessments?

Method

Participants, Setting and Target Responses

Two participants were recruited who resided at community organizations supporting persons with IDD. Program directors and agency behaviour clinicians were requested to circulate research initiation letters (see Appendix A) to the families of potentially eligible participants. Eligible participants included those who (a) were diagnosed with a mild to profound IDD, (b) engaged in challenging behaviour, (c) had a psychotropic medication adherence of 80% or higher (if they were currently taking psychotropic medication), (d) had a psychiatric team (or prescribing physician) who were considering psychotropic medication adjustments as part of their ongoing treatment plan, and (e) had no untreated medical conditions such as gastric disorders, terminal illnesses, sleep disorders, oral disorders (e.g., abscesses), eating disorders, ear, nose, or throat infections.

The researcher was contacted by interested families, at which time the consent form (Appendix B), describing all aspects of the project, was reviewed. Parents (guardians) were then invited to sign consent forms on behalf of the participating individual. Both participants did not have the capacity to consent for themselves. However, participant assent was carefully monitored.

Participant 1 (P1) was a 37-year-old male who lived in a residential treatment home for adults with disabilities who engage in severe challenging behaviour. He had a diagnosis of ASD, moderate ID, and 22q11.2 deletion syndrome.[2] P1 was ambulatory and communicated verbally using short sentences. It is important to note that P1 was able to complete 2D to 3D matching,

[2] As P1 was unable to provide informed consent, the SDM was contacted to provide preference for first-person or -identity-first language. P1's SDM indicated that they would prefer person-first language throughout the research paper.

complex sorting tasks, and previously used pictures to indicate wants and needs, making him a viable candidate for a pictorial preference assessment (Clevenger & Graff, 2005). P1's weight was recorded as part of his ongoing care routine. He weighed approximately 174 lbs throughout the study. Research sessions took place in his residence in a place he was familiar with (e.g., backyard, living room, common space). He initially participated in research sessions every Monday at 11:00. However, when his psychiatrist recommended administration times be adjusted from 09:00 to 12:00 hr, his research sessions were switched from Monday's at 11:00 to Monday's at 13:00. The researcher collected information on when psychotropic medications were altered, time of psychotropic medication administration, psychotropic medication adherence, and reason for prescription adjustments. Medication adherence for P1 was 100% for entire study duration. Extended participant information is provided in Table 1. It is important to note that all psychotropic medication prescriptions and adjustments were to address P1's severe challenging behaviour including self-injury (mainly head hitting and hand biting causing tissue damage), physical aggression towards others, and property destruction.

Participant 2 (P2) was a 20-year-old male who lived in a residential group home for adults with disabilities who engage in severe challenging behaviour. He had a diagnosis of ASD and moderate ID.[3] P2 was ambulatory and communicated verbally using short sentences and pictures. It was not initially clear if P2 had the skill set to make 2D to 3D discriminations. Therefore, the researcher conducted five trials of 2D to 2D matching and five trials of 3D to 2D matching. P2 scored 100% across all ten trials indicating that he was a viable candidate for a pictorial preference assessment (Clevenger & Graff, 2005). P2's weight was recorded as part of

[3] As P2 was unable to provide informed consent, the SDM was contacted to provide preference for first-person or -identity-first language. P2's SDM indicated that they would prefer person-first language throughout the research paper.

his ongoing care routine. He weighed approximately 130 lbs throughout the study. Research sessions took place in his residence in a place he was familiar with (e.g., common space or living room in his apartment). He participated in research sessions every Thursday at approximately 15:00. The researcher collected information on when psychotropic medications were altered, time of drug administration, psychotropic medication adherence, and reason for prescription adjustments. Medication adherence for P2 was 100% for the entire study duration. Extended participant information is provided in Table 1. It is important to note that all psychotropic medication prescriptions were to address P2's severe challenging behaviour including physical aggression towards others and property destruction.

Table 1

Participant Characteristics

	Age (yrs)	Weight (lbs)	Medication	Daily Medication or PRN	Time of Medication Administration
P1	37	174	Risperidone	Daily	08:00 20:00
			Lorazepam	Daily	**08:00** 12:00 17:00 21:00
			Lorazepam	PRN	n/a
P2	20	130	Aripiprazole	Daily	08:00
			Clonidine	Daily	08:00 20:00
			Sertraline	Daily	08:00 **17:00**

Clonazepam	Daily	08:00 20:00
Vyvanse	Daily	08:00
Lorazepam	PRN	n/a
Olanzapine	PRN	n/a

Note. The table depicts the age in years (yrs), weight in pounds (lbs), medication name, medication administration frequency (i.e., daily or pro re nata [PRN]), percentage of missed administrations, time of administration, and total dosage of the medication administered. Bolded terms indicate a change in medication administration time.

Target Responses

The researcher defined individualized "selection" responses for both participants to tailor the preference assessment to each participant's abilities. For P1, selection was defined as any time he made physical contact with the picture representing the actual stimulus. Some examples of selection behaviour included touching the picture of the stimulus and/or picking up the picture of the stimulus. Selection behaviour did not include picking up and throwing the picture or pushing the pictures away. While P1 could verbally request for items, he often did not correctly tact stimuli. Therefore, physical contact with the pictorial stimulus was required for a selection to be recorded. The researcher operationally defined and recorded a secondary target behaviour, non-selection. Non-selection response was defined as any time P1 made a verbal utterance to indicate he was rejecting a stimulus. Non-selection included P1 saying, "I don't want hot chocolate", or stating that he would like another (unavailable) item in the preference assessment. A non-example would include P1 relinquishing the leisure stimulus after the 30 s access period. For P1, all target behaviours were recorded as count, which were later converted to percentages (see Dataset Preparation for more information).

For P2, selection was defined as any instance P2 verbally or physically indicated a single stimulus. Some examples of selection behaviour include P2 touching the picture representing a stimulus, pointing to the picture representing a stimulus, or tacting the stimulus depicted by a picture (see Materials section for details regarding the pictorial preference assessments conducted). The researcher operationally defined and recorded a secondary target behaviour, non-selection. Non-selection responses were defined as any time P2 made a verbal utterance to indicate he was rejecting a stimulus. Non-selection included P2 saying, "No", or stating that he wanted another item (unavailable) in the preference assessment. A non-example included P2

relinquishing the leisure stimulus after the 30 s access period. For P2, all target behaviours were recorded as count, which were later then converted to average percentage of measurement.

Materials

For both participants photographs of featured leisure and edible stimuli were used to circumvent the likelihood of actual stimuli displacing those items or activities represented by a picture. That is, the use of pictures to denote the stimuli ensured equality. For example, if a picture depicting 'walk around the room' was presented alongside a piece of an Oreo, the physical presence of the Oreo versus the picture representing a walk could potentially bias selection responses (Karsten et al., 2011). Of note, participant selection resulted in immediate access to the item or activity depicted in the photograph selected. For example, if P1 selected a picture depicting walk around the room, he and the researcher would immediately go for a walk around the room. All solid edible stimuli were approximately dime-sized pieces. They were placed on a paper plate prior to delivery. All liquid edible stimuli were filled with approximately 15 ml in small clear plastic cups.

The edible stimuli included in P1's preference assessments were (a) hot chocolate, (b) Mr. Big chocolate bars, (c) peanut butter crackers, (d) honey lemon tea, (e) root beer, and (f) chicken nuggets. The leisure stimuli included in P1's preference assessments were (a) puzzles on the iPad, (b) reading the children's book, *Curious George*, (c) walking around the room, (d) colouring, (e) listening to Michael Jackson's song, *Billie Jean*, and (f) playing with PlayDoh. See below for Study Assessments for an outline on how all stimuli were selected.

The edible stimuli included in P2's preference assessments were (a) banana Greek yogurt, (b) iced tea, (c) mint Oreos, (d) Kraft Dinner, (e) Sour Patch Kids, and (f) cheese pizza. The leisure stimuli included in P2's preference assessments were (a) watching YouTube, (b)

Wiggles memory game, (c) trampoline, (d) sticker books, (e) read a book, and (f) dot-to-dot pages.

During all preference assessment sessions, settings were outfitted with a table and two chairs. The researcher also had all relevant data sheets pertaining to the specific preference assessment, a pencil, a timer, a recording device, a tray or bin for all stimuli, small plates for edible items, and small plastic cups for liquid edible items. It is important to note that a staff member for both participants were present to record the sessions, however, were instructed to limit verbal and non-verbal communication with the participant during the sessions unless otherwise indicated by the researcher (e.g., challenging behaviour occurred that required staff to intervene).

Interobserver Agreement

Two observers independently scored 30% of all sessions conducted (edible, leisure, and combined) via video recording. IOA sessions were randomly selected by an online random list generator. One observer was blind to the medication condition they were scoring. Trial-by-trial IOA was calculated by the number of trial agreements between observers divided by the total number of trials, multiplied by 100 for both selection and non-selection responses. So, if the observers agreed on six trials and there were ten total trials, the trial-by-trial IOA would be 60%. Agreements were defined as both the observers recording the same count (selection and non-selection) in each trial as well as agreeing which stimulus was selected. Disagreements were defined as one observer recording a different count (selection and non-selection) or indicating a different stimulus than the other observer in each trial. The trial-by-trial IOA for P1 was 100% (range 100 to 100%) and the trial-by-trial IOA for P2 was 100% (range 100 to 100%).

Procedural Integrity

Two observers independently scored the procedural integrity of 30% of sessions. MSWO assessments consisted of 15 trials for each stimulus class (i.e., a total of 45 trials). PSPA assessments consisted of 30 trials for each stimulus class (i.e., a total of 90 trials). Procedural integrity was described as (a) having the correct material and environmental set up to accommodate the preference assessment type to be run, (b) ensuring all stimuli were presented equidistant and systematically organized as per the preference assessment protocol (e.g., presented on both the left and right side of the participant across trials), (c) delivering the correct instruction, responding to the target behaviour(s) as outlined in the presentation protocol (see Item and Assessment Selection for more information), and (d) delivering the stimuli contingent on the identified response. If the researcher completed any of the above-mentioned steps incorrectly, the observers would record an integrity error (see for example, Wacker et al., 2013). Percentage of procedural integrity was calculated by the number of correct researcher responses divided by the total number of researcher responses and multiplied by 100. The procedural integrity for P1 was 100% (range 100 to 100%) and the procedural integrity for P2 was 96.3% (range 91 to 100%). See Appendices C and D for integrity checklists.

Research Design

The study designs employed for P1 and P2 resulted from naturally occurring medication adjustments. That is, the psychiatrist changed medication prescriptions as clinically indicated. Therefore, the resultant study design for P1 was an analogue modified withdrawal (ABCDBC), while the resultant study design for P2 was a withdrawal (ABCDEF).

For P1, the first medication adjustment involved reducing lorazepam from 1.25 mg (A) to 1 mg (B), followed by a reduction to 0.75 mg (C) and 0.5 mg (D). P1's PRN was 0.5 mg lorazepam. If a PRN was administered within 72 hours of the assessment (concentration level

was confirmed with the participants' pharmacist), this signalled a return to the whichever lorazepam dosage condition was relevant. For example, in condition D (0.5 mg lorazepam) a PRN was administered, which meant total lorazepam dosage was now 1 mg. Thus, instituting a return to 1 mg lorazepam condition (B). Following this medication phase, lorazepam was reinstated to a daily dose of 0.75 mg, creating another reversal (return to C). P1 was prescribed the PRN for the entire study duration. See Table 2 for full medication list.

At the beginning of the study, P2 was prescribed two antipsychotic PRN medications to assist with severe challenging behaviour (i.e., lorazepam and olanzapine). Both medications were able to be administered up to four times daily, up to doses of 8 mg of lorazepam and 20 mg of olanzapine in a 24-hour period. Given there were multiple possible medication combinations between the two PRNs, the researcher decided to denote daily medication changes as a letter (i.e., med condition A) with the addition of a combination of PRNs being denoted as a number (i.e., medication condition A1). See Table 2 for a full list of all possible medication conditions including all PRN medication conditions. For P2, his first daily medication adjustment involved reducing sertraline from 125 mg (A) to 100mg and discontinuing Vyvanse (B). The reduction in sertraline continued in the next medication condition to 75 mg (C) as well as an adjustment in administration time to 1700 (originally at 2100). Sertraline was reduced further to 50 mg (D) while 1 mg of clonazepam was added and the lorazepam PRN was discontinued. Following this medication condition, sertraline was reduced to 25 mg (E) and further discontinued (F).

Table 2

Medication Conditions

	Medication Condition	Medication	Total Dosage of Medication
P1	A	Risperidone	2 mg

		Lorazepam	1.25 mg
	B	Risperidone	2 mg
		Lorazepam	1 mg
	C	Risperidone	2 mg
		Lorazepam	0.75 mg
	D	Risperidone	2 mg
		Lorazepam	0.5 mg
P2	A1	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline	125 mg
		Vyvanse	30 mg
	A2	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline	125 mg
		Vyvanse	30 mg
		*Lorazepam	2 mg
		*Olanzapine	10 mg
	A3	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline	125 mg
		Vyvanse	30 mg
		*Lorazepam	2 mg
		*Olanzapine	5 mg
	A4	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline	125 mg
		Vyvanse	30 mg
		*Olanzapine	5 mg
	B2	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline	100 mg
		Vyvanse	*0 mg*
		*Lorazepam	2 mg
	C2	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline (1700)	75 mg
		*Lorazepam	2 mg
	C1	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline (1700)	75 mg
	C3	Aripiprazole	7 mg
		Clonidine	0.15 mg
		Sertraline (1700)	75 mg
		*Olanzapine	5 mg

D1	Aripiprazole	7 mg
	Clonidine	0.15 mg
	Sertraline	50 mg
	Clonazepam	**1 mg**
D2	Aripiprazole	7 mg
	Clonidine	0.15 mg
	Sertraline	50 mg
	Clonazepam	1 mg
	*Olanzapine	5 mg
E1	Aripiprazole	7 mg
	Clonidine	0.15 mg
	Sertraline	25 mg
	Clonazepam	1 mg
F1	Aripiprazole	7 mg
	Clonidine	0.15 mg
	Sertraline	*0 mg*
	Clonazepam	1 mg

Note. The table depicts medication condition label for both participants, the medication, and total medication dosage. PRN medications are denoted by asterisks, discontinued medications are denoted by italics, and bolded font illustrated additions and administration time changes.

Study Assessments

Reinforcement Assessment for Individuals with Severe Disabilities (Fisher et al., 1996)

The reinforcer assessment for individuals with severe disabilities (RAISD; Fisher et al., 1996) is a structured interview that an informant (e.g., caregiver, staff, teacher) completes to provide information about activities, items, or events that they feel may serve as reinforcers for the participant. See Appendix E for the RAISD that was used. There are four specified subsections as well as follow up probes to ensure a fulsome list of possible activities, events, or items has been compiled. The RAISD has been used by many researchers and clinicians to inform preference assessment stimuli prior to conducting a preference assessment (see Hagopian et al., 2004; Karsten et al., 2011; Russo et al., 2014; Verriden & Roscoe, 2016; Verschuur, et. al., 2011).

Preference Assessments

Unique participant characteristics (e.g., skills) required the application of different preference assessment methodology (see Stimuli and Assessment Selection for information on method selection). The researcher employed a MSWO with P1 and a paired stimulus preference assessment (PSPA) with P2 throughout the study.

Stimuli and Assessment Selection

First, three caregivers (i.e., staff) for each participant completed the RAISD (Fisher et al., 1996). The researcher reviewed their responses to determine which stimuli were identified across all three caregiver responses. Then, the researcher looked for the stimuli that were identified on two of the three caregiver responses. From this list, the researcher excluded stimuli that could not be delivered in 30 s (e.g., bubble baths, going on outings, visits with family). Finally, if the researcher did not have at least six possible stimuli for each assessment type after executing the abovementioned process, then the remaining stimuli identified in the RAISD were chosen at random using an online random order generator. For example, if alfredo pasta and cheese pizza were identified on the RAISD and the researcher needed one more stimulus for the preference assessment to total six stimuli, alfredo pasta and cheese pizza were put in an online random generator and whichever one was ordered first was selected to be included as the final stimulus in the preference assessments.

To determine the type of preference assessment best-suited for participants', the researcher applied the flow chart featured in Virués-Ortega et al. (2014). Participant characteristics such as functioning level, sensitivity to the removal of preferred stimuli, their matching to sample abilities, as well as their ability to discriminate between pictorial and tangible stimuli informed preference assessment selection. This information is collectively

featured in the chart (see Appendix F and G for annotated versions of the flow chart for both P1 and P2).

Multiple Stimulus without Replacement (DeLeon & Iwata, 1996). First, P1 had an opportunity to briefly inspect or engage with the stimuli that were featured in the assessment. Next, six stimuli were arranged in front of P1 in a line on the table. The researcher then invited P1 to select one picture depicting a stimulus (e.g., "touch the one you want") from an array of six. The picture was exchanged for the stimulus, and he was allowed 30 s to engage with the stimulus he had selected (or he was invited to consume the edible he had selected). The researcher then removed the picture representing the selected stimulus from the line of stimuli. The remaining pictorial stimuli were systematically moved to my left with the pictorial stimulus on the end moving to the end of the row on the right. The researcher repeated this process until the final stimulus was chosen. The MSWO was presented three times consecutively (i.e., three trials); the third trial marked the end of the preference assessment. The order in which P1 selected the stimuli indicated preference from highest to lowest on a scale (Cooper et al., 2020; Virués-Ortega et al., 2014). See Appendix H for a copy of the MSWO data sheet used.

Paired Stimulus Preference Assessment (Fisher et al., 1992). First, P2 had a brief (30 s) opportunity to inspect or engage with the stimuli that were featured in the assessment. Each trial in the PSPA consisted of systematically pairing pictures of stimuli. By the end of the trial, all stimuli had been paired with each other twice and each stimulus had been placed on both the right and the left side of the participant. The researcher presented a picture of both stimuli equidistant from one another to P2. Next, an invitation to select one picture representing one of the stimuli was delivered. Upon selecting the picture of the stimulus, P2 was immediately given the stimulus and allowed to engage with it for 30 s (or consume the edible) while the researcher

removed the unselected stimulus. The stimulus P2 selected was recorded and a new pair of stimuli were presented (Cooper et al., 2020). This procedure was repeated until all 30 trials had been presented. The number of times a stimulus was selected was recorded and then used to rank stimuli from highest to lowest (Cooper et al., 2020). See Appendix I for a copy of the PSPA data sheet used.

Procedure

At least three preference assessment sessions were conducted at baseline (i.e., initial dosage level) for both participants. That is, an edible, leisure, and combined assessment were conducted once per week for three weeks during baseline. For P1 baseline was characterized as risperidone 2 mg and lorazepam 1.25 mg condition. For P2, baseline was characterized as the A1 condition (aripiprazole 7 mg, clonidine 1.1 mg, sertraline 125 mg, Vyvanse 30 mg, 0 mg lorazepam (PRN), 0 mg olanzapine [PRN]).

As previously mentioned, psychotropic medication adjustments were made at the discretion of the participants' consulting psychiatrist or psychiatric team. Any changes were immediately communicated to the researcher and confirmed by reviewing the MARs. Study completion occurred either after three consecutive psychotropic medication adjustments or when further psychotropic medication adjustments were unlikely to continue as communicated by the psychiatric team. Research sessions were terminated if one of these criteria was met and after a stable pattern of responding was observed during the final psychotropic medication condition. Changes in all ongoing non-psychiatric medications or medical events were also recorded and confirmed by retaining copies of the medication administration recording sheets for both participants. None of the participants experienced medical events that would have influenced study results (e.g., new medical diagnosis, extended illness, unscheduled or scheduled surgery).

Further, neither participant experience life events that could have influenced study results (e.g., moving to a new facility, death of a loved one, a new housemate).

Research sessions were conducted at the same time (within one hour of medication administration, and one-hour post meal), on the same day each week. The researcher conducted sessions at the same time on the same day each week because repeated measures were necessary to monitor stability across time, while consistency in assessment timing may control for variables related to medication properties (e.g., half-life) as well as naturally occurring deprivation states (e.g., immediately before lunch vs. immediately after lunch).

Participants took part in a preference assessment sequence (edible-item preference assessment, leisure-item preference assessment, and combined-class preference assessment) weekly. That is, for P1 the researcher conducted a six-item MSWO featuring edible stimuli, followed by a six-item MSWO featuring leisure stimuli. Finally, the researcher conducted a six-item MSWO combined-class featuring the three highest ranked preferred edible stimuli and three highest ranked preferred leisure stimuli. For P2, the researcher conducted a six-item PSPA featuring edible stimuli; followed by a six-item PSPA featuring leisure stimuli. Finally, the researcher conducted a six-item PSPA combined-class featuring the three highest ranked preferred edible stimuli and three highest ranked preferred leisure stimuli. The following example illustrates how tied ranks were handled. If hot chocolate and root beer were tied for the third highest preferred edible item, an online random list generator was used to decide whether hot chocolate or root beer would be included in the combined class preference assessment. The preference assessment sequence remained the same across all sessions and participants.

P1 participated in the study for 22 weeks. His psychiatric team indicated further medication changes were unlikely and so after three research sessions were conducted in the

final medication condition, the study was complete for P1. P2 participated for 25 weeks. P2 was terminated after six formal medication adjustments made by his psychiatrist and sertraline was discontinued. Each medication condition for P1 ranged between three and seven weeks. Each medication condition for P2 ranged between two and eight weeks.

Data Analysis Protocol

Dataset Preparation

To prepare the data set for analysis, the researcher first reviewed all raw data collected to identify non-selection responses across all preference assessments conducted. From here, the researcher followed the non-selection response protocol as identified in Call et al. (2012). That is, the remaining "non-selected" stimuli received an equal ranking that averaged the remaining rankings. For example, if the participant selected four stimuli (ranks 1 through 4) while two were not selected, those two non-selected stimuli would be given a ranking of 5.5.

Next, the researcher calculated an "individual rank" for all stimuli by adding each rank across the three preference assessment trials and dividing this value by three. For example, if hot chocolate was selected third on the first trial, fourth on the second trial, and third on the third trial the individual rank for hot chocolate would be 3.33. After calculating the average, the researcher assigned an individual rank in accordance with that value. That is, the stimulus with the highest average would be assigned a rank of 1 (most preferred), while the stimulus with the lowest average would be assigned a rank of 6 (least preferred). This process was completed for all stimuli across each preference assessment type (i.e., edible, leisure, and combined class). Any tied ranks were handled in the following way. If hot chocolate and tea had individual average ranks of 3.33 and were the third and fourth most preferred items respectively; hot chocolate and tea would both be given the value of 3.5 (e.g., 3 + 4 = 7, 7/2 = 3.5).

Data Set Preparation for Spearman Rank Correlation Analysis

Two separate IBM SPSS Statistics (Version 26) files were created; one file for the edible ranks and one for the leisure ranks. Individual ranks for each stimulus class were entered in the SPSS file and these values were used in the Spearman correlation analysis. Importantly, the researcher applied the Call et al. (2012) protocol for missing data (see Dataset preparation section for more information) for all preference assessments with non-selection responses. Each assessment per week was compared against the initial baseline assessment, and the resultant value was graphed and inspected for stability within medication conditions. Average correlation coefficients were also calculated for each medication condition with two or more values. Averages were created by using all correlation values from that condition and generating their average. That is, adding them together and dividing by the number of coefficients in that condition. These average values were graphed and inspected for stability across medication conditions (see Results section for more information).

Data Set Preparation for Displacement Analysis

To prepare the data set for the displacement analysis "grand ranks" for all stimuli were calculated for each medication condition. Grand ranks were created by calculating an average individual rank for each stimulus for each preference assessment type using all data points (i.e., weeks) in a given medication condition. For example, if, in the first medication condition, puzzles on the iPad had an individual rank of two on week 1, four on week 2, and six on week 3, then the grand rank for puzzles on the iPad would be 4. From here, the three stimuli with the highest grand ranks from the edible preference assessment, the three stimuli with the highest grand ranks from the leisure preference assessment, and the six stimuli from the combined assessment for each medication condition were then assigned a rank from 1 (highest preferred)

and 6 (lowest preferred). Tied ranks were used for values that were the same. The assigned value grand ranks were then plotted and visually inspected for outcomes (Carter & Zonneveld, 2020; see Results for more information).

Data Set Preparation for Missing Data Analysis

It is standard practice to report "total percentage of missing measurements" in missing data research (Kumar De et al., 2020, p. 1356). Therefore, to analyze non-selection data the researcher first calculated percentage non-selection for each individual preference assessment. To do this, the numerator was the number of trials where a stimulus was selected, while the denominator was the total number of opportunities where stimuli could have been selected (i.e., total number of trials). For example, in a MSWO assessment there are 18 total opportunities to select stimuli. If P1 selected stimuli on 15 out of the 18 trials, the non-selection percentage would be 16.66% (i.e., 3 divided by 18). By contrast, in a PSPA there are 30 opportunities to select stimuli; if P2 selected stimuli on 29 out of 30 trials, the non-selection percentage would be 3.33% (i.e., 1 divided by 30). Non-selection percentages were generated for all edible, leisure, and combined assessments. In the combined assessment, total percentage non-selection for both stimuli classes together were generated as well as individual class stimuli percentage non-selection values to inspect subtle trends. For example, in the combined MSWO each stimulus class is presented in nine total trials. If P1 selected leisure stimuli only twice out of nine total opportunities, the non-selection percentage of the leisure combined assessment would be 77.77% (i.e., 7 divided by 9). This protocol was only employed for the combined MSWO assessments as creating non-selection percentages for the leisure and edible classes in a combined-class PSPA is not possible. That is, one cannot create a non-selection value when a leisure stimulus is presented

alongside an edible stimulus as only one stimulus can be selected. These data were then graphed and inspected visually for outcomes.

Dataset Preparation for Non-Parametric Partial Correlation Analysis

To prepare the SPSS file, the percentage non-selection values for each assessment (edible, leisure, edible combined, leisure combined) were entered into the file in rows. Total antipsychotic medication dosage was calculated by adding the psychotropic medications prescribed. For example, in condition C P1 was prescribed 2 mg of risperidone and 0.75 mg of lorazepam; so, the total medication dose input into the file was 2.75 mg. This value was also entered into a row corresponding with the non-selection value, as well as the assessment session number (i.e., the number of weeks of participation in the study). Doing this permitted analyzing separate and combined effects of time and medication dosage on the dependent variable (i.e., percentage non-selection) by conducting a non-parametric partial correlation analysis for each stimulus class (see Results below). A non-parametric partial correlation analysis was run for all non-selection percentages across edible, leisure, and combined assessments.

Results

Spearman Rank Correlation Analysis

It is prudent to explore participant selection responses through a Spearman rank correlation analysis because in doing so, it may provide specific insight into preference assessment stability in the context of psychotropic medication changes.

Participant 1: Edible Preference Assessments

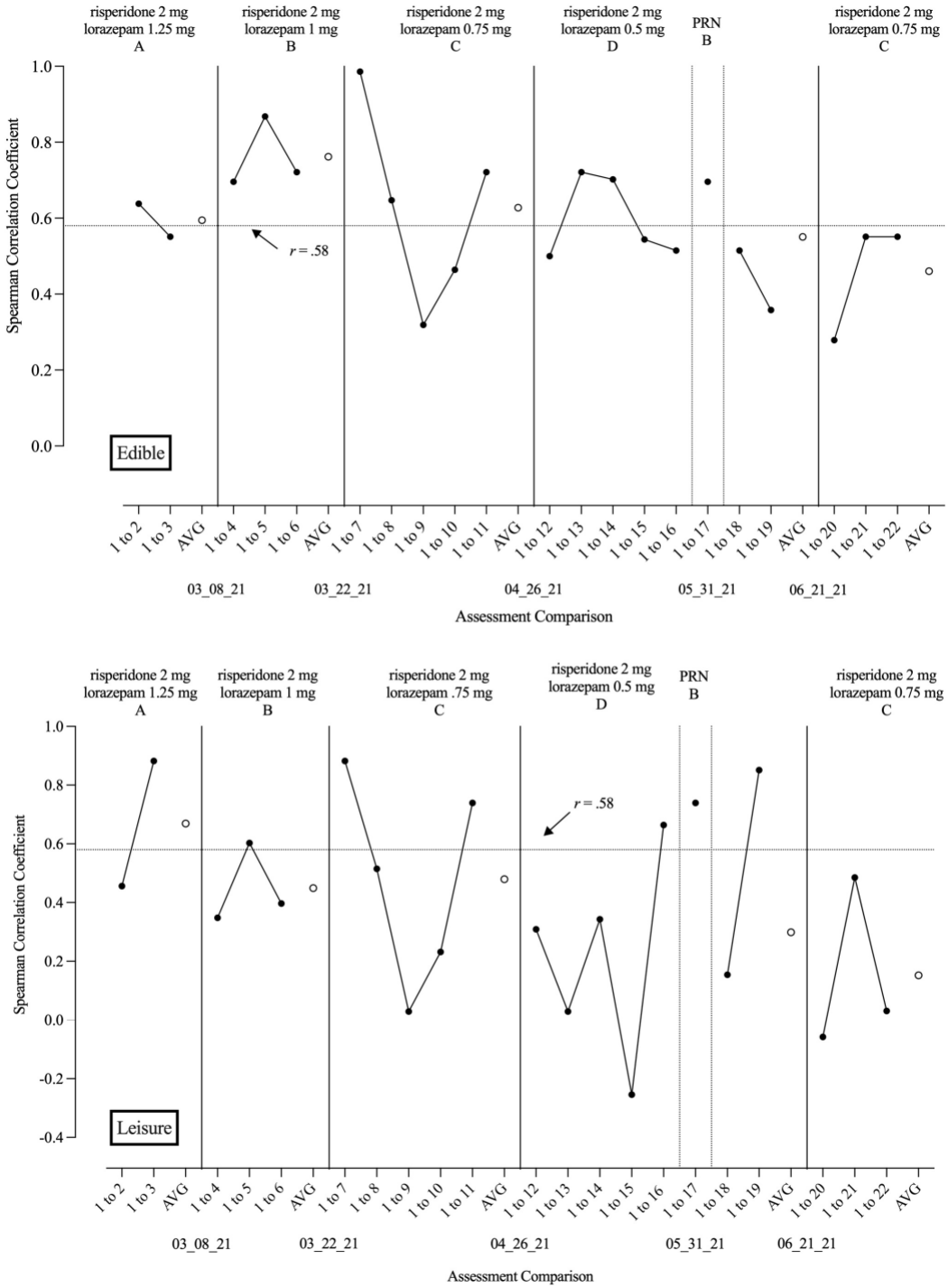
To assess preference assessment outcome stability across medication adjustments, the researcher inspected whether the average Spearman correlation coefficient (see open circles in Figure 1) for each medication condition met or exceeded the critical *r* cut-off (*r* =.58). In

condition A (risperidone 2 mg, lorazepam 1.25 mg), the average Spearman correlation coefficient exceeded the critical cut off (r =.59) – suggesting preference stability may have existed **within** the baseline condition. This is because, as is customary in preference stability literature (Hanley et al., 2006), the researcher used the first preference assessment outcome as a reference point for stability (i.e., baseline).

Preference stability **across** the first two medication conditions [B (risperidone 2 mg, lorazepam 1 mg) and C (risperidone 2 mg, lorazepam 0.75 mg)] was evidenced by average Spearman correlation values of r = .79 and r = .62, respectively. That is, values exceeded the critical r (Figure 1, top panel). Notably, when lorazepam was reduced to 0.75 mg the researcher observed more profound changes in correlation coefficients dropping well below the critical r. So, although overall preference remained stable (i.e., medication adjustment did not coincide with changes in overall stability), some emerging instability may have coincided with this medication condition. For condition D (risperidone 2 mg, lorazepam 0.5 mg) the average Spearman correlation coefficient dropped below the critical r cut-off (r = .55), suggesting instability may have coincided with this medication change. the researcher did not observe a return to stability coinciding with the return to condition C (risperidone 2 mg, lorazepam 0.75 mg). Instead, the average correlation coefficient associated with this condition was below the critical r (r = .46). By contrast, in the return to B condition [PRN (risperidone 2 mg, lorazepam 1 mg)], a return to stability may have been observed (r = .69), as in the original B condition.

Figure 1

P1 Spearman Rank Analysis



Note. Spearman correlation coefficient is scaled to the y-axis with assessment comparison scaled to the x-axis. The dotted line on the graph depicts our critical *r* cut-off to which all correlation coefficients are compared against. The top panel depicts the edible spearman correlation coefficient data with the bottom panel depicting the leisure spearman correlation coefficient data.

Participant 2: Edible Preference Assessments

In exploring P2's edible preference assessment outcomes, six out of the 13 medication conditions were standalone data points. That is, the researcher was only able to generate one data point per condition due to various PRN administration combinations. Thus, for these conditions the researcher could not generate an average Spearman rank correlation or inspect for trends. In lieu of this, the researcher opted to inspect the Spearman correlation coefficients as daily medication conditions (as seen in Figure 2 top panel) rather than separating all PRN conditions (delineated by dotted phase change lines; see Figure 3 top panel).

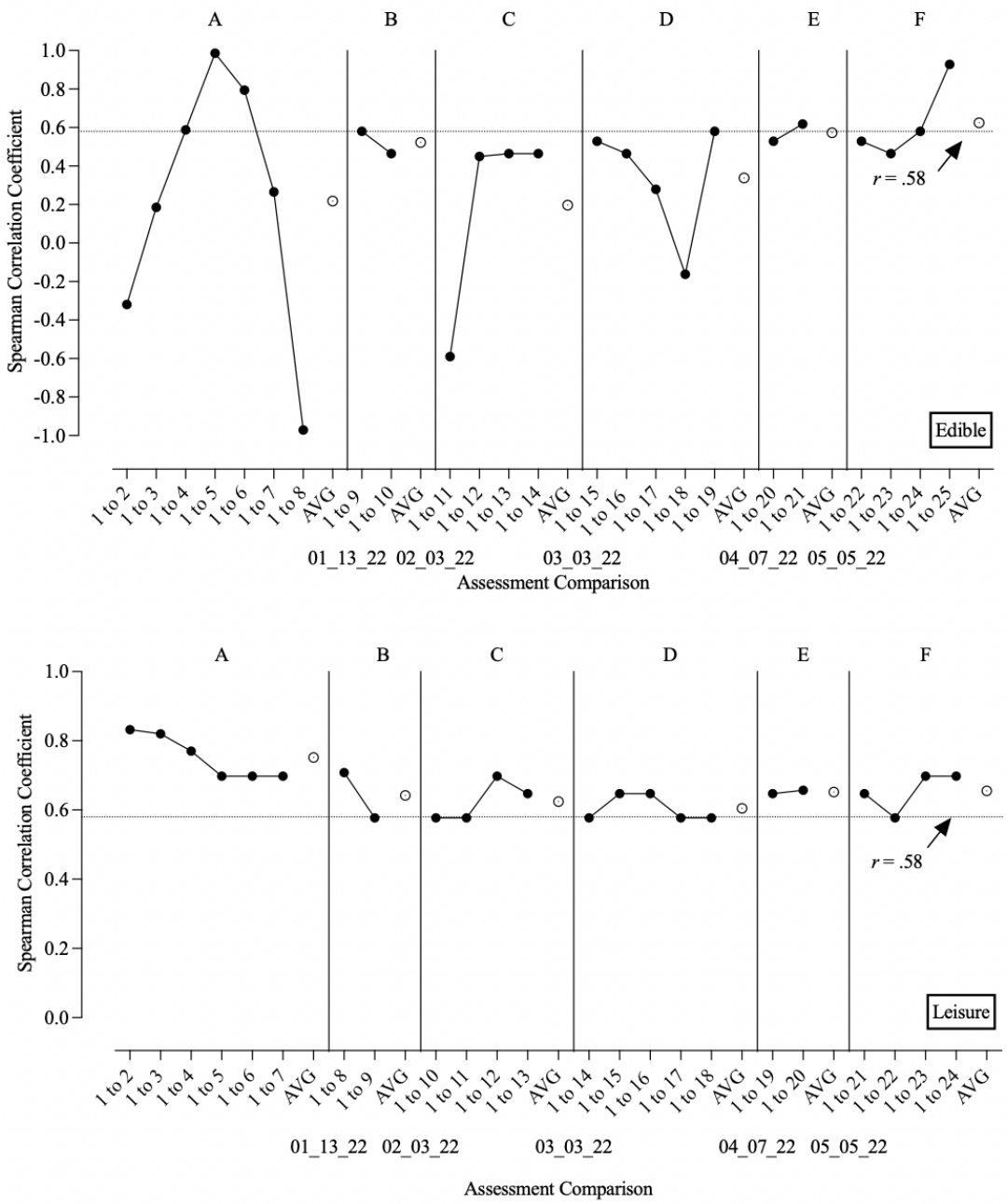
In condition A (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg), the average Spearman correlation coefficient did not exceed the critical *r* cut-off (*r* = .22). Correlation coefficients are highly variable ranging from -1.0 to 1.0, suggesting that in the eighth assessment P2 selected items in the exact opposite order compared to baseline selection responses. This may be interpreted as substantial preference instability **within** the baseline condition.

Preference stability patterns in condition B (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 100 mg) and condition E (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 25 mg, clonazepam 1 mg) suggest reduced variability, although the critical *r* values did not consistently meet the critical cut-off (*r* = .22 and *r* =.57 respectively). When the daily medication regime was aripiprazole 7 mg, clonidine 0.15 mg, sertraline 75 mg (condition C) and aripiprazole 7 mg, clonidine 0.15 mg, sertraline 50 mg, clonazepam 1 mg (condition D), the researcher observed relatively modest variability, compared to condition A; although the critical *r* still fell below the cut-off (*r* =.52 and *r* =. 33, respectively) for both medication conditions. It is not until the final medication condition [F (aripiprazole 7 mg, clonidine 0.15 mg, clonazepam 1 mg], that an

average correlation coefficient exceeds the critical *r* cut-off, suggesting stability across the condition (*r* =.62). One possible overall trend is that medication conditions depicting only one condition (e.g., B, E and F) seem to be associated with correlation coefficients that hover more closely around the critical cut off. It is possible that excessive PRN conditions (e.g., A, C and D) may differentially affect edible preference stability according to the results.

Figure 2

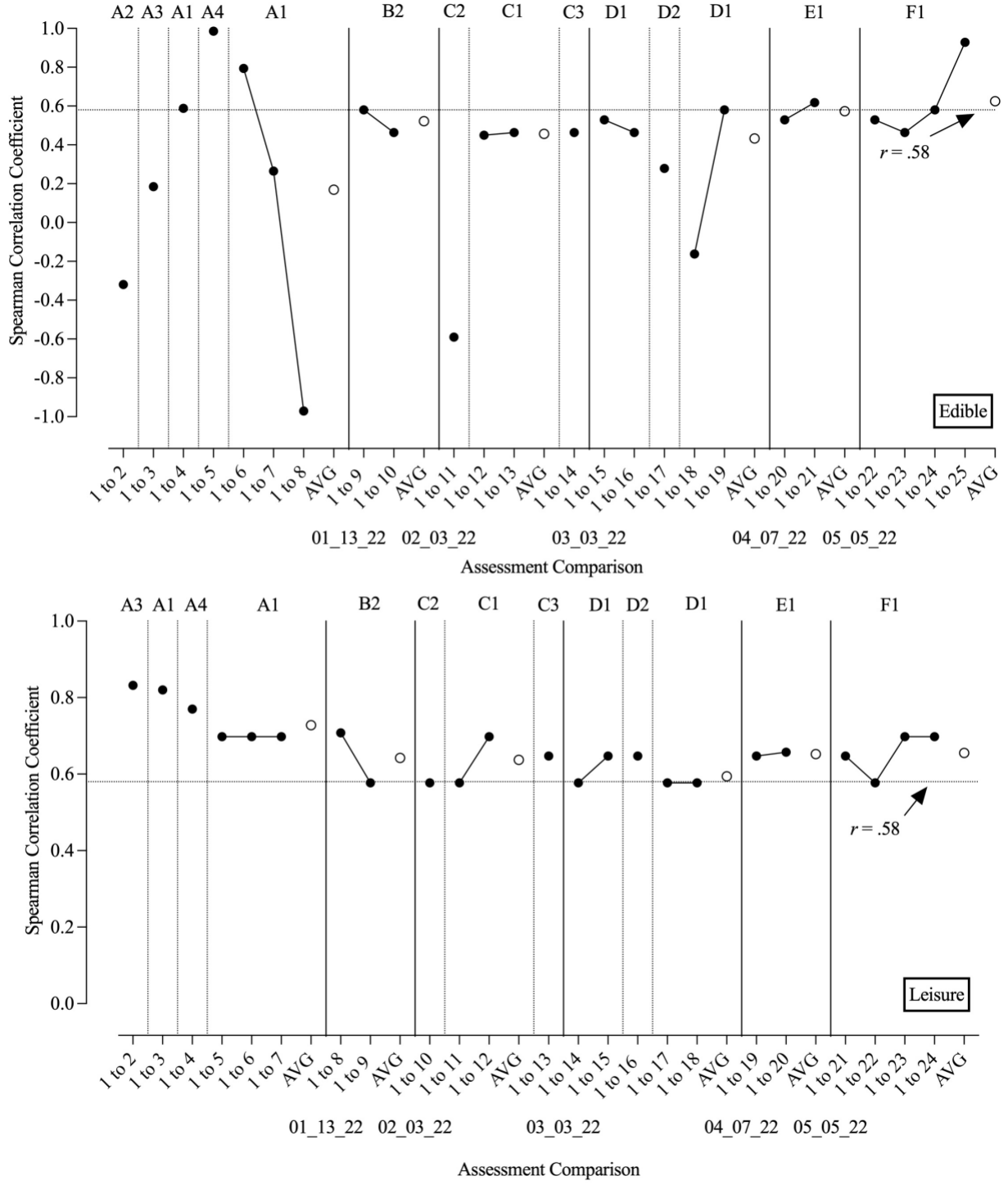
P2 Spearman Rank Correlation Analysis: Daily Medications



Note. Spearman correlation coefficient is scaled to the y-axis with assessment comparison scaled to the x-axis. The top panel depicts the edible spearman correlation coefficient data with the bottom panel depicting the leisure spearman correlation coefficient data. The dotted line on the graph depicts our critical *r* cut-off to which all correlation coefficients are compared against. The open (white) data points depict the average spearman correlation coefficient for a medication condition. It is important to note that for this graph that PRN conditions are amalgamated into the daily medication conditions.

Figure 3

P2 Spearman Rank Analysis: PRN



Note. Spearman correlation coefficient is scaled to the y-axis with assessment comparison scaled to the x-axis. The top panel depicts the edible spearman correlation coefficient data with the bottom panel depicting the leisure spearman correlation coefficient data. The dotted line on the

graph depicts our critical *r* cut-off to which all correlation coefficients are compared against. The open (white) data points depict the average spearman correlation coefficient for a medication condition. It is important to note that for this graph that PRN conditions are separated.

Participant 1: Leisure Preference Assessments

In condition A (risperidone 2 mg, lorazepam 1.25 mg), the average Spearman correlation coefficient exceeded the critical *r* cut-off ($r = .66$); however, individual correlation coefficients did fall below the critical *r* (see Figure 1, bottom panel). The researcher interpreted this result to mean there may be overall stability despite some variability **within** this baseline condition.

Preference stability **across** condition B (risperidone 2mg, lorazepam 1 mg) suggests some overlap with A, however, two of three coefficients in condition B are below the cut-off indicating less stability. This trend appears to persist across conditions C (risperidone 2 mg, lorazepam 0.75 mg) and D (risperidone 2 mg, lorazepam 0.5 mg) – wherein fewer and fewer single coefficients exceed the critical cut-off. In the return to B condition, the single data point in this condition suggests stability ($r = .74$). However, this outcome does not reflect a return similar stability level compared to the original B condition ($r = .45$). Regarding the return to C condition ($r = .15$), the researcher observed coefficients that remained below the critical cut-off, suggesting slightly less stability variability compared to the original condition C ($r = .49$). Apart from condition A, all average Spearman rank correlation comparison values fall below the critical *r* cut-off ($r = .44$, $r = .47$, and $r = .29$ respectively). This result could suggest that stability across conditions B, C and D may be absent.

Participant 2: Leisure Preference Assessments

In exploring P2's leisure preference assessment outcomes, five out of the 12 medication conditions were standalone data points. That is, the researcher was only able to generate one data point per condition due to various PRN administration combinations. Thus, for these conditions

the researcher could not generate an average Spearman rank correlation or inspect for trends. In lieu of this, the researcher opted to inspect the Spearman correlation coefficients as daily medication conditions (Figure 2, bottom panel) rather than separating all PRN conditions (delineated by dotted phase change lines; Figure 3, bottom panel).

In condition A (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg), the average Spearman correlation coefficient exceeded the critical *r* cut-off (*r* = .75) (see Figure 2, bottom panel). Similarly, all correlation coefficient comparisons exceeded our critical *r* cut-off within condition A, suggesting a highly stable preference **within** the baseline condition.

Preference stability patterns in conditions B (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 100 mg), C (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 75 mg), D (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 50 mg, clonazepam 1 mg), E (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 25 mg, clonazepam 1 mg), and F (aripiprazole 7 mg, clonidine 0.15 mg, clonazepam 1 mg) suggest relatively sustained stability **across** medication conditions. This stability was evidenced by all Spearman rank correlation comparison values and averages meeting or exceeding the critical *r* cut-off, with modest variability largely observed across conditions. For example, in condition A *r* values ranged between *r* =.83 and *r* =.70, while coefficients coinciding with condition B ranged from *r* = .58 *to r* = .71. These results could suggest that for P2 medication changes may not have differentially affected leisure preference stability, despite the presence of prolific PRN administration, which was responsible for generating several different medication conditions within a daily medication condition. This is this result contrasts with edible preference stability, which may have been differentially affected by rampant PRN administration compared to daily medication conditions associated with an absence of this.

Weekly Selection Analysis

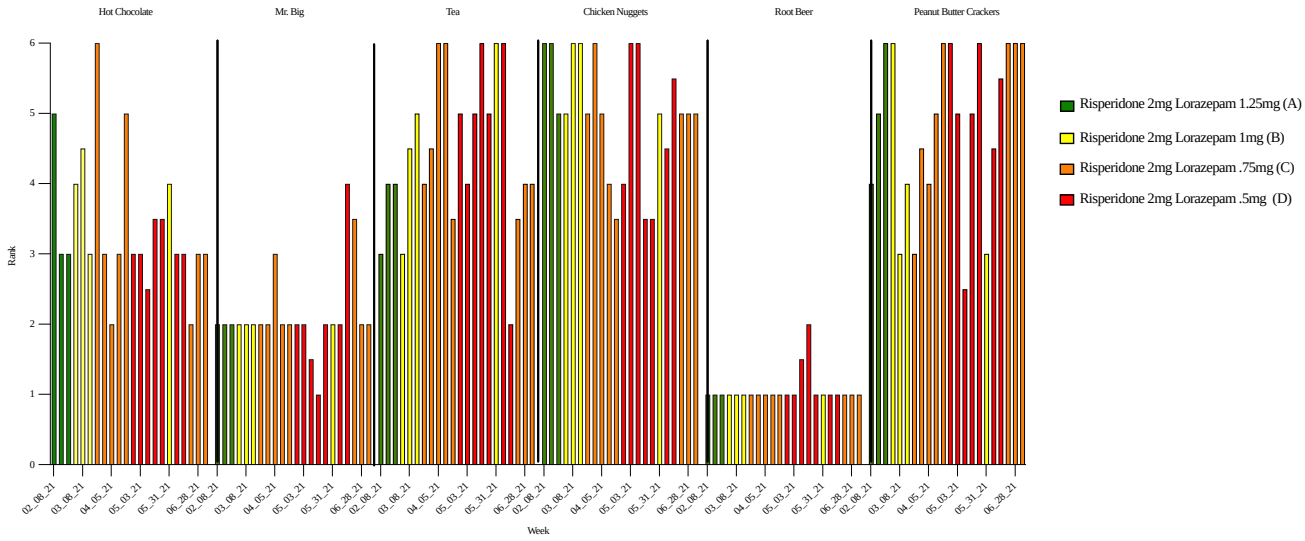
Up to this point, the researcher has explored and described relationships and patterns that may permit commenting on broader "signals" observed in the data. The weekly selection analysis visually depicts each stimulus' rank across each week for the entire study duration. This analysis may offer specific insight into subtler trends of stimulus stability thus, affording a more comprehensive analysis.

Participant 1: Edible Weekly Selection Analysis

Visually inspecting Figure 4 indicates Mr. Big and root beer were consistently selected as the first and second highest preferred edibles. Their rank appeared relatively sustained across all edible preference assessments regardless of medication condition. By contrast, more variable selection patterns may be apparent across the four remaining stimuli (hot chocolate, chicken nuggets, peanut butter crackers, and tea). This could suggest that instability observed as evidenced by correlation coefficients may have been largely driven by selection responses for the third, fourth, fifth and sixth ranked stimuli. This may also suggest that, for P1, medication status may not have differentiated affected selection responses as illustrated by weekly selection.

Figure 4

P1 Edible Weekly Selection



Note. Stimulus rank is scaled to the y-axis with week scaled to the x-axis. Medication condition is denoted by the corresponding colour. Stimuli are separated by the black phase change lines. The graph depicts rank of each stimulus across sessions and medication changes.

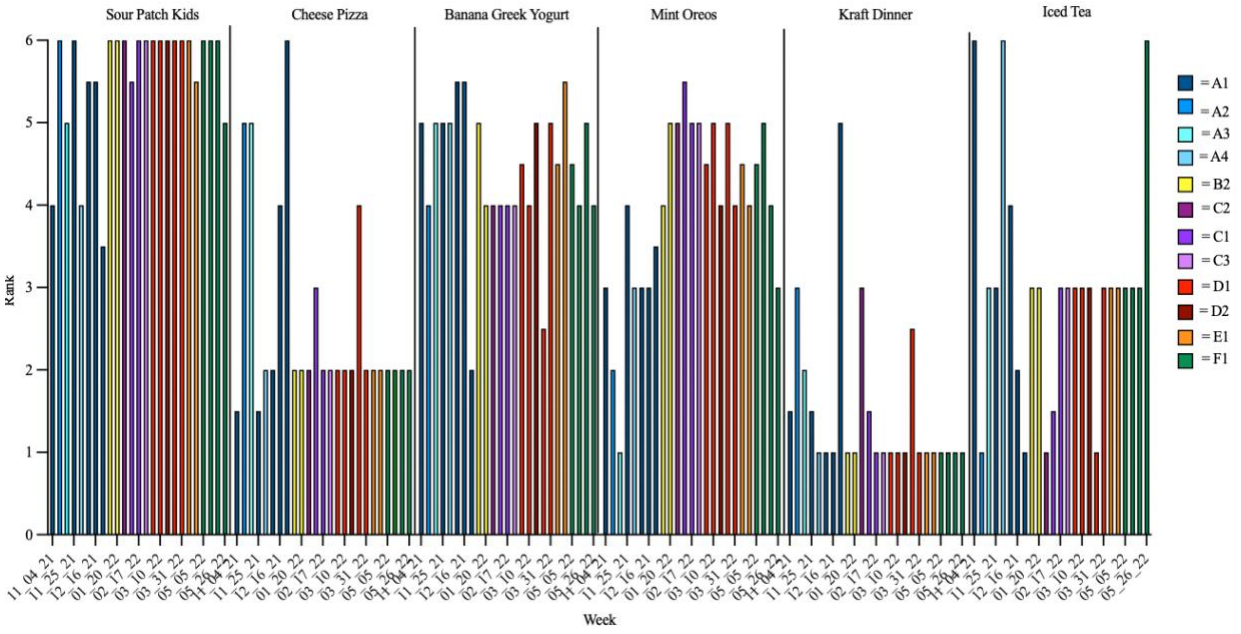
Participant 2: Edible Weekly Selection Analysis

A visual inspection of Figure 5 suggests that Kraft Dinner, cheese pizza, and iced tea were consistently selected as the first, second, and third highest preferred edible stimuli. Interestingly, it appears that medication condition A (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg; A1, A2, A3, and A4) may have coincided with greater selection instability across all edible stimuli. For example, sour patch kids were ranked between 3.5 to 6; while cheese pizza received rankings of 1.5 to 6 in condition A, even though it appeared to be reliably selected 2nd across all other medication conditions. Even Kraft Dinner, received rankings between 1st and 5th in condition A, while it was reliably selected 1st across all other medication conditions. As such, condition A may have been associated with greater instability across all edible stimuli compared to other medication conditions where selection responses were relatively consistent as evidenced by ranking range. That is, the selection rank range was no

more than one across all other medication conditions. For example, in condition B sour patch kids were reliably ranked 6th, cheese pizza was ranked 2nd, banana Greek yogurt was ranked either 4th or 5th, mint Oreos were ranked either 4th or 5th, Kraft dinner was ranked 1st, and iced tea was ranked 3rd. This pattern may provide insight regarding stimulus selection patterns that drove correlation coefficients indicating instability (i.e., well below the critical cut-off). Finally, this outcome may make it reasonable to suggest higher medication dosages (i.e., condition A; aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg) may have been differentially impacting edible preference assessment stability. That is, stability appears to be differentially impacted unlike P1.

Figure 5

P2 Edible Weekly Selection



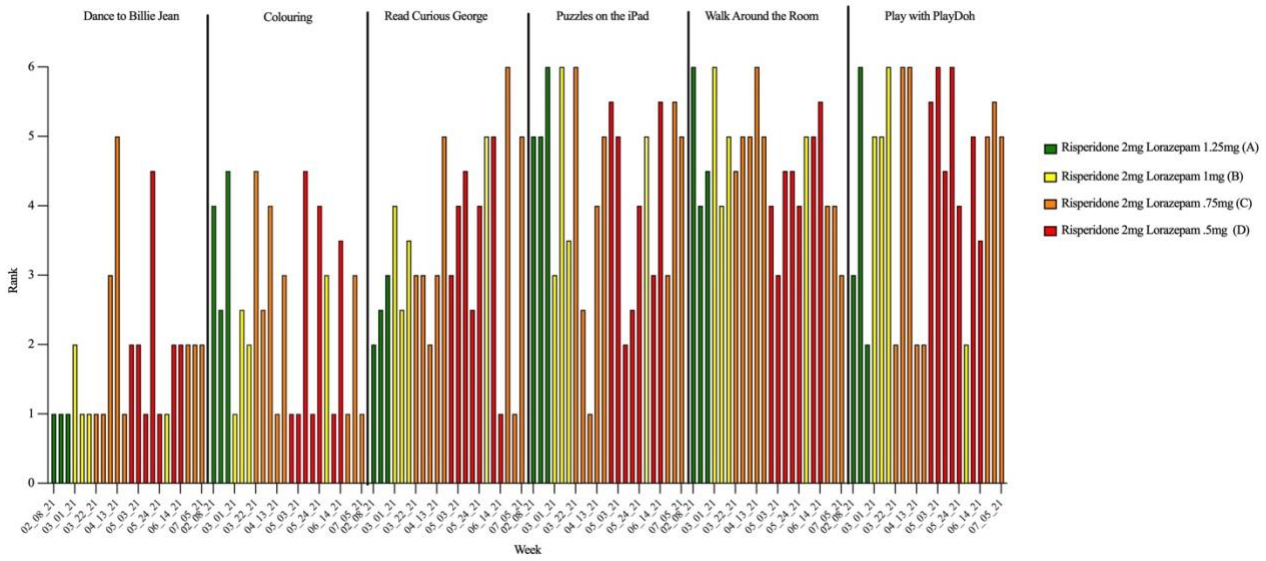
Note. Stimulus rank is scaled to the y-axis with week scaled to the x-axis. Medication condition is denoted by the corresponding colour, with stimuli being separated by the black phase change lines. The graph visually depicts rank of each stimulus across sessions and medication changes.

Participant 1: Leisure Weekly Selection Analysis

A visual inspection of Figure 6 suggests that dancing to Billie Jean (the top ranked leisure stimulus) may have been the only stimulus associated with relatively consistent selection pattern. These patterns seemed to persist across medication adjustments, albeit greater selection instability may have been associated with the original condition C; wherein this activity was select 1st as well as 5th during this medication condition. A return to "selection instability" did not appear to coincide with a return to condition C. Other distinct patterns appeared absent across the remaining five stimuli (colouring, reading Curious George, walk around the room, and puzzles on the iPad). For these stimuli, selection instability did not appear to coincide with any one medication condition, as evidenced by rank differences largely exceeding one across all medication conditions.

Figure 6

P1 Leisure Weekly Selection



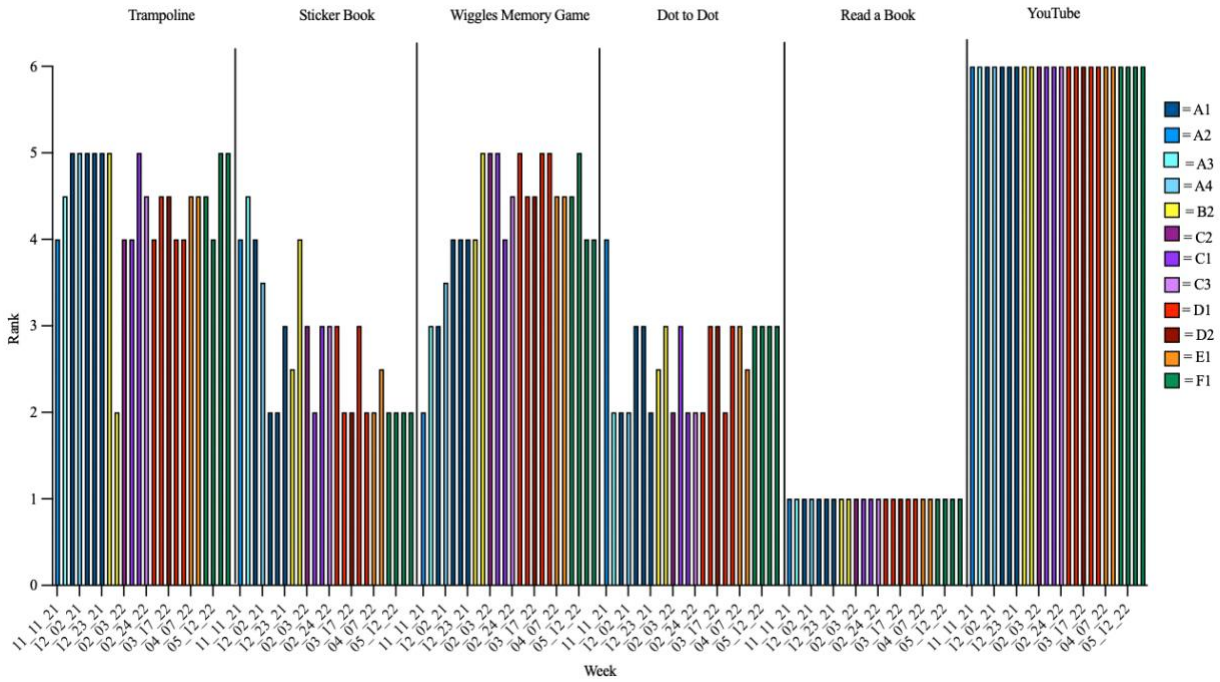
Note. Stimulus rank is scaled to the y-axis with week scaled to the x-axis. Medication condition is denoted by the corresponding colour, with stimuli being separated by the black phase change lines. The graph visually depicts rank of each stimulus across sessions and medication changes.

Participant 2: Leisure Weekly Selection Analysis

A visual inspection of Figure 7 suggests that reading a book was consistently ranked 1st, while YouTube was reliably ranked 6th across all medication conditions. Unlike the edible selections, medication condition A did not appear to differentially affect preference assessment results. In fact, leisure selections appeared to be relatively stable across all stimuli across all medication conditions. Albeit modest variability appeared more frequently among the moderately preferred leisure stimuli (trampoline, wiggles memory game, sticker books, and dot to dot books), as evidenced by more ranking differences (i.e., wiggles memory game selected between 2nd and 5th).

Figure 7

P2 Leisure Weekly Selection



Note. Stimulus rank is scaled to the y-axis with week scaled to the x-axis. Medication condition is denoted by the corresponding colour, with stimuli being separated by the black phase change lines. The graph visually depicts rank of each stimulus across sessions and medication changes.

Displacement Analysis

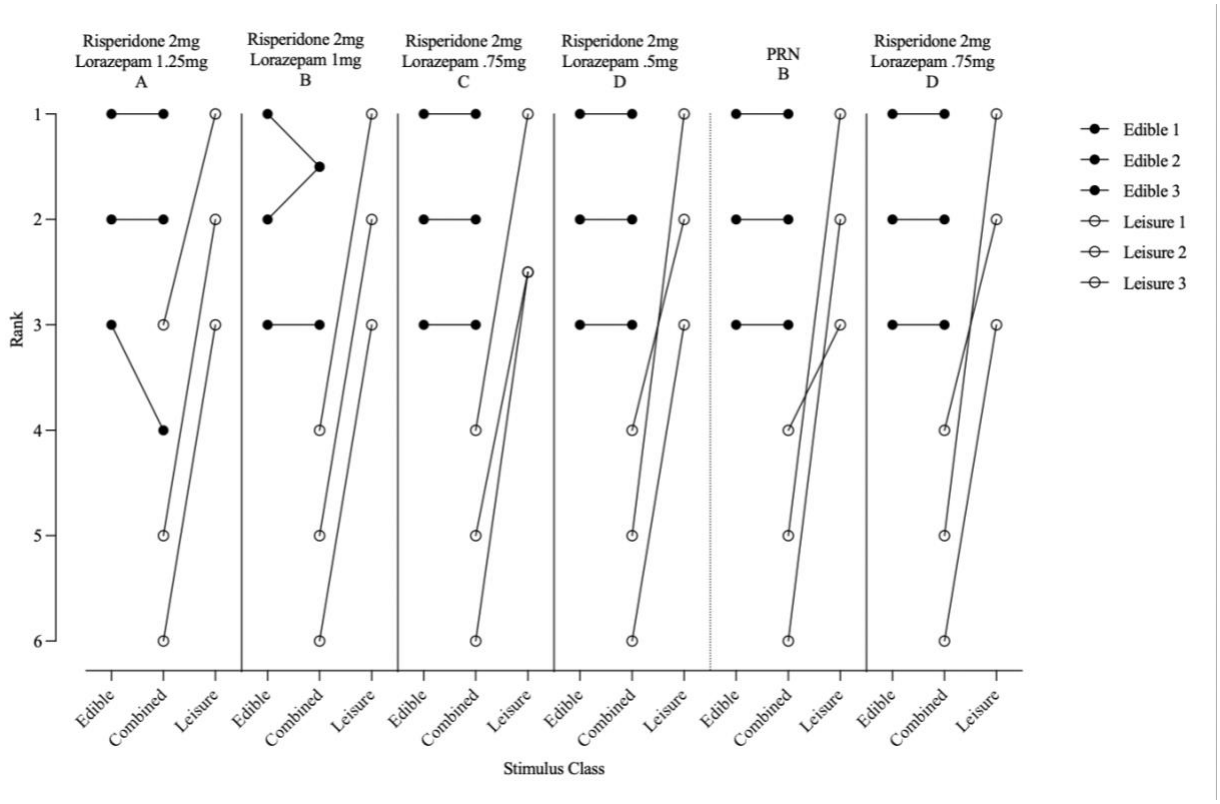
Participant 1

The researcher categorized each participant's combined-class preference assessment into one of three patterns of displacement to discern whether displacement occurred (as in Carter & Zonneveld, 2020). The three displacement patterns are (a) the participant selected all stimuli from one class over the other (pattern 1), (b) the participant selected two stimuli in one class over another (pattern 2), and (c) the participant selected all stimuli from one class before selecting all but one from the other class (pattern 3). Should a participant not display any of the above-mentioned patterns, the researcher concluded that displacement of one class of stimuli over another was absent.

P1's displacement analysis results (Figure 8) depict a relatively stable pattern of edible stimuli displacing leisure stimuli (pattern one). Specifically, pattern one was observed reliably in five of the six medication conditions (risperidone 2 mg, lorazepam 1 mg; risperidone 2 mg lorazepam 0.75 mg; PRN, risperidone 2 mg, lorazepam 0.5 mg; and return to risperidone, 2 mg lorazepam 0.75 mg). Specifically, edible stimuli appear to reliably displace leisure stimuli. Pattern two was observed in condition A (risperidone 2 mg, lorazepam 1.25 mg), wherein the top two ranked stimuli were edible, while the third was a leisure stimulus. Regarding the "analogue" reversal conditions, the researcher observed the same displacement pattern (pattern one) across condition B and return to condition B (PRN), as well as condition D and the return to condition D. Importantly, given displacement stability across all conditions, it may not be surprising that the researcher observed repeated displacement patterns across the two "reversal" conditions.

Figure 8

P1 Displacement Analysis



Note. Rank is scaled to the y-axis with stimulus class scaled to the x-axis. Closed (black) data points depict edible stimuli, with open (white) data points depict leisure stimuli.

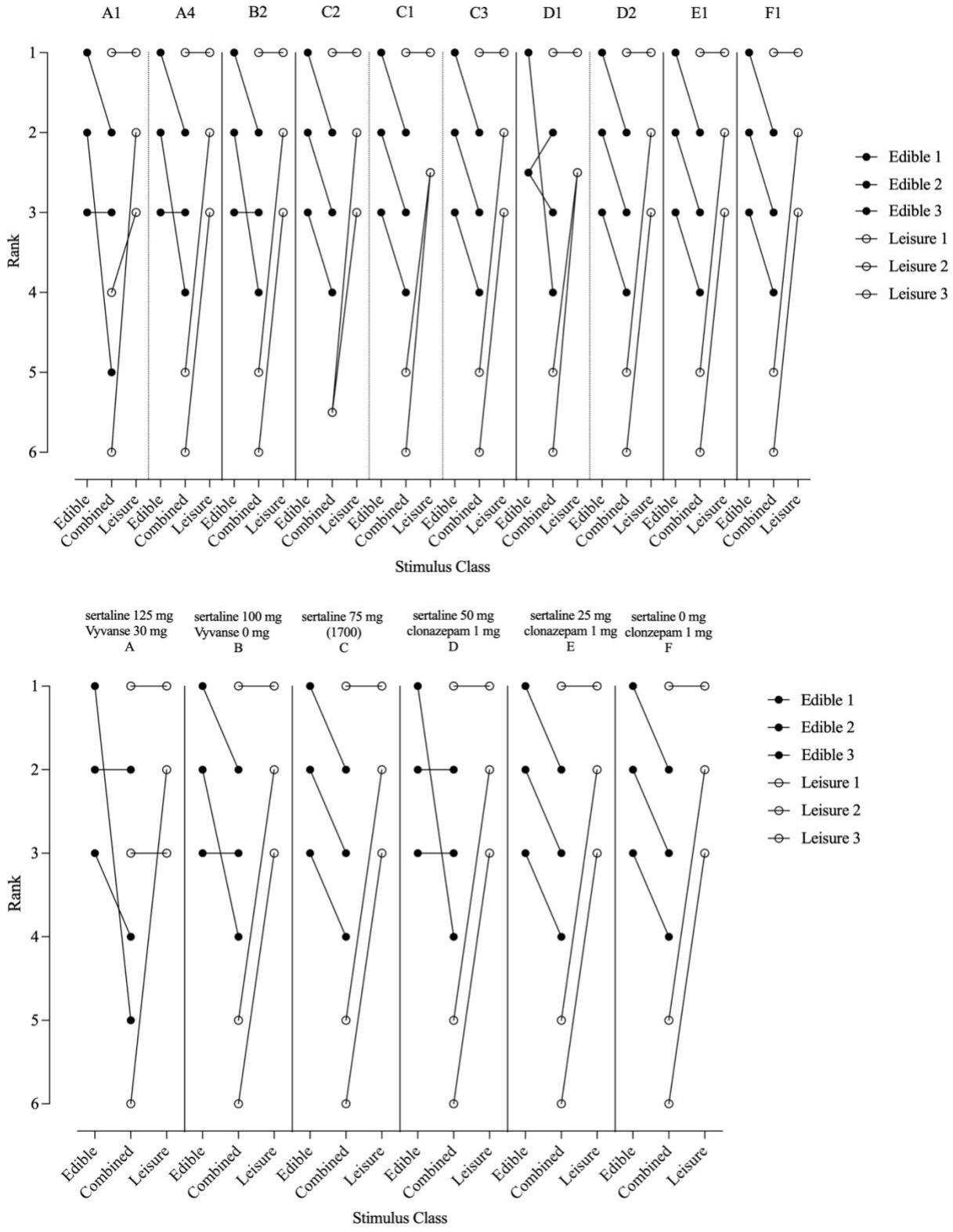
Participant 2

To assess class displacement outcomes, the researcher visually inspected the results across medication conditions as seen in the bottom panel of Figure 9. It is important to note that displacement could not be analyzed for A2 and A3 medication conditions as P2 refused to complete the assessments (100% non-selection), and thus has been removed from the analysis. As in earlier analyses, it was decided that exploring patterns observed within amalgamated "daily medication phases" may better facilitate the visual inspection of stimulus class displacement in the context of psychotropic medication adjustments (as illustrated in the bottom panel of Figure 9). The displacement analysis results depict a relatively stable pattern of one leisure stimulus

displacing all edible stimuli (pattern three), with the exception of condition A wherein no pattern was observed; meaning no class displacement of one stimulus class over another occurred. This was slightly different from P1, wherein we observed two different displacement patterns (pattern one and two). Specifically, for P2 the top ranked leisure stimulus appeared to reliably displace edible stimuli regardless of medication condition (pattern three).

Figure 9

P2 Displacement Analysis



Note. Rank is scaled to the y-axis with stimulus class scaled to the x-axis. Closed (black) data points depict edible stimuli, with open (white) data points depict leisure stimuli. The top panel depicts displacement across all medication changes separated by PRN conditions, with the bottom panel depicting class displacement for the daily medication changes inclusive of PRN conditions.

Non-Selection Analysis

Participant 1: General Visual Analysis Trends

As alluded to above, a comprehensive preference stability evaluation across medication conditions may be better achieved by also considering non-selection (see Table 3 for a summary of all results for each participant). For P1, visual analysis of non-selection trends suggests an absence of non-selection across all assessments for all preference assessment types in the first medication condition (A) (see Figures 10 and 11). This condition was followed by near zero levels of non-selection in the first two assessments of the second medication condition (B), with the sixth assessment reaching or exceeding 20% non-selection for all three preference assessment types (see Figures 10 and 11). From here pattern discrepancies emerged across the three assessment types. Specifically, in the edible preference assessments P1 engaged in 20% or more non-selection across seven of 22 assessments (see Figure 10, top panel). For the leisure preference assessments, 20% or more non-selection instances were observed across 16 of 22 assessments (see Figure 10, bottom panel). Finally, in the combined preference assessments P1 engaged in 20%, or more, non-selection across 17 of 22 assessments. Unique patterns and trends across each preference assessment type are discussed in the following sections.

Table 3

Participant Results Summarized

	P1	P2
Non-Selection Trends		

Edible	Variable patterns of non-selection across all medication conditions, except for medication condition B which appears to have low levels of non-selection (original B condition and return to).	Non-selection not observed throughout the edible assessments.
Leisure	High rates of non-selection persisted across most medication conditions. Original medication condition C and return to C both associated with an increasing trend.	High rates of non-selection persisted in medication conditions associated with the highest medication dosages (A2 and A3). Non-selection drops off to 0% beyond A1.
Combined	Non-selection appears to be minimal for edible stimuli during the combined assessments, however similar instability patterns were observed for medication condition C (original and return to). For leisure stimuli, instability was evident across all medication conditions (except for medication condition A).	100% non-selection observed in medication conditions associated with the highest medication dosages (A2 and A3). Drastic reductions in non-selection following A1 and beyond.
Non-Parametric Correlation		
Edible	As medication dosage decreased, non-selection increased. When time was controlled for, results just missed statistical significance.	n/a
Leisure	As medication dosage decreased, non-selection increased. When time was controlled for, relationship became nonsignificant.	As medication dosage decreased, non-selection decreased. When time was controlled for, results were not significant.
Combined	n/a	As medication dosage decreased, non-selection decreased. When time was controlled for, results were insignificant.
Combined Edible	As medication dosage decreased, non-selection increased. When	n/a

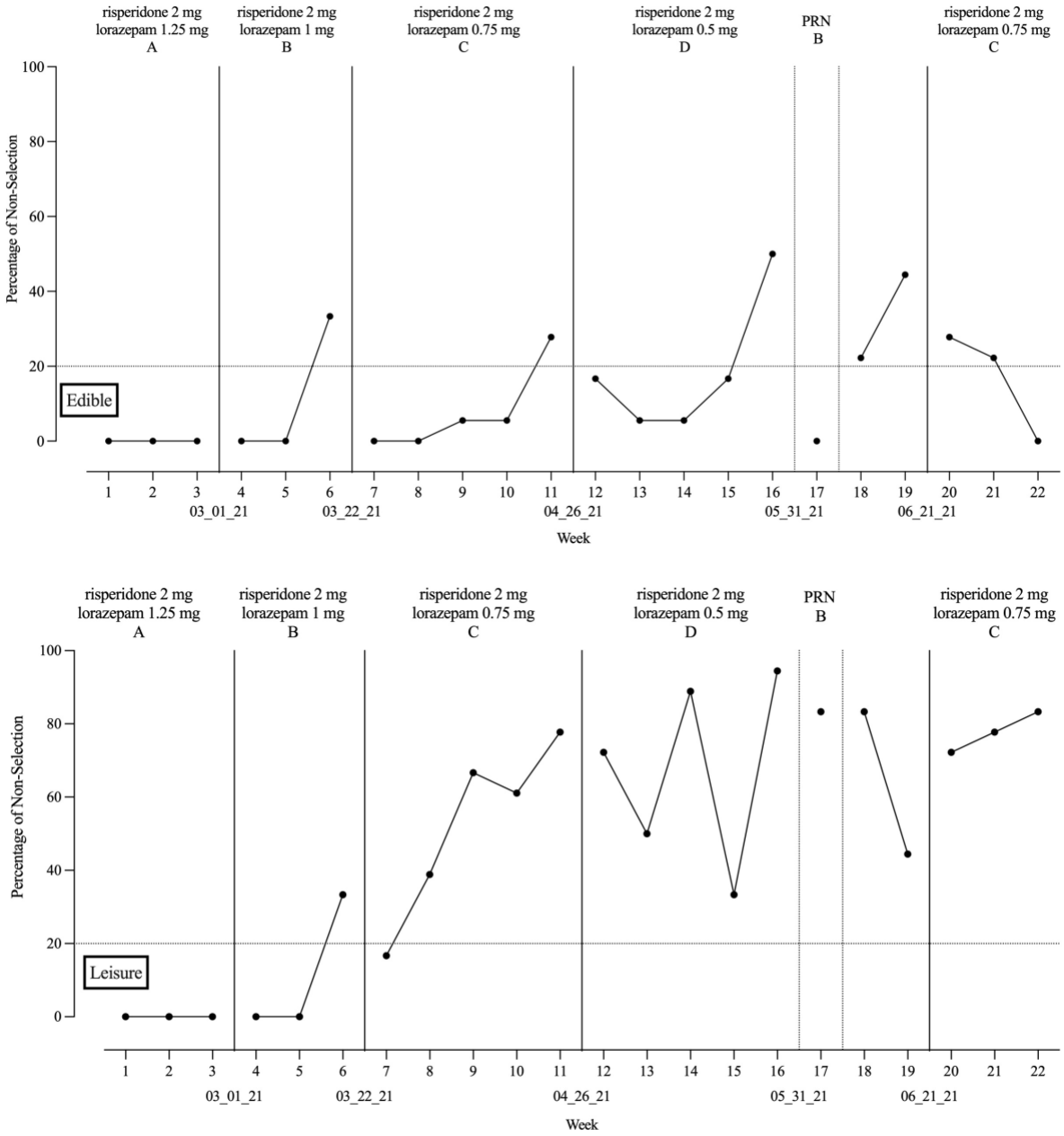
	time was controlled for, results were insignificant.	n/a
Combined Leisure	As medication dosage decreased, non-selection increased. When time was controlled for, results were just barely insignificant.	
Spearman Rank Correlation		
Edible	Preference stability may have existed within the baseline condition (A). Preference stability across medication conditions appeared in condition B and the return to B condition. Instability was observed in condition D.	Preference stability was highly variable within the baseline condition (A). Modest variability was observed with conditions B, C, D, and E. Condition F associated with stability across the condition.
Leisure	Overall preference stability may have existed within the baseline condition (A) however some variability observed. Stability across conditions B, C, and D were not observed.	Preference stability was highly stable within the baseline condition (A). Patterns of relative stability observed in conditions B, C, D, E, and F.
Displacement Analysis	Pattern one observed in five of the six medication conditions. Pattern two observed in one medication condition.	Pattern three observed in five of the six medication conditions. No pattern observed in one medication condition.
Weekly Selection Analysis		
Edible	The top two ranked stimuli were consistently selected highest regardless of medication condition. More variable selection patterns observed for moderately/low preferred items.	The top three ranked stimuli were consistently selected highest in all medication conditions, except for condition A (highest medication dosage). Greater instability for all edible stimuli was observed in this condition.
Leisure	The top ranked stimulus demonstrated consistent selection patterns across all medication conditions. All other stimuli were observed to have greater	The top ranked and lowest ranked stimuli demonstrated the most consistent selection patterns across all medication conditions. Medication condition A (highest

	instability regardless of medication condition.	medication dosage) did not appear to differentially affect selection responses for moderately preferred stimuli.

Note. The table depicts a summary of results for both P1 and P2 for each analysis run. Not applicable (n/a) was used to describe analyses that were not run.

Figure 10

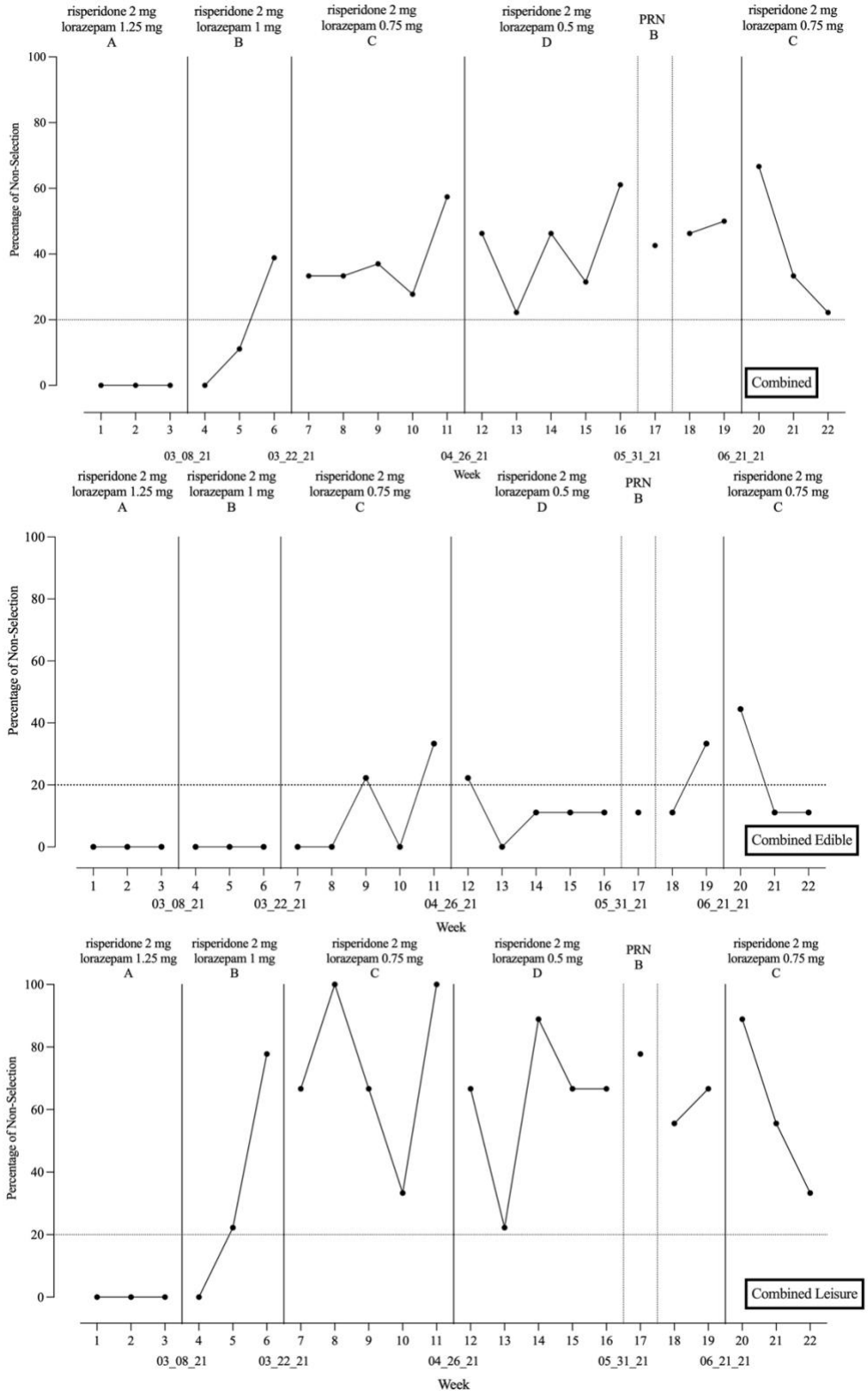
P1 Edible and Leisure Non-Selection Data



Note. The percentage of non-selection is scaled to the y-axis with week scaled to the x-axis. The top panel depicts the edible preference assessment non-selection data with the bottom panel depicting the leisure preference assessment non-selection data. The horizonal dotted line depicts when the participant engaged in 20% or more non-selection responses.

Figure 11

P1 Combined Non-Selection Data



Note. The percentage of non-selection is scaled to the y-axis with week scaled to the x-axis. The top panel depicts the combined preference assessment non-selection data, the middle panel depicts the percentage of non-selection data of the edible stimuli within the combined preference assessment, and the bottom panel depicts the percentage of non-selection data of the leisure stimuli within the combined preference assessment. The horizonal dotted line depicts when the participant engaged in 20% or more non-selection responses.

Visual Analysis of Edible Preference Assessments. In the edible preference assessments (Figure 10, top Panel), reducing lorazepam to 0.75 mg (C) appeared to coincide with an immediate decrease in non-selection, as well as relatively stable responding until the final assessment in this condition (see Figure 10, top panel). This pattern may be similar to the previous medication condition (B). That is, assessments conducted early in this medication condition coincided with less non-selection followed by a final assessment featuring markedly more non-selection. When lorazepam was further reduced to 0.5 mg (D), this appeared to coincide with an immediate decrease in non-selection; falling just below the 20% line where it remained, relatively stable, for the first half of this medication condition. The last three assessments, divided by a PRN medication condition (which could be conceptualized as a return to lorazepam 1 mg; B), appear to be variable with non-selection values ranging between 22% and 50%. Interestingly, the PRN condition (or a return to B condition) may be associated with low levels of non-selection at 0%. These low levels were observed in two of three assessments conducted in the earlier medication condition featuring lorazepam 1 mg. In the return to lorazepam 0.75 mg medication condition (return to C), unlike the previous medication condition C, which coincided with an immediate decrease in non-selection instances – these data appear to have a decreasing trend. That is, P1 engaged in zero instances of non-selection during the final assessment in this condition.

Visual Analysis of Leisure Preference Assessments. Reducing lorazepam to 0.75 mg (C) appeared to coincide with an increasing trend in non-selection that persisted to the end of this medication condition (Figure 10, bottom panel). When lorazepam was reduced to 0.5 mg (D), instances of non-selection appeared quite unstable with marked variability as evidenced by a wide range of non-selection values (33.33% to 94.44%). In the PRN condition (return to B condition), sustained high rates of non-selection at 83.33% were apparent. These high percentages persisted across the final medication condition where lorazepam was reinstated to 0.75 mg (C). Notably, the percentage non-selection values across the first (C) and second lorazepam 0.75 mg (return to C) conditions were similar. That is, both conditions appear to indicate an increasing trend. However, it appears non-selection may have been less variable in the final lorazepam 0.75mg condition (return to C) compared to the original lorazepam 0.75mg condition. This is evidenced by the difference in non-selection range between conditions at 16.66% to 77.77% and 72.22% to 83.33%, respectively.

Visual Analysis of Combined Preference Assessments. In the lorazepam 0.75 mg condition (C), the researcher observed relative stability of non-selection as evidenced by non-selection percentages remaining between 27.77% and 57.40% (see Figure 11, top panel). This relative stability appeared to persist when lorazepam was reduced to 0.5 mg (D). Albeit this medication adjustment may have coincided with a slightly larger range of non-selection percentage (22.22% to 61.11%). In the PRN condition (return to B), the researcher observed moderate non-selection at 42.59%. In the final medication condition (a return to lorazepam .75 mg) non-selection patterns may have been trending towards similar non-selection patterns as those observed in the original lorazepam 0.75 mg condition (C). That is, the final assessment may be interpreted as trending towards “return to 0.75 mg” responding. This interpretation could

also be supported by similar mean percentage non-selection. Specifically, both lorazepam 0.75 mg condition mean percentages were 37.77%.

Deconstructing Combined Preference Assessments. Given that it appeared non-selection occurred more often across leisure preference assessments compared to edible preference assessments, the researcher opted to analyze separate non-selection responses across each stimuli class within the combined preference assessments. For edible stimuli presented during the combined preference assessments (see Figure 11 middle panel), zero levels of non-selection coincided with edible items across the first two medication conditions (A and B). This trend appeared to persist into the third medication condition (risperidone 2 mg, lorazepam 0.75 mg; C), until the third preference assessment, where modest variability appeared across the rest of this condition as evidenced by non-selection values ranging from 0% to 33.33% (*M*= 11.11%). When lorazepam is further reduced to 0.5 mg, similar patterns of responding are noted to that observed in condition C (0% to 33.33%, *M*= 14.28%) as evidenced by the same range of values and a very similar mean percentage non-selection. In the PRN condition (return to B condition) non-selection occurred 11.11%. Although non-selection is less frequent, the researcher did not observe a return to an absence of non-selection, as observed in the original condition B. However, it is possible a return to condition B response pattern could have been observed had there been several consecutive occurrences of this medication condition. In the final medication condition, a return to lorazepam 0.75 mg (C), there appears to be a spike of non-selection in the first week of the condition at 44.44% (the highest percentage of non-selection in the combined preference assessments). However, the remaining weeks of the condition appear to stabilize at 11.11% NS (*M*=22.22%). Arguably, variability patterns observed in this return to C condition loosely reflect the modest variability observed in the original lorazepam 0.75 mg condition.

Moreover, one of the three (33%) assessments fell above the 20% non-selection criterion line, while in the original condition B two of five (40%) assessments fell above non-selection criterion line.

For the leisure stimuli, in the combined preference assessments (see Figure 11, bottom panel), the researcher observed similar patterns to those apparent in other preference assessments. That is, no non-selection occurred in baseline. When lorazepam was reduced to 1 mg (B), an absence of non-selection persisted for the first preference assessment followed by a steep increase in non-selection across the next two preference assessments. In the lorazepam 0.75 mg condition (C), the researcher observed highly unstable outcomes as evidence by the large range of non-selection values (33.33% to 100%) as well as a substantial increase in mean percentage non-selection from the previous conditions at *M*= 73.33%. A similar pattern of instability of non-selection percentages appeared to persist during the lorazepam 0.5 mg condition (22.22% to 88.88%; *M*=61.89%). Interestingly, in the final medication condition where lorazepam returns to 0.75 mg (condition C), non-selection appears to be on a downward trend as observed in sessions 8 through 10 (88.88% to 33.33%; *M*=59.25%); maintaining a similar range in non-selection to that of the original lorazepam 0.75 mg condition.

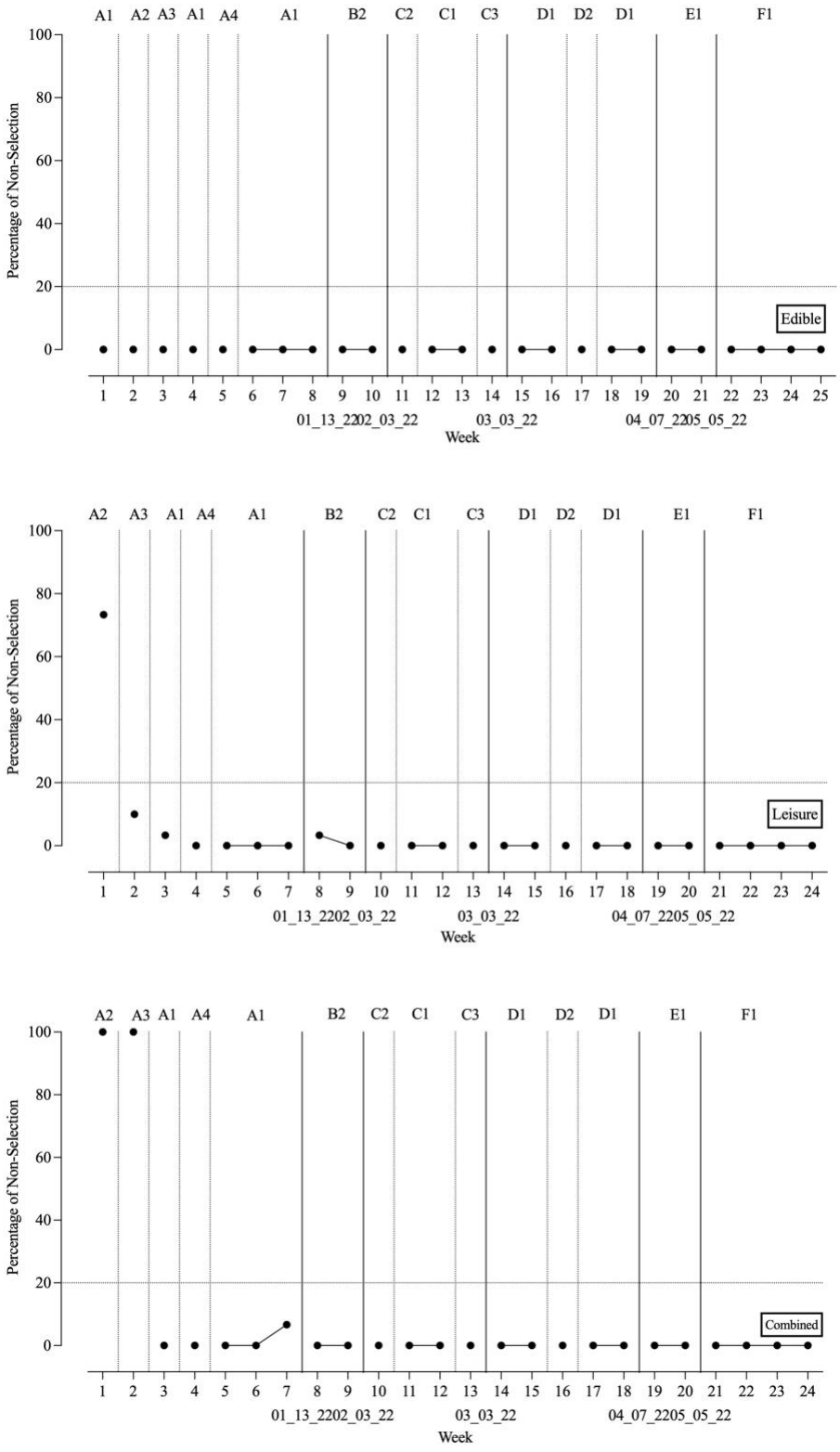
Participant 2: General Visual Analysis Trends

P2 also appeared to engage in non-selection, albeit much less frequently compared to P1. Further, non-selection discrepancies across edible and leisure preference assessments were observed however, differences were minimal across assessment types compared to P1 (see Figure 12). Regarding general trends, percentage non-selection was virtually 0 across assessment types after the first three assessments. Given P2 never engaged in non-selection during edible

preference assessments (see Figure 12, top panel), only unique patterns and trends across leisure and combined preference assessments are discussed below.

Figure 12

P2 Edible, Leisure, and Combined Non-Selection Data



Note. The percentage of non-selection is scaled to the y-axis with week scaled to the x-axis. The top panel depicts the edible preference assessment non-selection data. The middle panel depicts the leisure preference assessment non-selection data. The bottom panel depicts the combined

preference assessment non-selection data. The horizonal dotted line depicts when the participant engaged in 20% or more non-selection responses. Conditions with the numeral 1 (e.g., A1, C1, D1) depict no PRN administration, with lettered condition labels indicating a daily medication change. See Table 2 for more information regarding medication conditions.

Visual Analysis of Leisure Preference Assessments. P2 engaged in non-selection responses 73.33% of the time in medication condition A2, which also happens to be the condition wherein PRN dosages were highest (aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg, lorazepam 2 mg, olanzapine 10 mg); see Table 2 for full medication list). Following this, a drastic reduction in percentage non-selection (10%) coincided with lower PRN dosages having been administered (A3; aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg, lorazepam 2 mg, olanzapine 5 mg). This condition reflects the second highest PRN dosage administration condition. However, similar percentage non-selection patterns across subsequent PRN conditions (i.e., those with lower PRN dosages like A4, B2, C2, C3, D2) were not observed. That is, the researcher did not reliably observe "spikes" in percentage non-selection coinciding with PRN administration. Regarding A1, near zero values persisted where percentage non-selection remained at 0 beyond condition B2 (see Figure 12, middle panel).

Visual Analysis of Combined Preference Assessments. P2 engaged in non-selection responses 100% of the time (i.e., refusal to complete the assessment) across medication condition A2 and A3. These conditions also happen to be the conditions wherein PRN dosages were highest (see Table 2 for full medication list). Following this, a drastic reduction in percentage non-selection was associated with A1 at 0% and persisted across subsequent medication conditions (see Figure 12, bottom panel).

Participant 1: Non-Selection Non-Parametric and Non-Parametric Partial Correlations

To explore relationship strengths between percentage non-selection in the edible preference assessments and medication condition (i.e., total medication dosage) the researcher conducted a Spearman correlation. The results suggest there may be a statistically significant moderate negative correlation between medication condition and percentage non-selection. That is, as total medication dosage decreased, non-selection increased (r = -.594, 95% BCa CI [-0.69, -0.49], p = .004). To determine whether time uniquely influenced this relationship, the researcher conducted a non-parametric partial correlation. In controlling for time (in weeks), a relationship between total medication dosage and percentage non-selection was no longer apparent. That is, a small negative correlation that slightly exceeded statistical significance was observed (r = -.393, p = .078). Of note, SPSS was unable to generate confidence intervals for the latter analysis. However, the effect of time on this relationship may have been relatively modest. For example, the p value (p = .078) was only slightly above .05. This result could suggest the relationship between total medication dosage and non-selection may be trending towards meaningful such that medication dosage may correlate with non-selection for P1 over and above the influence of time.

The Spearman correlation exploring the relationship between percentage non-selection during leisure preference assessments and medication dosage suggested a strong statistically significant negative correlation may exist. That is, as total medication dosage decreased non-selection percentage increased (r = -.603, 95% BCa CI [-0.69, -0.50], p = .003). To determine whether time uniquely influenced this relationship, the researcher conducted a non-parametric partial correlation. In controlling for week (time), a relationship between total medication dosage and percentage non-selection was no longer apparent. That is, a weak, statistically insignificant

negative correlation was observed (r = -.183, p = .427), suggesting the passage of time likely influenced percentage non-selection, over and above the influence of total medication dosage.

The Spearman correlation exploring the relationship between percentage non-selection during the combined edible preference assessments and medication dosage suggested a strong statistically significant negative correlation may exist. That is, as medication dosage decreased non-selection percentage increased (r = -.523, 95% BCa CI [-.63, -.40], p <.012). To determine whether time uniquely influenced this relationship, the researcher conducted a non-parametric partial correlation. In controlling for week (time), a relationship between total medication dosage and percentage non-selection was no longer apparent. That is, a statistically insignificant negative correlation was observed (r = -.120, p = .608), suggesting the passage of time likely influenced percentage non-selection, over and above the influence of total medication dosage.

The Spearman correlation exploring the relationship between percentage non-selection during the combined leisure preference assessments and medication dosage suggested a moderate negative relationship that just missed statistical significance (r = -.401, 95% BCa CI [-0.52, -0.26], p = .064). Although the negative correlation was non-significant, it may still be prudent to explore any unique influence of time on this relationship. Therefore, the researcher conducted a non-parametric partial correlation. In controlling for week (time), the relationship between percentage non-selection and total medication dosage remained insignificant as expected. However, the effect of time on this relationship may have been limited – compared to the impact of time on the relationships described above (e.g., leisure and non-selection; combined and non-selection). That is, the correlation coefficient was only slightly adjusted (r = -.393, p = .078), as well as the p value, which changed only slightly (Δ= 0.014).

Participant 2: Non-Selection Non-Parametric and Non-Parametric Partial Correlations

Given P2 did not engage in non-selection across edible preference assessments, a non-parametric correlation could not be conducted.

The Spearman correlation exploring the relationship between percentage non-selection during the leisure preference assessments and medication dosage suggested the exact opposite relationship compared to P1. Specifically, the analysis revealed a moderate positive relationship (r = .533, 95% BCa CI [0.41, 0.63], p =.007). So, higher medication dosages coincided with high non-selection percentages. To determine whether time uniquely influenced this relationship, the researcher conducted a non-parametric partial correlation. In controlling for week (time), the relationship between percentage non-selection and total medication dosage remained insignificant as expected (r = -.274, p = .206). Of note, SPSS was unable to generate confidence intervals for the latter analysis.

The Spearman correlation exploring the relationship between percentage non-selection during the combined preference assessments and medication dosage suggested a moderate positive relationship (r = .518, 95% BCa CI [0.40, 0.62], p =.010). So, as observed with leisure and non-selection – higher medication dosages coincided with more non-selection. To determine whether time uniquely influenced this relationship, the researcher conducted a non-parametric partial correlation. In controlling for week (time), the relationship between percentage non-selection and total medication dosage remained non-significant (r = .116, p = .597). This may suggest that the relationship between total medication dosage and non-selection may be heavily influenced by time, which could minimize conclusions one could draw about the medication influence and non-selection. Of note, SPSS was unable to generate confidence intervals for the latter analysis.

Discussion

The following sections offer commentary on select patterns observed, suggest future research directions, clinician relevance, as well as the project's overall contribution to research and practice in behavior analysis. Due to the extensive analysis conducted, please refer to Table 3 for a summary of all participants results.

Preference Stability

One aim of the study was to explore preference stability within and across psychotropic medication conditions. Selection patterns and trends of selection responses will now be discussed.

Visual Analysis of Correlation Coefficients and Weekly Selection

In behaviour analysis, "there is a growing movement…to quantify results to improve decision-making and communication across studies and sciences" (Costello et al., 2022, p. 1). Thus, researchers are being encouraged to consider incorporating both visual and complementary statistical analysis to thoroughly explore phenomena. This project may exemplify this through visual analysis of correlation coefficients as well as visually analyzing weekly selection responses across medication conditions. By doing so, the researcher may have been in a better position to uncover selection response patterns that may have been driving correlation coefficient outcomes. Both approaches have been observed in the existing preference stability literature (see Hanley et al., 2006 and Verriden & Roscoe, 2016). However, as mentioned above, this project may be unique in that this approach has not been applied to explore preference assessment stability within and across medication conditions.

Correlation Coefficient Patterns. Individual patterns within and across the participants fluctuated making distinct conclusions more difficult. For example, in the edible preference assessment outcomes for P1 the researcher did not reliably observe a return to stability. That is,

both condition B's were associated with coefficients that met critical cut-off. However, the return to condition C was not associated with stability while the original condition C was. Thus, the absence of reliable return to baseline responding suggests evidence against a functional relationship between two variables (i.e., medication adjustment and preference assessment results; Ledford & Gast, 2018). Further, discrepant patterns were observed in the highest dosage conditions for P1 and P2. Specifically, the edible preference outcomes depict stability within this condition for P1 and instability for P2. Albeit it is possible that preference assessment type affected stability patterns (Verriden & Roscoe, 2016) making direct comparisons more difficult. Thus, future research may endeavour to replicate the current methodology with participants for whom only one type of preference assessment is appropriate. So, all participants would be completing either an MSWO or a PSPA.

Existing research on preference stability by Hanley et al. (2006), conducted in the absence of medication adjustments, concluded seven of 10 participants demonstrated preference stability across several months. Importantly, the largest range in coefficients across all participants was r = -.12 to r = .49. By contrast, coefficient ranges across both participants in the current study were generally much larger (apart from P2 leisure outcomes). These preliminary outcomes could suggest that participants undergoing frequent medications adjustments may demonstrate greater preference instability overall compared to those who are not experiencing frequent medication adjustments. In other words, it is possible that the clinical subset of adults with IDD who are currently undergoing psychotropic medications adjustments (i.e., medication trialing) may demonstrate greater preference instability; not necessarily in reference to a particular medication adjustment but rather the presence of ongoing adjustments may be a factor. This hypothesis may be viable given it is relatively well-accepted that "response rate in the

absence of a drug" (Poling & Byrne, 2000b, p. 185) will differ compared to in its presence. It could follow that, response rate (i.e., selection) in the presence of frequent medication adjustments (i.e., medication trialing) may be differentially affected because the variables influencing drug action are in a state of "flux" compared to when there is an absence of frequent medication adjustments. Practically, this could mean that clinicians may consider applying frequent preference assessments (e.g., daily brief preference assessments) during a medication trialing period. This could ensure the correct stimuli are being identified so interventions utilizing the contingent delivery of preferred items may continue to be effective across a medication trialing interval. Future researchers should consider assessing preference stability in matched samples. That is, recruiting adults with IDD who are currently undergoing frequent medication changes as well as a "control" group of adults with IDD who are not undergoing medication changes but are on a steady, unchanging dosage of psychotropic medications. Results from this work may garner more concrete support for the hypothesis that the presence or absence of medication adjustments may uniquely affect preference stability.

Regarding P2 edible preference assessment outcomes, the researcher observed coefficients that hovered around, or slightly exceeded, critical cut-off in conditions *not* associated with frequently fluctuating PRNs (e.g., B, E, F). For P2, it may be reasonable to conclude that frequent PRN fluctuation may have invariably affected edible stimuli stability. Interestingly, leisure stability appeared largely unaffected across medication conditions. One possible explanation for this outcome may be related to the side effect profiles associated with the featured daily medications and PRNs (e.g., dry mouth, changes in appetite, loss of appetite). These adverse side effects could have differentially affected response selection related to the presentation of edible stimuli. Future research may consider collecting specific information on

adverse side effects to determine the role they may play in the context of preference assessment stability (Valdovinos et al., 2017). In the meantime, practitioners and researchers should be monitoring for not only the intended medication effects (i.e., sedation) but also unintended effects (i.e., hyperactivity, changes in appetite) that might uniquely impact preference stability and in turn behavioural programming (see Cox et al., 2022; Valdovinos, 2019).

As PRN fluctuation ceased, the researcher observed increasing stability that was trending towards meeting the critical cut off. Interestingly, this could also be construed as preliminary evidence supporting the hypothesis that in some cases, rapid medication adjustments may be associated with greater instability in part because the variables affecting drug action are in a "state of flux". Future researchers should consider evaluating the effects of PRN polypharmacy, as well as interclass (i.e., medication class; benzodiazepines, stimulants, etc.) polypharmacy on preference stability outcomes.

Finally, it may be impractical, or unfeasible, for a clinician to repeatedly conduct full preference assessments as this study has done. Therefore, future work could consider assessing the practicality (i.e., ecological validity) of repeatedly assessing preference stability across medication conditions, or even outside of medication adjustments (see Kelley et al., 2016 for more information regarding assessing preference stability weekly). The results of which could inform and influence the way in which clinicians adjust their practice to monitor preference stability. For example, researchers should continue to assess convergent validity of a full preference assessment protocol (as in the current project) with weekly brief (2 or 3 stimuli) preference assessments (i.e., brief EFA versus standard EFA).

Weekly Selection Analysis. The Spearman rank correlation analysis provided important information. However, it offered information on broader "signals", while a weekly analysis may have offered a more in-depth analysis of trends and patterns.

First, visually inspecting the weekly selection patterns of leisure stimuli for P2 suggests that the top ranked and lowest ranked stimuli were extremely stable, while the moderately preferred stimuli tended to range in ranking. This could suggest that the modest instability observed, as per correlation coefficients, may have been largely driven by moderately preferred stimuli and medication condition did not appear to differentially affect selection patterns of specific stimuli, as evidence by relatively modest rank ranges. By contrast, instability for P2 edible was differentially observed when medication was at its highest dosage (medication condition A). However, this pattern appeared to be absent from the remaining medications for this participant. Without the weekly selection analysis, this pattern may have been overlooked.

In analyzing trends informed by the weekly selection analysis the researcher noticed some corroboration in findings between the two analyses that may affirm what was previously indicated by the "broader" signals of the Spearman correlation analysis. For example, the researcher noted that for P2 medication condition A (when medication dosage was highest) appeared to have coincided with the greatest amount of instability across all edible stimuli. It is possible to suggest that what might be observed is a unique side effect profile from the administration of psychotropic medications acting as abolishing operations. For example, the administration of lorazepam is associated with changes in appetite, olanzapine dry mouth, sertraline a loss of appetite, aripiprazole changes in appetite, and Vyvanse a loss of appetite. Perhaps, the administration of high dosages of these psychotropic medications in combination

with one another created a unique motivating operation where the participant had shifting preference more frequently than other medication conditions.

Given the results, it appears both analyses provided useful and important information. The results of the current project may reiterate the messaging in Costello et al. (2022) in that a fulsome analysis may be better achieved by employing a combination of visual and complementary statistical analysis.

Displacement Analysis

The third research objective aimed to evaluate displacement patterns across psychotropic medication conditions (e.g., edible vs. leisure) (Bojak & Carr, 1999). Recall, P1's results suggested complete edible class displacement over leisure stimuli (pattern one) in five of the six medications conditions, with condition A depicting two edible stimuli displacing all but one leisure stimulus (pattern two). By contrast, P2's results indicate the top ranked leisure stimuli displaced all edible stimuli (pattern three) in five of the six medication conditions (condition A depicted no "identified" pattern). Given there is no precedent with which to compare the results, the researcher felt it prudent to discuss the current results in relation to outcomes observed in the general displacement literature for the purposes of highlighting similarities or differences, where applicable.

First, the results appear to be consistent with that of Conine and Vollmer (2019). Specifically, these authors concluded "edible items were more likely than leisure items to rank highly…However, leisure items were also selected more often overall than in prior research" (p. 557). My results could offer preliminary evidence in support of their hypothesis, which was that leisure stimuli may be more likely to be displaced by edible stimuli for adults in residential settings because of various motivating operations, including the increased likelihood of

prescription medications. Future research might consider recruiting a larger sample size to further explore displacement patterns in the context of medication adjustments to see if the patterns observed here may be replicated.

Importantly, displacement patterns did not appear to reliably change in association with specific medication adjustments, which could suggest medication adjustments may not differentially affect displacement. This outcome might be clinically relevant because it means if behavioural programming is utilizing contingent (or non-contingent) access to stimuli type (i.e., leisure), rather than specific stimuli (i.e., reading Peppa Pig book), a practitioner may not be as concerned with the possibility of a medication trial differentially affecting intervention outcomes.

Existing drug-behaviour research could offer some insight into the current outcomes. For example, Northup et al. (1997) evaluated whether MPH (a stimulant) affected the reinforcing effectiveness of various stimuli often seen in classrooms (e.g., activities, tangibles). The authors found that when placebo was administered two of the participants were more likely to complete math problems to earn edible reinforcers. By contrast, when MPH was administered, these two participants were more likely to complete math problems to access activities. This result suggested a shift in reinforcing stimuli type was observed. It is possible that because P1 and P2 in the current study never experienced a no medication (i.e., placebo) phase, the conditions did not exist wherein it would have observed a shift in displacement as evidenced by an alternate displacement pattern coinciding with a medication adjustment. Although it may be difficult, future research may consider attempting to recruit participants who may be undergoing medication adjustments that will result in no-medication condition (even for brief windows of

time; washout period) to determine whether the no-medication coincide with alternate displacement patterns (e.g., shifting pattern one to two).

Another possible explanation for this outcome could be that that displacement may be a less sensitive analysis in relation to changes associated with medication adjustments; while inspecting weekly stimulus (for example) may represent a more sensitive (i.e., fine-grained), and thus illuminate potential patterns more readily (as noted in earlier sections).

Non-Selection Analysis

The final objective of the project was to explore the relationship between psychotropic medication adjustments and non-selection in preference assessments. Non-selection is infrequently cited but likely present across the behaviour analytic research. This is evidenced by reports indicating up to 67% of cases in SCED research suggest the presence of missing data (Dong & Peng, 2013; Kumar De et al., 2020; Peugh & Enders, 2004). More specifically, in a review featuring five major behaviour analytic journals, 24% of the journals meeting inclusion criteria reported missing data (Peng & Chen, 2018). The result of neglecting this topic means there are few strategies in place for handling missing data other than: (a) omitting missing sessions without explanation, (b) omitting participants with missing data without reporting attrition, or (c) replacing missing data with zero (Kumar De et al., 2020). By handling missing data through deletion or omission, the remaining data may be misrepresenting the independent variable's impact. As described earlier, another limitation stemming from this neglected research area is that entire clinical sub-populations may be underrepresented in the literature base.

Existing recommendations and protocols typically employed in preference assessment research (see Melanson, 2021 for an example), recommend against incorporating participants who engage in non-selection (MacNaul et al., 2020). Thus, both P1 and P2 would have been

omitted. As such, they may represent an important subset of the clinical population (i.e., persons with IDD who engage in severe challenging behaviour) that may be largely missing from the preference assessment literature more generally. If missing data in SCED is as prevalent as previously mentioned, then it is possible that upwards of a quarter of the target population (e.g., 24%) may be unrepresented. Practically, this presents a substantial problem in the context of preference assessment literature (and practice). For example, it could mean that outcomes obtained through current preference assessment processes may not accurately reflect results for participants who fit "different clinical subsets". Excluding participants who engage in non-selection from preference assessment research may interfere with innovation. That is, developing and empirically evaluating protocols that undercut the likelihood of ongoing non-selection. Or, empirically evaluating mathematical/statistical processes to account for missing data (i.e., non-selection); as is commonly observed in group design research (e.g., last observation carried forward, Lachin, 2016; multiple imputation, Royston, 2004; deleting cases listwise, Field, 2018).

It goes without saying that neglecting missing data likely diminishes results generalizability because of the absence of a subset of the intended target population; while threats to internal validity increase as attrition rates rise (Ledford & Gast, 2018). Albeit attrition may not be reliably reported (Kumar De et al., 2020). By simply excluding or removing the non-selection information from analyses, the data may not be properly and comprehensively analyzed. So, resulting conclusions drawn may be somewhat erroneous.

As mentioned earlier, one possible solution could be to employ flexible preference assessment protocols to accommodate for non-selection (i.e., missing data). In a relatively recent systematic review of preference assessment stability literature, Call et al. (2012) was the only article featuring an approach that could accommodate missing data (MacNaul et al., 2020). In

addition to being the only study, to the researchers knowledge, exploring preference assessment stability across psychotropic medication conditions, the current protocol replicated and extended the approach by Call et al. (2012). Importantly, the Call et al. protocol was designed to be used during MSWO assessments and has not yet been applied to any other preference assessment types. Protocol execution states that after three trials of non-selection, the remaining items are to be given equal rankings that average the remaining rankings left to assign. The researcher replicated the application for P1, while uniquely applying an adjusted version to P2 given P2 completed PSPAs. Specifically, the researcher could not apply the protocol live during an assessment to non-selected items, as in MSWO. However, the researcher used Call et al. (2012) protocol to calculate individual and grand rankings.

If behaviour analysis can establish protocols to accommodate non-selection, perhaps flow charts like that of Virués-Ortega et al. (2014) should also be adjusted to reflect this specific response. That is, they may add selection pathways that promote the user to consider whether non-selection will occur, in addition to existing participant characteristics already considered (e.g., ability to discriminate between pictorial and tangible stimuli, ability to discriminate between multiple stimuli).

Applying the adjusted protocols (i.e., Call et al. 2012) appears to have facilitated exploring non-selection across medication conditions, as well as allowed the researcher to generate raw data to explore preference stability across medication conditions. The researcher observed two vastly different non-selection patterns across P1 and P2. For example, P1 engaged in minimal non-selection during the first medication condition (condition A; risperidone 2 mg, lorazepam 1.25 mg), which also reflected the highest medication dosage, across all assessments conducted (i.e., edible, leisure, and combined class). Thereafter, the researcher observed non-

selection responses drastically increase across subsequent medication adjustments. By contrast, P2 engaged in markedly more non-selection during the first medication condition (condition A; aripiprazole 7 mg, clonidine 0.15 mg, sertraline 125 mg, Vyvanse 30 mg), which was also when he was receiving the most medication; while subsequent medication conditions (e.g., B, C, D, E, F), were associated with markedly less non-selection responses. These vastly different participant outcomes suggest the approach may be equally applicable across very different outcome profiles. It is also possible that high medication dosages (regardless of medication type) uniquely affect non-selection across individuals. Future research should endeavour to secure a larger sample size of participants to further explore this line of inquiry. This work could begin to uncover consistent patterns within this clinical population; perhaps similar to pattern types described in the automatic EFA literature. For example, Virues-Ortega et al. (2022) identified three consistent patterns of automatically maintained challenging behaviour that accounted for 60% of previously published EFA results that indicated an automatic function. Perhaps we might be able to see some uniformity in patterns of non-selection at high, medium, and low medication dosages amongst a larger sample size. This patterning could in turn help clinicians generate assessment schedules that may garner valuable information regarding behavioural effects coinciding with medication adjustments that also minimize assessment time (see Cox et al., 2022; Valdovinos, 2019 for recommendations on medication assessment approaches).

In reviewing P1 results, it is possible that the edible stimuli preference assessments offered some level of "protection" against non-selection. For example, there were only seven assessments that fell above 20% non-selection in the edible assessments, while 16 fell above 20% non-selection across leisure stimuli preference assessments. This "protective" factor was further observed when the researcher deconstructed the combined edible non-selection outcomes

(see Figure 11, top panel). That is, only five assessments fell above 20% non-selection. For the edible preference assessment, non-selection may have been largely driven by the lesser preferred items in this hierarchy (i.e., those ranked 4th, 5th and 6th). That is, once P1 selected his top three, which were relatively constant – he did not want to select the remaining three. Given only the top three edible items are included in the combined-type assessment, he was only being asked to select from items ranked 1st, 2nd, or 3rd (i.e., top selections). Practically, this could mean that for participants who frequently engage in non-selection – clinicians or researchers may consider relying more heavily on results obtained from combined-type assessments. This approach could minimize non-selection responses. Albeit, in order to obtain the stimuli array for combined-type, at least one separate edible and leisure preference assessment would need to be conducted. Future research may consider exploring whether, or for whom this pattern occurs across participants' who frequently engage in non-selection. Researchers may also consider testing the viability of this approach outside of the context of psychotropic medication evaluation. Additionally, researchers may consider assessing whether high rates of non-selection affect preference assessment validity. That is, do high percentages of non-selection coincide with poorer agreement in accordance with reinforcer assessment outcomes compared to when near zero percentages of non-selection are observed. Following this, future work may consider developing and evaluating different protocols that accommodate for non-selection (like that of Call et al. [2012]) to determine which best aligns with reinforcer assessment outcomes meant to corroborate results generated by a preference assessment.

Non-Selection Spearman Correlations and Non-Parametric Partial Correlations

The issue of non-selection could be further compounded in longitudinal work, exemplified by the current project's methodology. In this context, assessments are repeatedly

applied, which could result in an increased likelihood of non-selection. A comprehensive analysis meant exploring the data to see whether total medication dosage influenced non-selection, as well as whether time uniquely affected relationships. For P1, as medication dosage decreased non-selection increased. However, upon controlling for time through the partial correlation, these relationships became non-significant suggesting time was uniquely influencing them. Of note, in controlling for time across non-selection observed in edible assessments across medication conditions, the significance (i.e., *p* value) was only slightly above what is considered acceptable. Therefore, it is possible that a modest relationship was sustained, meaning higher dosages could differentially affect non-selection for some participants. Future research on this topic might consider attempting to recruit a substantially larger sample size of participants so that moderator analyses may be conducted to discern whether medication adjustments function as a moderator (i.e., affecting the strength or direction of the relationship between time and non-selection). Although it would be difficult to find a group of individuals undergoing the same medication changes for the same medication type, perhaps the first step might be to make more general queries related to high, medium, or low dosages (of any medication combination).

Limitations

First, the researcher used the central tendency mean in my calculations. For example, the researcher used mean values to calculate overall Spearman rank correlation coefficient cut-off's per medication condition. One important limitation of using the mean to communicate the "middle point" is the fact that it is differentially influenced by outliers in the data set (Field, 2018). In the current project, large variability was frequently observed for both participants across Spearman rank correlation coefficient outcomes. In datasets with highly variable datapoints, it may be more beneficial for researchers to consider the use of median as a central

tendency (see Table 4 and 5 for Spearman correlation coefficient mean and median values). To the researcher's knowledge, comparing the accuracy of preference assessment stability outcomes that employ the use of mean versus median have not yet been conducted. Future research may consider exploring this topic. Until then, it made sense for the researcher to employ the previously published protocols commonly observed in preference assessment works (see for examples, Hanley et al., 2006; Verriden & Roscoe, 2016).

Table 4

Edible Spearman Rank Correlation Mean and Median

	Medication Condition	Spearman Rank Correlation Mean	Spearman Rank Correlation Median
P1	A	.60	.60
	B	.76	.72
	C	.63	.65
	D	.55	.51
P2	A	.22	.26
	B	.52	.52
	C	.20	.46
	D	.34	.46
	E	.57	.57
	F	.62	.50

Note. The table depicts the edible Spearman rank correlation mean and median values for each medication condition for each participant.

Table 5

Leisure Spearman Rank Correlation Mean and Median

	Medication Condition	Spearman Rank Correlation Mean	Spearman Rank Correlation Median
P1	A	.67	.67
	B	.45	.40
	C	.48	.52
	D	.30	.31
P2	A	.75	.73
	B	.64	.64
	C	.62	.61

D	.60	.58
E	.65	.65
F	.66	.67

Note. The table depicts the leisure Spearman rank correlation mean and median values for each medication condition for each participant.

Second, percentages were used throughout the analysis, which may introduce bias when cross comparing to other percentage values wherein the denominator is not the same. For example, non-selection percentages were created for both P1 and P2. However, participants employed different preference assessment methodology (three-trial MSWO and 30 trial PSPA). For instance, if P1 engaged in one instance of non-selection throughout the MSWO, the non-selection percentage would be 6.66% (1 divided by 15, multiplied by 100%). If P2 engaged in one instance of non-selection throughout the PSPA, the non-selection percentage would be 3.33% (1 divided by 30, multiplied by 100%). This issue is again exemplified in creating the grand ranks for the displacement analysis wherein the denominator (number of sessions) across each medication condition varied (range one to seven assessments). This may have affected my ability to create comparable grand ranks. While this may be an issue cross-comparing results between participants due to discrepant denominators, the researcher attempted to account for this limitation by describing patterns within participants. Future researchers could explore alternative methods to compare outcomes across participants that might minimize bias introduced by discrepant denominators. For example, it may be of value to explore the viability of effect size estimates in the context of preference stability across medication conditions (see for example, Cox & Virues-Ortega, 2022).

Third, applying Call et al. (2012) protocol for handling non-selection during MSWO assessments as well as tied ranks may have affected the outcomes and resultant interpretations.

For example, Call et al. (2012) is the only protocol, to the researchers knowledge, that has been developed to handle missing data in the context of SCED and preference assessment literature. The protocol may not be entirely substantiated, and so applying it in the current context may have affected the results. However, the application of the protocol may lend credibility to its utility and flexibility, which suggests it may be a viable tool for use in future research on this topic – as well as by clinicians currently supporting clients undergoing frequent psychotropic medication adjustments who engage in non-selection.

Finally, as in much of the applied behavioural pharmacology research (e.g., Cox et al., 2022; Valdovinos et al., 2009) behaviour analytic researchers do not have control over the primary independent variable, medication adjustment. This is particularly troublesome when attempting to draw conclusions (i.e., deciphering functional relations) regarding the impact of the medication adjustment (Ledford & Gast, 2018). However, the researcher was able to reliably (see Study Strength below) implement a flexible protocol to monitor the effects of medication administration in a clinical context, which suggests the approach may have some ecological validity. As mentioned above, future research may consider exploring ways to minimize assessment duration while maximizing behavioural information gleaned across medications conditions.

Study Strengths

Although there were several limitations, the study methodology showcased many important strengths. For instance, the researcher embedded as many methodological safeguards as possible according to best practice in applied behavioural pharmacology (see VanHaaren & Weeden, 2013). For example, each assessment was conducted on the same day, at the same time, one-hour pre or post meal, and one-hour post daily medication administration. This may have

controlled for external variables that can affect internal validity. Specifically, VanHaaren and Weeden (2013) reference peak-plasma levels (i.e., medication concentration within the bloodstream; steady state). Of note, the researcher was able to retain this rigour by shifting assessment timing once for each participant in response to dosage administration timing changes. Second, overall assessment fidelity, fidelity IOA, as well as IOA on the dependent variables (selection or non-selection responses) was high. Third, the raters were blind to the medication conditions during all aspects of coding (i.e., IOA and fidelity; single blinding). This may have circumvented any rater-bias in that the assessment results related to pre-existing biases associated with medication, and its affect on selection responses. Finally, as per VanHaaren and Weeden (2013), the researcher provided medication administration times, medication dosage, interval of time between administration of the medication and the assessments, medication adherence (100%), and pertinent demographic information regarding the participants.

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Appendix A

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St. Catharines, ON
L2S 3A1 Canada
T (705) 773 8870
brocku.ca

<current date>

Dear Parents/Guardians/Substitute Decision Maker:

We are writing to inform you of a research project called, *Evaluating the impact of psychotropic medication in persons with intellectual and developmental disabilities who engage in challenging behaviour.* We are recruiting individuals who engage in challenging behaviour, have a diagnosis of intellectual and developmental disability (IDD), and are currently taking (or are going to begin taking) one, or more, psychotropic medication (e.g., risperidone, aripiprazole, cannabis oil, etc.).

There are two goals for the study. First, we will explore whether medication changes impact individual preferences. For example, we would like to look at whether a medication adjustment (that your physician prescribes) changes what individuals like to spend their time doing (e.g. leisure activities, toys/games, etc.). We will also explore how accurate different kinds of assessments are at showing how medication adjustment affect individuals' who engage in challenging behaviour. It is important to note that we (the research team) would not be involved in the medication prescribing process, your loved one's prescribing physician would make medication changes according to clinical need – the medication adjustment process is entirely separate from our work.

We feel this project is important because it may help us better understand how medication can change behaviour (i.e., what the individual prefers) and whether the tools used to assess impact are accurately showing medication effects. The information we get from this study could be used by your loved one's care team to assist with possible treatment strategies in the future.

Participation is voluntary, and you can withdraw at any point.

If you wish to learn more about the study or would like to get involved, please email us at ak18lb@brocku.ca. The lead researchers on this project are Drs. Alison Cox and Maurice Feldman. The project is a joint initiative by <name service provider> and Brock University.

We hope you will consider participating, and/or consenting on behalf of your significant other.

Sincerely,

Alison Cox, PhD, BCBA-D
Brock University

Maurice Feldman, C. Psych, BCBA-D
Brock University

Autumn Kozluk, M.A Candidate (Principal Student Investigator)
Brock University

Appendix B

Project Description and Consent to Participation Form

Researchers:
Alison Cox, Ph.D., BCBA-D, Assistant Professor
Maurice Feldman, Ph.D., BCBA-D, C. Psych, Professor
Principal Student Investigator: Autumn Kozluk, MA Candidate,

Contact information: Email: Autumn Kozluk ak18lb@brocku.ca, phone: (705) 773 8870

Research Project Title: *Evaluating the impact of psychotropic medication in persons with intellectual and developmental disabilities who engage in challenging behaviour*

The description below is your copy of the ongoing project that is for your reference as part of the consent process. The description will give you a basic idea of the project and what participation in the study will be like should you chose to be involved. If you have any questions about any of the information, please feel free to reach out via phone or email. Please take the time to read this carefully and to understand all the information.

What is the purpose of the project?

The goal of the project is to understand the impact of medication changes in persons with intellectual and developmental disabilities (IDD) who engage in challenging behaviour. Our research team will not influence the timing or clinically indicated need for participants' medication prescriptions. Instead, we will be informed by the care providers (with your permission) that a change has occurred and, at designated times, will complete several assessments that will help us answer our research questions (listed below).

Specifically, we will:

1.) Look at whether responses to well-known questionnaires (e.g., the Aberrant Behaviour Checklist, ABC; Behaviour Problems Inventory – Revised; BRI-R) align with direct assessment outcomes (e.g., functional analysis, daily data collection). For example, if support staff report improved outcomes – do the daily data collection system and/or functional analysis assessment also show improvement?

2.) Look at whether medication adjustments affect individuals' preferences. For example, what they like to spend their time doing.

What is a functional analysis?

The conditions included in a functional analysis are called: 1.) alone, 2.) demand, 3.) activities (play), and 4.) attention. During the alone condition, no materials are required. Rather the participant is provided time alone for up to 15 minutes. Research assistants will record the frequency of challenging behaviours that occur during this condition. If resources are not available (e.g., a room with a one-way mirror) then the RA would sit in the room with the individual but not engage with them for the duration of the session. This condition will tell us if the participant does not require external items or persons to be motivated to continue to engage

in the behaviour. During the demand condition, where the purpose is to assess whether the individual engages in challenging behaviour to escape a request or instruction, the RA begins this session by presenting a relevant task (educational, vocational, self-care etc.). If the participant does not attempt to complete the task within 5 seconds of the instruction being placed, the RA then demonstrates the correct response. If the participant does not follow the instruction within 5 seconds of being provided the model, the RA then provides gentle physical guidance to support them in completing the task. If the individual engages in challenging behaviour at any time during the session, the materials are removed, and the research assistant turns away for 30 seconds (providing escape from the task). During the activities (play) condition, the individual is provided with free access to preferred items, and the RA engages in brief conversation with the individual every 30 seconds. The RA will ignore any instances of challenging behaviours. During the attention condition, which assesses whether the individual engages in challenging behaviour to get attention from others, the room will contain some moderately preferred items (e.g., leisure items) that are freely available during the session. The session begins when the RA tells the participant that they are "going to do some work" and proceeds to "mark a paper", "read a book". The individual is permitted to engage with the items at their leisure, the RA will not interact with the individual unless they begin to engage in challenging behaviour. Upon the occurrence of challenging behaviour, the RA will provide a brief statement of concern (e.g., "you will hurt yourself, please stop; you will hurt me, please stop) and then return to work. This will continue until the session is timed out.

How is the study organized and how long will the project take?

Agreeing to participate means participants will take part in weekly 1-hour (approximately) in-person assessments, where they will complete up to three preference assessments. This will provide us with information about their preferred activities and items. When medication adjustments are prescribed, they will participate in up to six functional analysis, approximately three functional analysis (direct assessment) per session (over approximately two weeks) to assess medication impact. These sessions will take approximately 90 minutes.

Before the first preference assessment, we will ask caregivers to tell us which items or activities we should use during the first preference assessment. We will also ask caregivers to complete the ABC and BPI-R each time the medications are adjusted. This will tell us about target challenging behaviour in relation to frequency, intensity, and duration. Each questionnaire will take approximately 10 minutes to complete and can be done online or by pencil and paper. The total study length may change for every individual due to 1.) the likelihood of medication adjustments and 2.) the length of medication absorption into the bloodstream.

Will my personal information be kept confidential?

All information that we obtain about the participant including: 1.) relevant participant demographics; 2.) contact information; 3.) completed assessments; and 4.) psychotropic medication list, will be kept confidential and stored in a locked office or on in an encrypted electronic database. Only the research staff directly involved in the study will have access to research materials and data. Any presentation, reports, or publications about the project will reflect individual outcomes however, participant results will be presented without identifiers. Will your permission, all data will be kept up to five years after the study's completion date and all hard and electronic copies will be destroyed thereafter.

What are the risks taking part in this study?

There is minimal risk for participating in this study – in that the risk is no greater than what the participant would be exposed to during their daily life. For example, the assessment scenarios will include activities and instructions they experience during their day (e.g., "make you bed please", "fold this shirt please"). The functional analysis is well-known and considered best-practice in the field of behaviour analysis. Further, we will have a pre-determined 'termination criteria' so that researchers know when the stop the assessment if the participant becomes very distressed. Finally, where applicable, direct care staff will be alerted to when sessions are taking place, in the event participants become increasingly agitated. The study is set up to minimize all risks to participants.

What are the potential benefits of participating in this study?

Participation in this study will allow for immediate feedback about target challenging behaviour that will can be used to assist the care team in making real time informed decisions regarding the treatment program.

Is there any cost for participating?

There is no cost for participating.

Is participation voluntary?

Participation is voluntary. You can decline to participate (on behalf of the participant) at any time throughout the study without penalty by emailing the researchers listed on this document.

How and to whom will the research results be share?

Summary results will be disseminated in scientific journals, at conferences, and other presentation for educational purposes. Participants names and identifiers will not be used in any summary of results or in any presentations about the study. A nontechnical summary report will be shared on the researchers Brock website. Results will be shared to disseminate study outcomes that may be useful to other practitioners, research, care providers and students. No disseminated results will contain any of your identifying information.

When will I receive the results of this project?

Within four months of the completion of this study (approx. April 2022), we will email all participants a summary of the results.

Signing the Consent Forms

Signing the following pages of this *Project Description and Consent Form* indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate. You are free to withdraw from the project at any time, and/or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

Principal Investigator Dr. Alison Cox: 905-668-5550 Ext: 3949

The research project has received clearance from the Social Science Research Ethics Board at Brock University (file #___). If you have any concerns or complaints about this project, you may contact any of the above-named persons, or directly contact the Research Ethics Office at Brock University reb@brocku.ca, or by phone: (905) 668-5550 Ext: 3035. A copy of this Project Description and Consent Form has been given to you to keep for your records and reference.

I, _____ (Guardian/Substitute Decision Maker name - please print and sign) herby provide consent for _____(participant name – please print) to take part in the project, "*Evaluating the impact of psychotropic medication in persons with intellectual and developmental disabilities who engage in challenging behaviour"*.

By providing consent I am allowing the research team to:

- Evaluate the impact of medication changes through indirect and direct measures described above,
- Allow caregivers to provide information regarding preferences (RAIS-D) and medication impact by answering questions to the indirect measures listed above (ABC; BPI),
- Video record sessions for research purposes (i.e., obtaining inter observer reliability, evaluate research assistant implementation fidelity)
- Use the data in order to publish in journals, present at conferences, and disseminate relevant information with the care team,
- I understand that I can revoke or amend this consent at any time for any reason.

Please check YES or NO for the following items:	**YES / NO**	
I would like to receive the results of this project after it is completed (approx. April 2021). I would prefer that the researchers contact me by (check): □Email _____ □Phone _____	□	□
I give permission for the researchers to retain my name and contact information up to five years after study completion.	□	□
I give permission for the researchers to retain my data, without personal identifiers, up to 5 years after study completion.	□	□
I give the permission for the researchers to access the participants' daily behavioural data collection and medication records (e.g., Medication Administration Recording Sheets) to answer this project's research questions. Participant Signature: _____	□	□
I give permission for the researchers to use the data collected for this project to answer research questions for other related studies (secondary use of data). Participant Signature: _____	□	□
The researchers may contact me directly for possible future related studies. You may decline to participant in these studies.	□	□
I give permission to the researchers to video record sessions for the purpose of interrater reliability and assessing treatment fidelity).	□	□
If I decide to withdraw before study completion, the researchers may use any data obtained up to the time of withdrawal	□	□

Email: _____

Phone 1: _____ **Preferable hours:**_____

Date: _____

Name of researcher/delegate	Signature of researcher/delegate	Date
_____	_____	_____

Appendix C

Fidelity SPA Type: MSWO Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	
Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	
Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

MSWO Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	

If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented with each other. When an item is selected the item is removed and the remaining items are rotated and represented.	
Session terminated once all trials are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Fidelity SPA Type: MSWO Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	
Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	

Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

MSWO Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	
If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented with each other. When an item is selected the item is removed and the remaining items are rotated and represented.	
Session terminated once all trials are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Fidelity SPA Type: MSWO Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	

Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	
Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

MSWO Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	
If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented with each other. When an item is selected the item is removed and the remaining items are rotated and represented.	
Session terminated once all trials are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Appendix D

Fidelity SPA Type: Pairwise Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	
Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	
Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

Pairwise Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	

If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented twice with each other and rotated from left and right presentation	
Session terminated once all pairings are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Fidelity SPA Type: Pairwise Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	
Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	

Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

Pairwise Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	
If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented twice with each other and rotated from left and right presentation	
Session terminated once all pairings are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Fidelity SPA Type: Pairwise Date of Session:

Observer: SPA type: edible leisure combined (circle)

Instructions: put yes, no, or N/A for each corresponding section. Should there be multiple trials, put Yes, No, or N/A for each trial.

Setting Preparation	Yes, No, or N/A
Scanned the area for other stimuli not included in the session and removes unnecessary stimuli (if applicable).	
Ensures the tabletop or area on the floor are large enough for the presentation of the stimuli.	
Ensures the session is in an area the individual has previously been accustomed to.	
Total Correct:	

Material Preparation	Yes, No, or N/A
Pre-organized all necessary material, including stimuli, and are readily accessible.	
Ensured all edible stimuli are cut into dime-sized pieces (if using edible stimuli).	
Has set up the camera to record the session (if applicable).	
Total Correct:	

Data Preparation and Pre-assessment Sampling	Yes, No, or N/A
Filled out all required information required on the data sheet (e.g., individual's name, therapist's name, date, and stimuli used) prior to the onset of the preference assessment.	
Presents each stimulus one at a time.	
Names the stimulus	
Allows the individual to select, consume, or engage with the stimulus for approx. 30-s.	
Removes the stimulus if the individual does not select or approach or refuses the stimulus.	
Total Correct:	

Pairwise Presentation and Implementation	Yes, No, or N/A
Presents the array of stimuli simultaneously to the individual, spaced appropriately (approximately 0.7m apart), within arm's reach of the individual.	
Therapist delivers instruction to select their favourite or pick one. If the client picks one before the instruction the therapist presents item selected.	
If the client selects a stimulus within 5 s, the therapist provides 30 s of access to the stimulus or allows 30 s for the individual to consume the item if it is edible (if applicable).	
If the client refuses any stimulus or expels an edible stimulus, it is removed from the array and this information is recorded. If the client refuses to select from the remaining stimuli, the trial is terminated.	
All pairings are presented twice with each other and rotated from left and right presentation	
Session terminated once all pairings are presented or if the client refuses an item.	
Total Correct:	

Total IOA:	/ = %

Appendix E

Reinforcement Assessment for Individuals with Severe Disabilities (RAISD)

Student's Name: _____
Date: _____
Recorder: _____

The purpose of this structured interview is to get as much specific information as possible from the informants (e.g., teacher, parent, caregiver) as to what they believe would be useful reinforcers for the student. Therefore, this survey asks about categories of stimuli (e.g., visual, auditory, etc.). After the informant has generated a list of preferred stimuli, ask additional probe questions to get more specific information on the student's preferences and the stimulus conditions under which the object or activity is most preferred (e.g., What specific TV shows are his favorite? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?)

We would like to get some information on _____'s preferences for different items and activities.

1. Some children really enjoy looking at things such as a mirror, bright lights, shiny objects, spinning objects, TV, etc. What are the things you think _____ most likes to watch?

   _____

   Response(s) to probe questions:

   _____

2. Some children really enjoy different sounds such as listening to music, car sounds, whistles, beeps, sirens, clapping, people singing, etc. What are the things you think _____ most likes to listen to?

   _____

   Response(s) to probe questions:

   _____

3. Some children really enjoy different smells such as perfume, flowers, coffee, pine trees, etc. What are the things you think _____ most likes to smell?

   _____

   Response(s) to probe questions:

   _____

4. Some children really enjoy certain food or snacks such as ice cream, pizza, juice, graham crackers, McDonald's hamburgers, etc. What are the things you think _____ most likes to eat?

   _____

   Response(s) to probe questions:

   _____

Fisher, W. W., Piazza, C. C., Bowman, L. G., & Amari, A. (1996). Integrating caregiver report with a1 systematic choice assessment. *American Journal on Mental Retardation, 101,* 15–25.

5. Some children really enjoy physical play or movement such as being tickled, wrestling, running, dancing, swinging, being pulled on a scooter board, etc. What activities like this do you think _____ most enjoys?

   Response(s) to probe questions:

6. Some children really enjoy touching things of different temperatures, cold things like snow or an ice pack, or warm things like a hand warmer or a cup containing hot tea or coffee. What activities like this do you think _____ most enjoys?

   Response(s) to probe questions:

7. Some children really enjoy feeling different sensations such as splashing water in a sink, a vibrator against the skin, or the feel of air blown on the face from a fan. What activities like this do you think _____ most enjoys?

   Response(s) to probe questions:

8. Some children really enjoy it when others give them attention such as a hug, a pat on the back, clapping, saying "Good job", etc. What forms of attention do you think _____ most enjoys?

   Response(s) to probe questions:

9. Some children really enjoy certain toys or objects such as puzzles, toy cars, balloons, comic books, flashlight, bubbles, etc. What are _____'s favorite toys or objects?

   Response(s) to probe questions:

10. What are some other items or activities that _____ really enjoys? Response(s) to probe questions:

After completion of the survey, select all the stimuli which could be presented or withdrawn contingent on target behaviors during a session or classroom activity (e.g., a toy could be presented or withdrawn, a walk in the park could not). Write down all of the specific information about each selected stimulus on a 3" x 5" index card (e.g., likes a female adult to read him the 'Three Little Pigs' story.) Then have the informant(s) select the 16 stimuli and rank order them using the cards. Finally, list the ranked stimuli below.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

Notes:

Fisher, W. W., Piazza, C. C., Bowman, L. G., & Amari, A. (1996). Integrating caregiver report with a3 systematic choice assessment. *American Journal on Mental Retardation, 101*, 15–25.

Appendix F

Annotated Flow Chart for P1

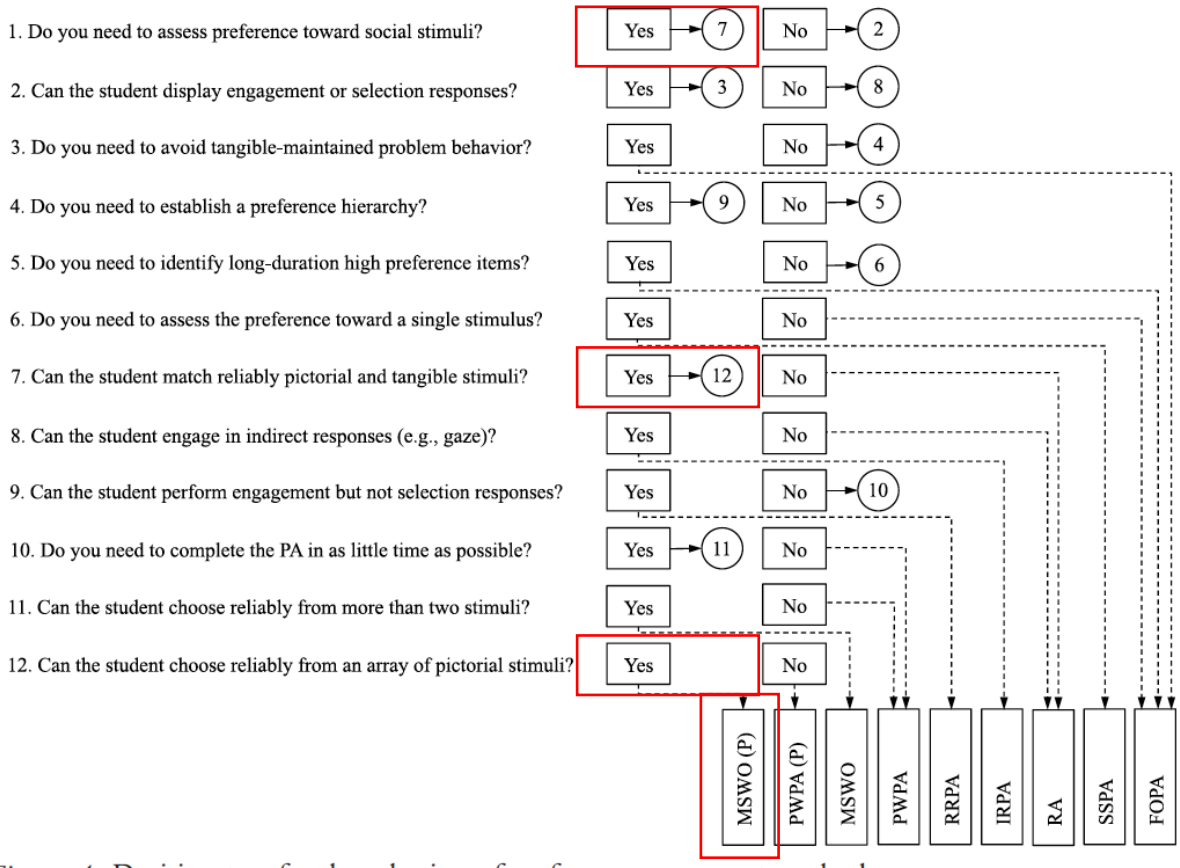

Figure 4. Decision tree for the selection of preference assessment methods.
Notes. *FOPA* = Free operant preference assessment; IRPA = Indirect/idiosyncratic response preference assessment; MSWO = Multiple-stimulus without replacement; PA = Preference assessment; PWPA = Pairwise preference assessment; (P) = Pictorial stimuli; RA = Reinforcer assessment; RRPA = Response-restriction preference-assessment; SSPA = Single stimulus preference assessment.

Appendix G

Annotated Flow Chart for P2

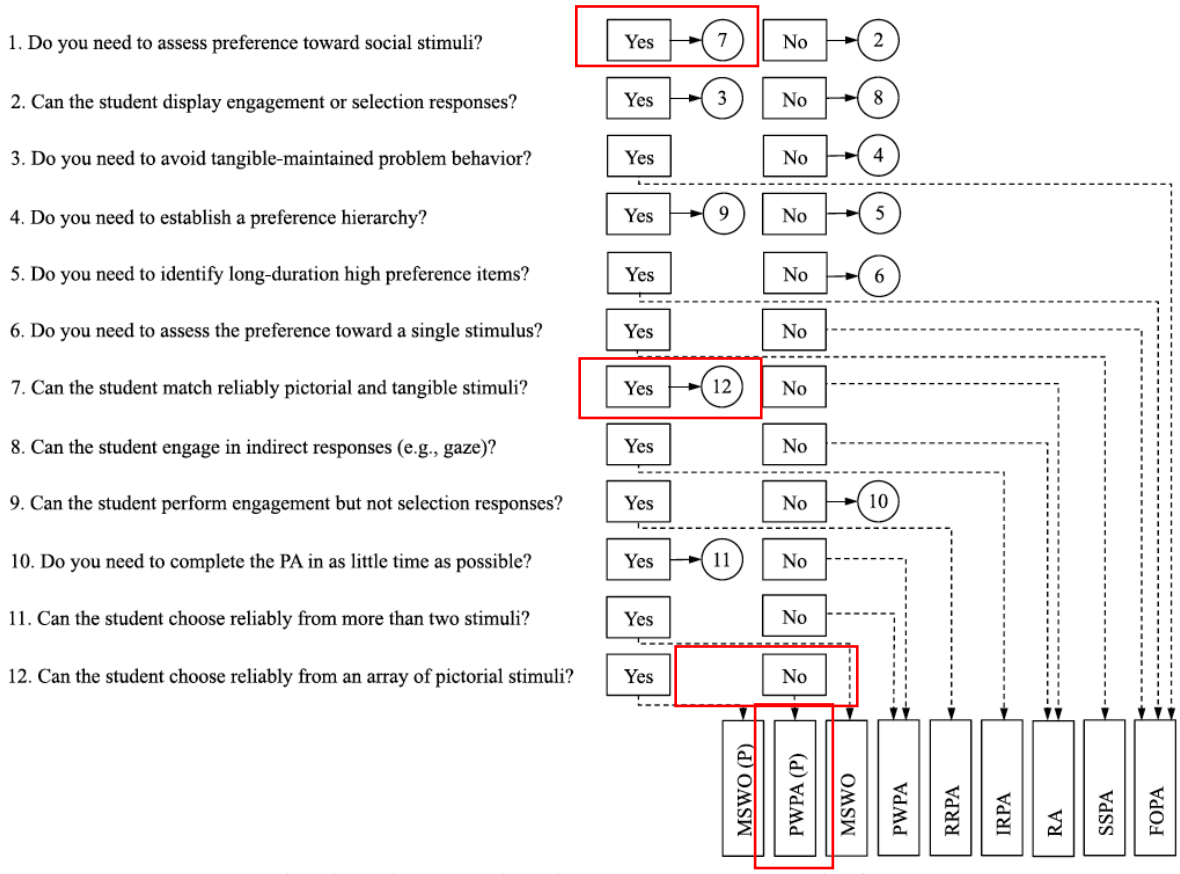

Figure 4. Decision tree for the selection of preference assessment methods.
Notes. *FOPA* = Free operant preference assessment; IRPA = Indirect/idiosyncratic response preference assessment; MSWO = Multiple-stimulus without replacement; PA = Preference assessment; PWPA = Pairwise preference assessment; (P) = Pictorial stimuli; RA = Reinforcer assessment; RRPA = Response-restriction preference-assessment; SSPA = Single stimulus preference assessment.

Appendix H

PREFERENCE ASSESSMENT: MULTIPLE STIMULI WITHOUT REPLACEMENT

Participant: _____ Experimenter: _____

Date: _____/_____/_____ Primary / Secondary

Class: Edible / Leisure / Combined Condition: _____

Stimuli / Trials	1	2	3	4	5	6
1						
2						
3						

Instructions:

1. Deliver each item for the participant one at a time, for 10 seconds or until it is consumed.
2. Place an array of 6 items, evenly spaced and randomly sequenced in front of the participant,
3. Give the instruction for the participant to select an item from the array. Mark the first item which a physical contact was made.
4. Let the participant to access the object for 30s, or until it is consumed.
5. If at the end of 30 seconds an item is not selected the trial is over. Move on to the next the next trial, without removing any stimuli
6. After a selection, the chosen item is removes and the remaining items is rotated by taking the item at the left end of the line and moving it to the right end, then shifting the others items so that they are again equally spaced on the table.
7. Repeat the process until 3 sessions are complete

Appendix I

PAIRWISE PREFERENCE ASSESSMENT SHEET

Fisher et al. (1992)*

Participant no. 2 Date of birth ___/___/____ Date of assessment _____

Main diagnosis (if known) _____

Observer: Autumn Kozluk Primary / Secondary

Edible

Mint Oreos x Sour patch kids	Sour patch kids x banana Greek yogurt	Banana Greek yogurt x mint Oreos	Banana Greek yogurt x sour patch kids	Cheese pizza x sour patch kids
Banana Greek yogurt x kraft dinner	Iced tea x banana Greek yogurt	Kraft dinner x iced tea	Sour patch kids x mint Oreos	Sour patch kids x iced tea
Banana Greek yogurt x iced tea	Iced tea x sour patch kids	Cheese pizza x kraft dinner	Iced tea x kraft dinner	Iced tea x cheese pizza
Cheese pizza x iced tea	Kraft dinner x cheese pizza	Cheese pizza x mint Oreos	Mint Oreos x banana Greek yogurt	Kraft dinner x sour patch kids
Sour patch kids x kraft dinner	Mint Oreos x cheese pizza	Kraft dinner x mint Oreos	Kraft dinner x banana Greek yogurt	Cheese pizza x banana Greek yogurt
Sour patch kids x cheese pizza	Mint Oreos x kraft dinner	Banana Greek yogurt x cheese pizza	Iced tea x mint Oreos	Mint Oreos x iced tea

Stimuli	Sour Patch Kids	Cheese Pizza	Banana Yogurt	Mint Oreos	Kraft Dinner	Iced Tea
Selection #						
Rank						