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**Choosing Choice:  
An Assessment of Children's Preference to Choose**

A thesis  
submitted partial fulfillment  
of the requirements for the degree  
of

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## **Abstract**

The current study examined the effects of choosing among alternatives for five children in a series of experiments. In the first, a concurrent-chains arrangement was used to assess all participant's preferences for choice making. Initial link selections resulted in access to terminal links in which the completed task resulted (a) the choice of identical reinforcers (choice), (b) the delivery of an identical reinforcer (no-choice), or (c) no reinforcer delivered (control). One of the five participants showed an initial preference for choice, the others had either an inconsistent preference or were indifferent. Additional evaluations were conducted (Experiments 2 and 4) to demonstrate whether preference for choice could be established by either increasing variability of the stimuli, or by increasing the number of stimuli from which to choose. Choice-link selections increased for one participant when more items were available from which to choose and for another participant when the items from which to choose varied. Experiment 3 and 5 quantified the value of the opportunity to choose using progressively increasing schedule requirements during the choice terminal link for the 3 children who demonstrated a preference for choice. All 3 children continued to select the choice link even when the schedule requirements in the choice link were much higher than that in the no-choice link.

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## **Introduction**

Is the opportunity to choose a reinforcer preferred by young children? Will a child work harder for the opportunity of choose? It may be that the opportunity to choose is not preferred. If so, would increasing the number of items from which to choose effect preference? Or will the availability of differential outcomes increase a person's preference for the opportunity to choose? If so, will the preference maintain in situations where the response requirement is increased for choosing? This thesis aims to examine choice-making and these questions through a five-part evaluation.

To begin we will provide a context in which choosing to choose research sits within the field of behaviour analysis. Following this we review concepts related to choosing behaviour such as, preferences and reinforcers, and variables that influence the value of reinforcers. Choice behaviour is further explored and the procedures used to measure the preference for choice, and the value of choice are discussed before the introduction to the current investigation.

## **Literature Review**

Individuals with intellectual and developmental disabilities can present with multiple barriers that may inhibit their ability to make choices. These barriers are often due to low levels of communication and language skills. Furthermore, research suggests that there are often limited opportunities for these individuals to make choices during their day to day lives. The ability to express one's preferences and make choices has been described as crucial to building independence, and choice-making has been conceptualized as being a normal part of life (Wehmeyer, 2007).

Incorporating choice-making opportunities into the life of an individual with intellectual or developmental disabilities can have many positive outcomes. Previous research has shown that the addition of choice making opportunities can reduce aberrant behaviour and increase appropriate behaviour. Many examples in the literature provide individuals

with the opportunity to choose their tasks and assess how this variable effects task engagement and/or challenging behaviour. For example Dunlap, De Perczei, Clarke, Wilson, Wright, White, and Gomez (1994) provided children with challenging behaviour choices from a menu of academic tasks. The authors measured the student's level of task engagement and disruptive behaviour during choice and no-choice conditions. Using a reversal design the results found that all participants demonstrated a decrease in disruptive behaviour and an increase in task engagement during the choice condition compared with the no-choice condition. The results were further evaluated in a follow-up study with another student in an effort to control for some of the compounding variables of choice-making, such as the degree of preference for the outcomes. The authors yoked the no-choice phase to the previous choice phase, and still found that the student's levels of task engagement and disruptive behaviour surpassed baseline.

Powell and Nelson (1997) extended the research of Dunlap et al. (1994) with one participant who had a diagnosis of ADHD and who exhibited a range of challenging behaviour within the classroom setting. The study investigated the effects of the opportunity to choose on the participant's undesirable behaviour. There were two conditions, the no-choice and choice condition, and a reversal design was employed to evaluate the effects of these two conditions. During the choice condition the participant was provided with a choice between three different academic tasks. In the no-choice condition the teacher provided the participant with the academic task. The results showed a significant decrease in undesirable behaviour during the choice condition. This finding was consistent with the results found in Dunlap et al. (1994).

Rispoli, Lang, Neely, Camargo, Hutchins, Davenport, and Goodwyn (2012) investigated the effects of offering choices both across activities (e.g., choice between activities) and within activities (e.g., the location or materials used to complete the task). The purpose of the study was to assess the effects of these choice arrangements on escape maintained challenging behaviour. An alternating treatments design was embedded

into a reversal design. The authors found that both the choice conditions resulted in less challenging behaviour than the baseline (no-choice) condition for all the participants. The across-activity choice condition had a slightly larger positive effect on challenging behaviour compared to the within-activity choice.

Another example of the positive effects of choice with task selection is Tasky, Rudrud, Schulze, and Rapp (2008). This study looked at using choice to increase on-task behaviour in individuals with traumatic brain injury. There were two conditions, task assigned (no-choice) and choice of task. An ABAB withdrawal design was used to evaluate the effects of choice on task engagement. The second task assigned condition was yoked to the participant's previous choice condition. The results for all three participants showed an increase in task engagement during the choice condition.

Vaughn and Horner (1997) assessed levels of problem behaviour when the student was able to choose among lower preference activities and higher preference activities compared with teacher selection (no-choice) of low or high preference activities. Following preference assessments the authors identified the relative preference for each academic task. They demonstrated that problem behaviour occurred at a higher rate during lower preference tasks. In the third phase the participants were given a choice between two lower preference tasks or two higher preference tasks. The data from each of the conditions were compared to those from the condition in which the teacher selected the same tasks. Rates of problem behaviour were measured during each condition. The results showed that for half the participant's problem behaviour was lower during the student choice of the lower preference task condition, compared with the teacher choice. The other half of the participants had roughly equivalent rates of behaviour during these choice and no-choice conditions. In the higher preference task condition, the participants showed relatively similar, but low rates of problem behaviour in the choice and no-choice phases. These results vary slightly from

previously discussed studies. This is likely due to the different methodologies employed.

Another choice-making intervention that is common in the literature is choice of task sequence. In these interventions individuals are provided with opportunities to choose the order in which they can complete activities or tasks. For example, Jolivette, Wehby, Canale, and Massey (2001) conducted a study in which they assessed on-task and disruptive behaviour during choice and no-choice conditions. The participants were said to have emotional/behavioural disorders and typically engaged in disruptive behaviours during academic tasks. During the no-choice condition they were given maths assignments and the order in which they had to complete the assignments. During the choice condition, the maths assignments were provided, and the student was able to choose the order in which to complete the assignment. The choice of order was the independent variable. A multiple baseline across participants design was used to evaluate the effects of the choice and no-choice conditions on the student's on-task and disruptive behaviours. The results showed that the addition of choice positively influenced the behaviour of some of the students. Across all participants task engagement was the highest during the choice condition. Disruptive behaviour was generally lower during the choice phases, however the difference wasn't considered significant. For some of the students accurate academic responding was higher during the choice condition, for others it was indifferent. Overall allowing the students to choose which order they completed the academic tasks had a positive effect on both on-task and disruptive behaviours.

Kern, Vorndran, Bailin, and Hilt (2001) conducted a similar study looking at the effects of choice of task sequence in reducing problem behaviour in a range of individuals. Each individual engaged in problem behaviour during academic tasks. A reversal design was used with each participant to evaluate the effects of choice versus no choice conditions. In the no-choice condition participants were given the tasks and the order in which they had to complete the tasks. In the choice condition the tasks were selected for each participant and the participant had the choice of

which order they wanted to complete each tasks. The results showed that each participant demonstrated positive outcomes in task engagement and problem behaviour during the choice phases of the assessment.

Other authors have assessed on-task behaviours, task completion and accuracy of academic tasks performed by students with emotional/behavioural disorders when choice-making of task-sequence was implemented as an intervention (Ramsey, Jolivette, Patterson & Kennedy, 2010). In this study the authors used an ABAB withdrawal design to evaluate the effects of the choice-making intervention. During the choice condition participants were presented the tasks that they had to complete and were asked to choose which one they would like to do first and which one they would like to do second. The no-choice condition consisted of the teacher presenting both the task and the sequence in which the student had to complete the tasks. The dependent variables were measured during each of the conditions. The results demonstrated positive outcomes for each of the participants during the choice conditions. Data for each participant suggested that the addition of the opportunity to choose the sequence of the task increased the length of time the students were on task, the number of tasks completed and the accuracy of student's academic work. Overall the findings of this study showed positive effects of choice-making interventions.

Another example of this type of choice intervention is found in Watanabe and Sturmey's (2003) study conducted with adults on the Autism Spectrum. This study assessed the individual's on-task behaviour during choice and no-choice conditions embedded within activity schedules for their morning routines. During the no-choice (baseline) condition the experimenters wrote out the morning schedule. The participants were required to complete the morning routine tasks in the order provided by the experimenter. In the choice condition the experimenter provided the participants with the list of activities required to complete, and asked the participants to make the order of the schedule. The results of this study indicated that during the choice condition the participants had a higher percentage of on-task behaviour. This study

demonstrated that choice of the order in which the schedule was to be completed had a positive effect on the individual's behaviour. Thus replicating results of the previously discussed research.

Other research on choice has looked at the effects on problem behaviours when individuals are given the opportunity to choose among both tasks and reinforcers. In Dyer, Dunlap and Winterling's (1990) study they used a within-subject reversal design to assess the effect that both task and reinforcer selection had on the problem behaviours of three children. During the choice condition the children were able to choose the task that they engaged in, and following task completion they were able to select a reinforcer from a range of previously identified preferred alternatives. In the no-choice condition the same tasks and reinforcers were provided, but were given in a predetermined schedule by the teacher. The findings from this study showed the choice conditions produced lower levels of problem behaviours than the no-choice conditions. During the choice conditions participants also showed the lowest rates of serious aggressive behaviour. The results concluded that choice making produces reductions in problem behaviours.

Overall the discussed studies showed that the opportunity to choose as an intervention was effective in reducing problem behaviours and/or increasing appropriate behaviours. Some of the authors discussed that the mechanisms involved in choosing the task is likely related to choice functioning as an abolishing operation for escape maintained behaviour (Rispoli et al., 2012). Along this same line of thought authors discussed the idea that choice provides an opportunity to select the most preferred stimuli or activity in that given moment, thus functioning as a motivating operation. Shogren, Faggella-Luby, Bae, and Wehmeyer's (2004) meta-analysis of choice-based interventions reported that when problem behaviour was maintained by escape, choice interventions were more effective at reducing the problem behaviour. However, choice as an intervention was still seen to be effective for behaviours maintained by different functions, albeit to a lesser extent. This suggests that there may

be other behavioural mechanisms in place during choice-making opportunities.

The main limitation across the discussed studies is the confounding variables that choice-making opportunities bring. That is, choice-making provides the opportunity for the individual to access a variety of stimuli at anyone time. Without isolating the variable of choice itself, this research cannot be conclusive on the behavioural mechanisms at play. Based on these studies it could be concluded that by just adding a variety of different activities or tasks could be sufficient in reducing problem behaviours and increasing on-task behaviour.

The problem is that most of the research on choice does not isolate the effects of choice as an independent variable. It therefore remains unclear whether the opportunity to choose in itself is a reinforcer or if it is the additional variables that are typically involved in choice-making opportunities, differential reinforcement and variation of reinforcement, and variables that could influence the value of choice (i.e., motivating operations).

There has been few applied studies conducted that attempt to uncover whether the effectiveness of choice as an intervention is due to choice as a reinforcer or due to the differential reinforcement associated with choice. However, there are some experimental studies that have evaluated choice as an independent variable (e.g., Catania, 1975; Catania and Sagvolden, 1980; Cerutti & Catania, 1997; Voss & Homzie, 1970).

Voss and Homzie (1970) were first to evaluate the notion that choice was preferred. In this experiment rats were placed in a maze that had two alternative routes that took them to a goal box. One of the routes had a choice point and the other was of equal length but did not have a choice point. 15 rats were used in the experiment and the results supported the notion that choice was preferred in rats. Catania (1975) was next in evaluating the notion of choice as a preference. His paper is considered an original in the study of choosing choice. In the first experiment Catania ran the reinforcement was held constant across in both the free choice and forced choice terminal links in order to

understand if choice *itself* was reinforcing. He ran four different experiments in order to assess the preference of pigeons for free choice over forced choice, informative stimuli over uninformative stimuli, variety of stimuli and number of stimuli presented. Using concurrent-chain schedules it was found that pigeons demonstrated a preference for free choice as well as a preference for informative stimuli. No preference was found for number of stimuli and variety of stimuli. Because it was found that there was no preference for number or variety of the alternatives, it can be inferred that these variables did not confound the free-choice versus forced-choice experiment. The author discussed that free-choice may be preferred because choice signals alternatives are available, therefore the preference for choice means the same as preference for alternatives. A preference for alternatives may be phylogenetic in nature. It can be concluded from this experiment that pigeons have a preference for choosing choice as a reinforcer.

Catania and Sagvolden (1980) assessed choice as a preference by having forced-choice and free-choice conditions, which were arranged using a concurrent chains design. Four keys were presented in the terminal links. When the free-choice initial link, (VI) 30-sec, was selected a peck on any of the 3 green keys (not the red key) on a (FI) 30-sec schedule produced 3-seconds of food delivery. When the forced-choice initial link, (VI) 30-sec, was selected a peck on the 1 green key (not the 3 red keys) on a (FI) 30-sec schedule produced 3-seconds of food delivery. An initial procedure was run to establish the concurrent-chain performance, replicating previous choosing choice studies. The results showed a preference when the number and variety of the stimuli were equivalent for free-choice over forced-choice within a concurrent-chains arrangement. The authors suggest that preference for choosing choice may have both phylogenic and ontogenic origins. They state that choosing choice may increase the opportunity or variety of reinforcers, which may have evolutionary advantages. Overall these studies have shown that choice as an independent variable is preferred.

Other researchers have also conducted translational research with human subjects in order to control for the confounding variable of differential reinforcement by equating the outcomes in the choice and no-choice conditions. There have been three procedures that try to equate the choice conditions and the no-choice conditions, including providing different by highly preferred items in choice and no-choice conditions, yoking reinforcers between choice and no-choice conditions, and delivering identical reinforcers in all conditions.

For example, Fisher, Thompson, Piazza, Crosland and Gotjen (1997) conducted research to assess whether three children (aged 8, 10 & 13 years old) with destructive behaviour and feeding disorders preferred choice to no choice conditions when both produced identical outcomes. The response rate per minute of key pressing on independent but concurrent VI schedules where key one was the choice condition and key two was the no choice condition were evaluated. The outcomes of selecting the choice condition lead to the experimenter presenting a choice of two highly preferred items. In the no choice condition the experimenter selected a single highly preferred item for the participant, this selection was based on a yoked schedule. The results of this first experiment demonstrated that all three participants responded mostly on key one, the choice condition, during all three phases. Thus all three participants showed a preference for the choice conditions, in other words they were choosing to choose. In the second experiment the procedures were similar to that of the first experiment. However the outcomes of the choice and no-condition varied from Experiment 1. In the choice condition participants were presented with two low preference items of which to choose. In the no-choice condition participants were provided either a low or high preference item, which was selected at random by the experimenter. Both low and high preference items were presented an equal amount of times. The results of Experiment 2 showed that the participants preferred higher valued reinforcers provided in the no-choice condition to the choice of two lower valued reinforcers in the choice

condition. In other words the higher value reinforcer possibly overshadowed the preference to choose, as seen in Experiment 1.

Sellers, Bloom, Samaha, Dayton, Lambert and Keyl-Austin (2013) investigated the factors that relate to preference for choosing choice with four children with developmental disorders. Each individual's preferences for edible items were assessed using a paired-stimulus assessment. The top four ranked items, highly preferred (HP), were included in the remainder of the assessments and moderately preferred (MP) items were used in later assessments. All subjects initially underwent the same choice preference assessment. The participants responded by selecting one of the three coloured coins and place it in a slot. The responses per minute were used to measure the relative preference for each of the conditions. Each coloured coin was associated with a particular condition. If the participant selected the coloured coin associated with choice, this resulted in the child being provided a choice between varied HP edibles. If the no-choice coin was selected then the participant was provided a single HP edible. There were no programmed consequences if the participant selected the coin associated with the control condition. The results of the initial assessment showed that two of the four subjects preferred choosing choice. These two participants went on to partake in subsequent assessments in order to investigate the influence of variable and differential outcomes on choice-making. Both of the participants showed a preference for choice during a choice (varied HP) versus no choice (yoked) assessment. However, only one participant maintained their preference for choice during the choice (identical HP) and no choice (identical) conditions. The two other participants who initially did not show a preference for choice also went through a range of different assessments in order to identify the conditions that may influence their preference for choice. Only one of the two participants showed a shift in preference towards choice-making opportunities during the choice (varied MP) and no choice (MP) assessment. However, there was no change in preference for the both participants during the choice (varied MP) and no choice (yoked) assessments. The results showed that only one subject

appeared to choose choice when items were identical for both conditions. These results suggest that there may be idiosyncratic differences in the preference for choice-making. Factors such as variability of the stimulus and differential outcomes can influence the preference for choice.

Tiger, Hanley and Hernandez (2006) also examined the reinforcing effects of choice. The first experiment in the study evaluated the preference for choice among six preschool children. Three conditions, choice, no choice and control conditions were differentiated by coloured worksheets, orange, blue and yellow respectively. When the child completed a choice worksheet they were presented with a plate of five identical edible items (e.g., five blue M&Ms). If the child selected the no choice worksheet, then they received a single edible item that was identical to that in the choice condition. The control condition produced no edible items just praise. Initially the children were prompted to experience each condition and were provided a verbal description of the contingencies. The results of the first experiment showed that the choice condition was preferred by five out of the six children. Although for two of the five children that preferred choice their preference diminished and became indifferent following several sessions. The second study investigated whether the number of items to choose from influenced children's selection of choice conditions. Three of the children from the previous study whom showed a preference for the choice condition were provided the same materials as in Experiment 1. The orange condition provided the child with a plate of four identical items of which they could choose one item, and the blue condition provided the child with two identical items of which they could choose one. The yellow condition resulted in praise. The quantity of choices in the orange condition was systematically increased from four to eight, to twelve and sixteen items. The results from this study showed that participant selection of the choice condition increased along with the quantity of items from which to choose. In other words, increasing the number of items enhanced previous preference of choosing. The three children that did not show consistent preferences or no preference (for one participant) for choice in the first

experiment were selected to partake in an experiment similar to experiment two. The items to choose from in the orange condition were increased systematically from five, ten and to fifteen. The selection in blue condition (choice) remained constant with once identical edible. The results showed that selecting from an array of five items was no more reinforcing than receiving an identical item for all the participants. However, as the number in the array increased so did each of the participant's preference for the choice condition. The last study, Experiment 4, assessed how valuable the opportunity to choose was for each of the participants. The value of the reinforcer (i.e., preference) was assessed by systematically increasing the response requirements in the choice condition. The contingencies in Experiment 4 were identical to those in Experiment 1. The number of tasks the three children were required to complete in the choice condition before receiving the corresponding outcomes was increased progressively from two, three, four, eight, twelve, sixteen and thirty-two across the sessions for each of the participants. The results demonstrated that when the response effort increased the participants still favoured the choice conditions over the "easier" no choice condition.

This paper provided more evidence of the preference for choice over no choice conditions, as well as showing that increased quantity of choice were preferred over a smaller number of choice or no choice conditions. The last experiment extended the choice research and tested the value of choice over no choice when response effort increased. The methodology employed was effective for evaluating choosing behaviour and preference for choice, in particular because the choice items were kept identical across both no choice and choice conditions. The authors raised a concern that the presentation of the stimuli may have had a potential effect on preference, as the choice condition may have signaled a bigger magnitude of reinforcement over the no choice. However, this was unlikely, as participants were exposed to numerous trials, and the preference for choice did not increase across trials.

The authors concluded that in applied settings providing choice likely increases reinforcer effectiveness because choice in itself is reinforcing and choice (in natural settings) typically provide access to *relatively* high-preference alternatives.

Schmidt, Hanley and Layer (2009) attempted to replicate and extend the Tiger et al. (2006) study on choice. Prior to the experiments the authors conducted paired-item preference assessment with each of the participants. The three highest ranked edible items were used during the first experiment. Similar to Tiger et al. (2006) the participants were provided with different coloured but otherwise identical worksheets. The colours differentiated each of the conditions; orange=choice, blue= no choice and yellow=control. In this study the plates of edibles were identically presented, that is both choice and no choice worksheets had plates sitting behind them with the same number of identical edible items. This controlled for the possible illusion of magnitude of reinforcers across both the choice and no choice condition. During the first assessment, when the choice condition was selected the participant completed the worksheet and was then able to choose one edible from the plate of identical edibles. When the no choice condition was selected, following the completion of the worksheet, the experimenter selected an edible item for the participant. During the control condition only praise was provided following worksheet completion. In the second assessment lower preferred items, identical stickers were delivered as consequences. During the choice condition children were able to pick from a panel of stickers, in the no choice condition the experimenter picked a sticker from the panel, and the control condition was identical to the previous assessment. The results supported the findings in Tiger et al., the data showed that children prefer choosing choice even when the consequences do not result in qualitatively or quantitatively different outcomes. The results during the second assessment validated that choice is also preferred even when less preferred items are used as consequences. This research provides another example of the preference of choosing choice.

Ackerland Brandt, Dozier, Juanico, Laudont and Mick (2015) replicated and extended previous research similar to Tiger et al. (2006). In Experiment 1 the authors used a concurrent chains arrangement to evaluate the participant's preference for choice. The dependent variable was the frequency of selection of the choice options (child choice, experimenter choice and control). A selection of the child choice initial link resulted in the participant being presented with one expressive labeling trial, following responding the participant was given a plate of five identical edibles to choose from. If the participant selected the experimenter choice link the participant was presented an expressive label trial, and then presented one item that the experimenter selected from the plate. The control link resulted in an expressive labeling trial, following responding the participant was presented with an empty plate. The results of the choice assessment showed that twenty of the thirty participants had a preference for the child choice condition over the experimenter and control conditions. The other ten participants showed no preference for either the child or experimenter condition. These results support previous findings on the preference for choice even when the outcomes of choice-making were equated with the no-choice option. However 1/3 of the participants did not have a preference for choice, suggesting that preference for choice is likely idiosyncratic too.

Overall the discussed research demonstrates that choice is frequently preferred over no choice and it also functions as a reinforcer. This phenomenon was observed across a range of species and populations (e.g., Ackerland Brandt et al., 2015; Catania et al., 1980; Cerutti & Catania, 1997; Fenerty & Tiger, 2010; Fisher et al., 1997; Geckler, Libby, Graff, & Ahearn, 2000; Perdue, Evans, Washburn, Rumbaugh, & Beran, 2014; Schmidt et al., 2009; Sran & Borrero, 2010; Tiger et al., 2006; Tiger, Toussaint, & Roath, 2010; Voss et al., 1970).

### **Preference and Preference Assessments**

In order to fully understand the phenomenon of the preference for choice it is important to examine preferences and preference assessments

further. Identifying an individual's preferred items or activities is the first step in identifying stimuli that can function as reinforcers. Many behaviour change interventions require reinforcers in order to be effective. An individual's preferences are therefore very important to practitioners and researchers in the field of behaviour analysis. Due to the transitory nature of preferences preferred stimuli do not always function as reinforcers. However, researchers have developed a variety of methodologies and procedures, which can be used to fairly accurately identify preferred stimuli that may also function as a reinforcer. There are many methods employed to assess preferences and sometimes more than one assessment is used to determine an individual's preference. Generally speaking stimulus preference assessments are procedures that aim to determine an individual's preferences for particular stimuli and the relative preference of that stimuli. The variations are typically seen in 1) who completes the preference assessment, 2) how the stimuli are presented to the individual, and 3) the measures used to assess the preference of the stimuli (Cooper, Heron & Heward, 2007; Green, Reid, White, Halford, Brittain & Gardner, 1988; Piazza, Fisher, Hagopian, Bowman, Toole, 1996).

One variation of preference assessments is to ask the target person or a significant other what he or she likes. Surveys around preferences can be presented in an open-ended question format, a choice format (e.g., "would you rather work for chips, popcorn or your iPad?"), or a rank-ordering format in which the person ranks a list of items from most to least preferred. Adaptations can be made for individuals with limited language skills such as presenting visual icons or the actual stimuli can be presented in a yes/no format. In addition pre-task choice assessments can also be used to determine what an individual wants to earn before presenting a task. All of these procedures are fairly simple and quick to perform, however there are limitations in any individual's ability to verbally self-report their or others preferences and potential reinforcers. Despite these limitations surveying the person or their significant others can be an important place to begin preference assessments and may guide the

researcher in selecting appropriate stimuli to use in additional stimulus preference assessments.

Free operant observations may also be used to assess an individual's preferences. There are generally two ways in which you may use free operant observations to assess preference, either contrived or naturalistic methods. During a contrived free operant observation the individual would first be provided non-contingent access to the stimuli in order to expose them to each of the items, following this, an observer would set up the environment so that all the items were available. The observer would then record the total duration of time that the individual engaged with each of the stimulus. The naturalistic free operant observation differs in that the observation is conducted in the individual's everyday environment, and the observer records the length of time the individual devotes to each activity or stimulus.

The other types of stimulus preference assessments are trial-based. Trial-based stimulus assessment methods are frequently used in research and applied settings as they often yield the most reliable results. These methods will measure the approach, contact or engagement with a stimulus. There are three types of trial based preference assessments: single stimulus, paired stimuli, multiple stimuli presentation methods. A single stimulus assessment involves an individual being presented with an item/activity and their reaction to it is noted. For example it is noted if the individual approached or rejected the stimulus, and perhaps the length of time the individual touched the item or the frequency of touches. Each item is presented several times during the assessment in random order (Cooper et al., 2007).

The paired stimuli presentation involves the individual being given a forced choice between two simultaneously presented stimuli. Each stimulus is matched at random with the other stimuli. The measurement is the number of times each stimulus was selected, which allows a rank-order in terms of high, medium, or low preference items. This assessment has been shown to be more accurate at obtaining the relative preference between high and low items when compared to the previously discussed

preference methods (Pace, Ivancic, Edwards, Iwata, & Page, 1985; Paclawskyj & Vollmer, 1995).

The other types of trial based preference assessments are the multiple stimuli presentation methods. These are similar to the paired preference assessment but during presentation of the stimuli there are three or more items in the array. There are two different kinds of these assessments, the multiple stimuli with replacement (MSW) and the multiple stimuli without replacement (MSWO). As the names suggests the MSW assessment has the assessor present an array of items to the individual. The individual is then able to select an item from the array, and in this assessment the selected item is replaced before the next trial. In the MSWO the assessor presents the array of items, the individual selects an item and the item is not replaced in the array, the remaining items are rearranged and the next trial is presented. The measurement of these methods is the proportion or percentage of times each stimulus was selected. This allows a rank-order of preferences to be established (Cooper et al., 2007).

While these methods can be both efficient and accurate means of identifying an individual's preferences, it is well known that highly preferred stimuli may not always function as reinforcers. Therefore reinforcer assessments have been developed to measure the effectiveness of reinforcers under different conditions.

### **Reinforcer assessment**

Single, concurrent and progressive-ratio reinforcement schedules can all be used to identify reinforcers in a reinforcer assessment. A single stimulus reinforcer assessment involves two or more conditions in which an individual is required to respond to a simple operant response. Following a correct response the individual is provided an item. In one condition the item may be a highly preferred, and in the other condition the item may be of low preference. The responses in each condition are compared in order to assess the reinforcing effectiveness of each the items presented. The condition that shows a higher rate or percentage of

responding typically is considered the most effective reinforcer. In Pace et al. (1985) paper the results showed that contingent access to highly preferred stimuli increased correct responding of their target behaviours compared to baseline (no reinforcer) and non-preferred items.

As suggested by Fisher, Piazza, Bowman, Hagopian, Owens and Slevin (1992) a concurrent schedule may provide a clearer picture of reinforcer preference and effectiveness of reinforcers relative to other reinforcers. Roscoe, Iwata and Kahn (1999) used concurrent schedules to compare low preference and high preference stimuli as reinforcers. Their results showed that single stimulus reinforcer assessments were appropriate for measuring absolute reinforcement effects, however concurrent schedule reinforcer assessments were best suited to measure relative reinforcement effects.

Although simple operant responses and low schedule requirements (e.g., FR 1) can be used to compare reinforcer effects, there may be limitations in the generality of the results. A reinforcing stimulus that maintains behaviour under simple or low schedule requirements may not function as a reinforcer under higher response requirements (e.g., and FR 5). As Fisher and Mazur (1997) stated it is “beneficial to assess potential reinforcers using schedule requirements similar to those the individual is likely to encounter in his or her training activities” (pg. 399). Progressive-ratio (PR) schedules can be used to assess the relative effectiveness of reinforcing stimulus while response requirements increase. In a PR schedule the response requirements are systematically increased, and the increasing schedule requirements are independent of the participants responding. For example, the first response requirement is an FR 1, then reinforcement might be provided after every second response (FR 2), then perhaps after every fourth, eighth, and sixteenth response (FR 4, FR 8 and FR 16). It is likely at some point the participant may no longer select the preferred stimulus at all, suggesting that under that particular schedule the item doesn't function as a reinforcer. This is referred to as the breaking point. In Tustin's (1994) study on preference for reinforcers under varying schedule arrangements one participant was exposed to an a PR schedule

(e.g., FR 1, FR 2, FR 5, FR 10, FR 20) for button pressing. One of two of the reinforcing stimuli was presented in a single stimulus assessment. Under low schedule demands the response rates for each of the stimulus were relatively equal. However, as the schedule requirements were increased one of the reinforcing stimulus maintained higher rates of responding compared with the other stimulus. This was also shown with another participant using a concurrent schedule arrangement and PR schedule. These results show that the relative preference and value of the reinforcing stimulus changed as the schedule demands increased. Others have also obtained similar results (i.e., DeLeon, Iwata, Goh & Worsdell, 1997; Roane, Lerman & Vorndran, 2001).

In short slight increases in schedule requirements may enhance the relative preference for one reinforcing stimulus over another and alter the reinforcing value of the given stimulus (Cooper et al., 2007, Fisher & Mazur, 1997). The discussed reinforcer assessments have important implications when understanding choice behaviour and how choice might function as a reinforcer.

### **Choice Behaviour**

Before coming back to preference and reinforcer assessments and how they can be utilized in the context of choosing to choose research, choice behaviour will be discussed further.

“Choice responding refers to the manner in which individuals allocate their time or responding among available response options” (Fisher & Mazur, 1997, pg. 387). One of the major theoretical accounts within in this area of behaviour analytic research is matching law. Matching law states that the relative rates of responding match the relative rates of reinforcement obtained by the responding (Catania, 2007; Herrnstein, 1970). In other words an individual will allocate more time or responses to the response that receives the most reinforcement. However, there are a number of variables that influence an individuals choice responding, which can cause deviations from matching. In order to study

matching and choice behaviour concurrent schedule arrangements are used.

One variable that is studied in choice research is immediacy and size of reinforcement. In essence these studies ask whether humans prefer smaller more immediate reinforcers compared with larger delayed reinforcement. Many of these studies demonstrate that subjects typically prefer the smaller, more immediate reinforcer (e.g., Rachlin & Green, 1972, Solnick, Kannenberg, Eckerman, & Waller, 1980).

There are other variables that may effect choice responding such as response effort, reinforcer quality, reinforcer rate, delay, reinforcer magnitude and variety of reinforcers. These variables are examined in behaviour analytic research as to how they effect choice responding. Neef, Mace, Shea and Shade (1992) examined special education students choice responding when two concurrently available tasks were correlated with unequal rates, and equal rates versus unequal qualities of reinforcement. The two schedules were V1 30-s and VI 120-s schedules of reinforcement. When reinforcer quality was equal matching was demonstrated. However the experimenters observed deviations from matching when the quality of reinforcers differed.

Neef, Mace and Shade (1993) also demonstrated matching in their study and deviation from matching when delays in reinforcement were manipulated. When the delay to reinforcement differed they found a participant had a bias towards the response that had shorter delays. These observations are important in the context of choice, in particular when utilizing concurrent schedules to identify preferences for reinforcers and the types of influential dimensions (e.g., delay and quality) on matching.

### **Stimulus Variability and Preference**

Another dimension that may influence choice behaviour is stimulus variation. Stimulus variability has shown to be preferred when compared to constant reinforcement. It has also been shown to increase response rate

and speed. Bowman, Piazza, Fisher, Hagopian and Kogan (1997) demonstrated that individuals with Autism had a preference for lower quality but varied reinforcers over higher quality but constant reinforcing stimuli. In another study Egel (1980) compared number of response, bar presses, when the reinforcer was held constant and when the stimulus was varied. Egel showed that stimulus variation increased responding in participants. Milo, Mace and Nevin (2010) also compared the effects if varied versus constant reinforcers had on rate of responding, as well as resistance to change, and preference in young children with Autism. Their results showed that varied reinforcers were preferred and maintained higher rates of responding. In addition varied reinforcement was more resistant to distraction. The authors of the discussed studies suggest that stimulus variability might be preferred and result in increased responding because it delays satiation, which can occur from constant presentation of reinforcement. Overall varying reinforcement was shown to be preferred, as well as increase responding when added to behaviour change programs (Bowman et al., 1997; Egel, 1980; Milo et al., 2010).

### **Motivating Operations**

Reinforcers and preferences can vary greatly for an individual within and across situations. The environmental variables that alter the effects of reinforcers or preferences are called motivating operations. A motivating operation is defined as “any environmental variable that (a) alters the effectiveness of some stimulus, object, or event as a reinforcer; and (b) alters the current frequency of all behaviour that has been reinforced by that stimulus, object, or event” (Cooper et al., 2006, p.375). For example, food deprivation can alter the effect of food as a reinforcer and increase the frequency of previously reinforced food seeking behaviour.

Vollmer and Iwata (1991) examined how establishing operations might influence the responding of five developmentally disabled adults. Their motor responses were assessed during three different conditions, baseline, satiation and deprivation of three different consequences: food,

music and social praise. The results of this study showed that the effectiveness of the reinforcer was altered following deprivation conditions compared with satiation conditions. In other words following periods of deprivation from music, music functioned more effectively as a reinforcer than it did following periods of satiation of music. These results showed that deprivation and satiation altered the effectiveness of the stimuli, and altered the rate of responding accordingly during each of the conditions, thus supporting the analysis of motivating operations and their effects on stimuli (Michael, 1993).

### **Preference for Choice**

It is suggested that the preference for choice probably has phylogenetic advantages. The preference for free choice is an outcome of evolutionary selection. Organisms that have a preference for environments with multiple food supplies have an advantage over organisms that choose an environment with a single food supply (Catania, 1975, 2007; Catania et al., 1980). Others suggest that preference for choice may be due to the learning history of an organism (ontogenic). In that choice situations often result in differential reinforcement, thus the organism begins to prefer choice making opportunities (Ackerland Brandt et al., 2015; Karsina, Thompson & Rodreiguez, 2011). It is likely that a preference exists for a combination of both of these factors, biological and learning history. Nevertheless the preference for, and the reinforcer efficacy of choice appears to be fairly consistent across organisms.

### **Choice Preference and Reinforcer Assessments**

There are two ways in which a preference for choice can be measured: single stimulus preference assessment procedures and concurrent operant- arrangements. During single stimulus preference assessments response rates are measured during choice and no-choice conditions. In essence we assume that the condition with the higher response rate is the more preferred condition. For example Dunlap et al. (1994) assessed task engagement during choice and no-choice conditions

while subjects performed academic tasks. Task engagement levels were found to be higher during choice conditions compared to no-choice conditions. Thus the authors assumed that choice was more preferred and functioned as a more effective reinforcer than no-choice. The authors also yoked the no-choice condition to the choice condition to ensure momentary fluctuations in preference could be somewhat accounted for.

Choice behaviour however is more often studied using a concurrent-operants arrangement. A concurrent-operants arrangement is when two or more responses are simultaneously made available to select from, and each response is correlated with different schedules of reinforcement. This type of arrangement allows for a far more sensitive measure of preference than single stimulus arrangements, as it pits the concurrently available consequences against each other, allowing for a relative preference measure to be made. A preference for one reinforcer over another can be measured by the allocation of responding to that response and its correlated reinforcer. For example, suppose in the morning you went to the office kitchen for a snack and found there was only chocolate chip biscuits to eat. You ate a chocolate chip biscuit. At lunchtime you went to get another snack and there were only chips to eat. So you ate the chips. For afternoon tea you went back for a snack and there were chocolate chip biscuits and chips available to eat. You choose to eat the chips on this occasion. You could say in this case that you preferred both chocolate chip biscuits and chips, as was shown in the single stimulus arrangement (morning and lunchtime options), or you could say that you preferred chips over chocolate chip biscuits as shown in the concurrent arrangement during afternoon tea when both reinforcers were simultaneously available. A concurrent arrangement as in this example provides a more sensitive and relative preference measure in choice studies. In addition you can assume that if an individual is allocating their responses to one stimulus over another then it is likely that that stimulus would function as a more effective reinforcer (Cooper et al., 2006; Fisher & Mazur, 1997).

### **Measuring the value for choice**

To assess choice as a reinforcer additional measures would need to be conducted beyond those made in a preference assessment. Preference assessments are easily conducted, rapid methods of identifying potential reinforcers. Although, preference assessments typically only assess the preference for reinforcers that are freely available or are made contingent upon low schedule requirements, with the assumption that these reinforcers will maintain responding even when schedule requirements increase. However it has been shown that schedule requirements and increasing schedule demands may have an effect on the efficacy and value of a reinforcer. Therefore preference assessments may not be an appropriate measure of the efficacy and value of a reinforcer (DeLeon, Iwata, Goh & Worsdell, 1997; Roane et al., 2001; Tustin, 1994).

One way to quantify the value of choice would be to examine responding under increasing schedule requirements using progressive ratio (PR) schedules (Hursch, 1980; Roane et al., 2001). For example DeLeon et al. (1997) investigated the effects that progressive ratio schedules had on the preference for concurrently available food items in individuals with developmental delays. Initially the items used in the study were considered equally preferred, but as the schedule requirements progressively increased (i.e., FR 1, FR 5 to FR 10) a distinct preference for one of the food items developed. This study showed that progressive ratio schedules could provide a way to enhance differences in preferences, and therefore provide a way to quantify the relative value of one reinforcer compared with another. These methods could equally be considered as a way to measure the value of choice as a reinforcer. This method was utilized in the studies by Tiger et al. (2006) & Tiger et al. (2010) which assessed preference and value of choice as a reinforcer

### **Current Study**

The purpose of the current investigation was to methodically assess preference for choice-making opportunities, where choice was the independent variable and the confounding variables typically involved in

choice-making conditions (i.e., differential outcomes and varied reinforcement) were controlled for. Following the choice preference assessment we continued our investigation of the conditions that surrounded the preference or non-preference for the opportunity to choose. Consequently, in the following experiments we 1) evaluated the preference for choice relative to (identical) no-choice conditions in five children, 2) assessed the effects of number of stimuli on the preference for choice, 3) identified the value of choice-making opportunities by progressively increasing response requirements for the choice condition, 4) assessing preference for the opportunity to choose from a variety of highly preferred stimuli relative to (identical) no-choice conditions in participants, and 5) repeated the methods of experiment three to order to identify the value of choice-making when stimuli varied in the choice condition by progressively increasing the response requirements for that condition.

## **General Method**

### **Ethics**

Prior to advertising for participants, ethical approval was granted from the University of Waikato School of Psychology Research and Ethics Committee. (#15.62).

### **Participants**

Participants were recruited and selected from children whom were receiving Applied Behaviour Analysis (ABA) services through a behavioural organisation in Auckland, New Zealand. The client's siblings were also approached to participate in the research. Participants were recruited through an email that went out to the parents (Appendix 1). The advertisement (Appendix 2) which was attached to the email provided a brief explanation of the research and the steps in which the parent would need to take to express their interest in having their child/children participate (i.e., contact the researcher). Two families responded to the

research advertisement to register their interest. Both of these families went on to participate in the research, one had two children participate and the other family had three children participate. Five children participated altogether, they were aged between 3.5-10 years old of typical and atypical development and were selected to participate based on child and experimenter availability.

Based on parent responses each participant was presented with either a simple worksheet or shape sorter task to check that they are able to independently complete the task before starting the choice assessment. Based on the child's responses each participant was put into one of two groups either: the worksheet group or the shape sorter group. The groups only differed by the task they were to complete during the forthcoming research sessions.

There were two participants assigned to the worksheet group, Shadow and Mia. Shadow is a nine year-old male with a diagnosis of Autism Spectrum Disorder. Shadow is considered a high functioning individual, however he still presents with significant delays in literacy skills, in particular reading comprehension, as well as social cognitive skills, such as perspective taking. Shadow attends his local school in Auckland, New Zealand. He attends school without any additional support and is enrolled in a mainstream classroom. Shadow has been receiving approximately six hours a week of 1:1 ABA therapy afterschool for the past three years to address some of his delays in development. Mia is Shadow's younger sibling. She is seven years old and is of typical development. She attends a mainstream public school in Auckland, New Zealand.

Billy, Prince and Chuck were assigned to the shape sorter group. All three of these participants are siblings. Billy is six years old and she has a diagnosis of Global Developmental Delay. She presents with significant delays in fine and gross motor development, adaptive and social and communication skills. Billy does not receive any type of intervention services. She currently attends a mainstream school with the assistance of a teacher aide. Prince and Chuck are three year-old male dizygotic twins. Prince is of typical development, and Chuck has a

diagnosis of Autism Spectrum Disorder. Chuck has been receiving Early Intensive Behavioural Intervention services for the past 21 months. He has made significant gains, however still presents with minor delays in language and social skills. Both of the boys attend a mainstream preschool three days per week. Chuck has a therapist shadow him during his preschool sessions. For summary of each participant see Table 1.

Table 1. Participant Summary

Name	Age	Developmental description	Gender	Reinforcers	Academic task
Mia	7	Typical	F	TimTams, gummy bears, chips and MellowPuffs	Worksheet
Shadow	9	ASD	M	Chewing gum, chips, mint chocolate and chocolate macadamia nuts	Worksheet
Billy	6	GDD	F	Gummy bears, Hula Hoops, Kinder Surprise and Marshmallow	Shape sorter
Chuck	3	ASD	M	Chocolate chip cookie, sprinkle cookie, Toffee Pops and Skittles	Shape sorter
Prince	3	Typical	M	BBQ Shapes, Hoops, Skittles and MnMs	Shape sorter

## **Materials**

Preference Assessments were conducted prior to the choice evaluation. During the assessment participants had a range of preferred food items presented on a large white plastic tray. The researcher used a paper data sheet (see Appendix 3) and pen to score the child's responses during the assessment. The worksheet group used three coloured worksheets (green, red, yellow) other than the colour these worksheets are identical. Each worksheet contained discrete stimuli that would occasion a response (for examples of the worksheets see Appendix 4). There was a bank of 110 different questions that were presented at random during the assessment sessions. The worksheets were presented to the participant in a coloured 39 cm by 25 cm filing boxes, the boxes and worksheets matched in colour. The three boxes were placed approximately 20 cm apart on the floor in front of the participant (see Appendix 5). The participant sat with a small flat surface/ tray to write on and a pencil was provided for them to write with.

The shape sorter group had three identical plastic shape sorters for their task. Each shape sorter was blue with an orange lid, each lid had a square, circle, star, triangle and heart shaped holes on it. The shape sorters were all identical except that each had a either green, yellow or red otherwise identical 3D shapes that were used to post through the corresponding holes in the lid (see Appendix 6). Each shape sorter was presented in front of 45 cm by 35 cm coloured boards and on top of coloured mats that sat approximately 30cm apart in a straight line. Each of the mats and boards were the same colour (i.e., either green, yellow or red) (see Appendix 7).

The food items used in the choice evaluations were either presented as whole bits or smaller pieces so that they were of equal size (i.e., approximately 1.5cm square). For example, some food items such as the mini toffee pop biscuits were prepared before sessions and were chopped into quarters in order for the food items to be of equal size. All food items were presented to the participants on three identical white 40

cm by 30 cm trays. Food items were kept in a cooler bag when being transported to sessions.

Data were taken with paper and pen and scored during the session on the corresponding data sheet (see Appendix 8, 9 & 10 for all data sheets). An iPad mini was used to record at least 20% of sessions in order for reliability measures to be taken by a second observer. The observer recorded on a separate, but identical data sheet.

## **General Procedure**

### **Preference assessment**

Participants' parents were asked via email to list ten of their child's preferred foods. Following this, seven items from the list were selected based on ease of delivery and availability. The seven items were used to conduct a MSWO (Multiple Stimulus Without replacement) preference assessment.

Prior to the preference assessment beginning, participants were able to sample each of the edible items. The participant was then presented all seven items in a straight-line approximately 5 cm apart and the items were presented in no particular order. The experimenter asked the participant to select one item. Following a selection the edible item that was selected was not replaced. Prior to the next trial items were rotated by taking the item on the left end and moving it to the right end, then all items were shifted so that they sat evenly apart. The second trial was then immediately presented. This procedure continued until all items in the array had been selected or the participant made no selection within 30 seconds of the beginning of the trial. If the participant didn't make a selection within 30 seconds then that session ended.

Five consecutive sessions were conducted in total. Following the five sessions, the four items associated with the highest selections were used in the subsequent choice assessments. To obtain a ranking of the edible items the order that items were selected from the array were recorded next to the corresponding number in which it was selected. For

example the first item that the participant selected would be written in the space marked "1". Following the session the researcher summarized the data by giving each item a ration based on the number of times it was selected (0 or 1) over the number of times it was available (1 to 7). For example, the first three items that were selected will be given  $1/1$ ,  $1/2$ , and  $1/3$ , in the order that they were selected. If the student only selected three items but did not select anymore after the fourth presentation, then all the unselected items would be given the ration  $0/4$ . After all five sessions were completed the researcher summed the ratios of each item across all sessions. For example, if during the five sessions an item produced the ratios of  $1/7$ ,  $1/5$ ,  $1/1$ ,  $1/3$ , and  $1/3$  the overall sum would be  $5/19$  and the conversion would yield a score of .26 indicating that the item was chosen 26% of the trials that it was available (DeLeon & Iwata, 1996).

The results of each participant's preference assessment are displayed in Figure 1, 2 and 3. The four items associated with the highest selection percentage were used in the choice assessments. One item was available during each session, and those items were randomly rotated across sessions.

### **Concurrent Chain Procedure**

During the choice assessments a concurrent-chains arrangement was used similar to that described in Tiger et al. (2006). A concurrent schedule of reinforcement was used to assess the variable of choice as a reinforcer compared with no-choice as a reinforcer. This arrangement allowed for a measure of the relative preference of each of the reinforcers available in the terminal links.

### **Worksheet Group**

In the initial link of the chain the participants were sitting on the floor approximately 50cm in front of three boxes. Each box contained A4 worksheets, the worksheets differed only by the colour of the paper. The colour of the worksheet was the same as the colour of the box.

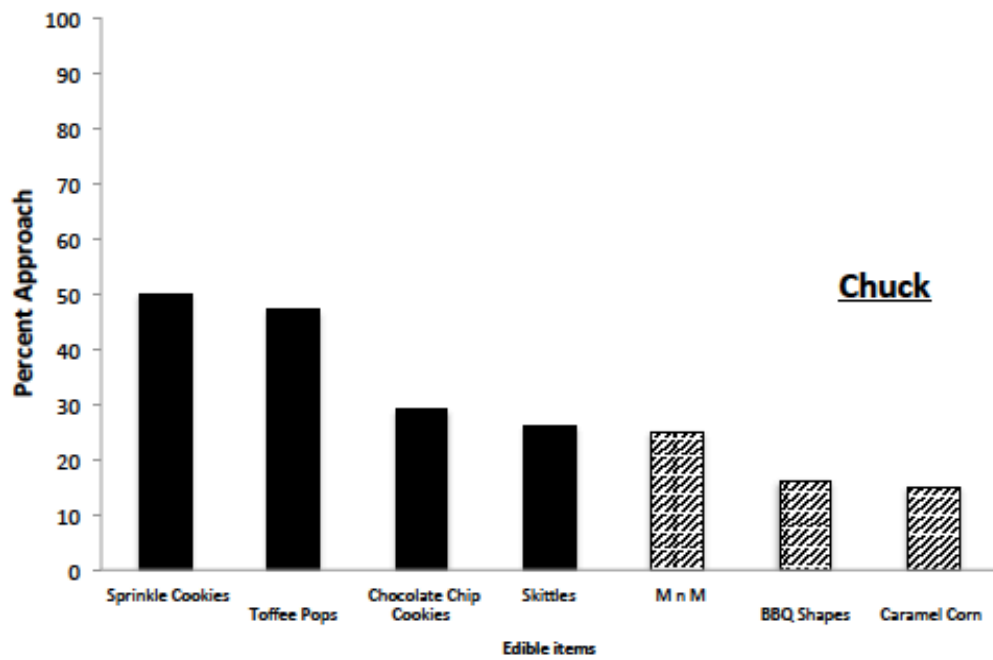
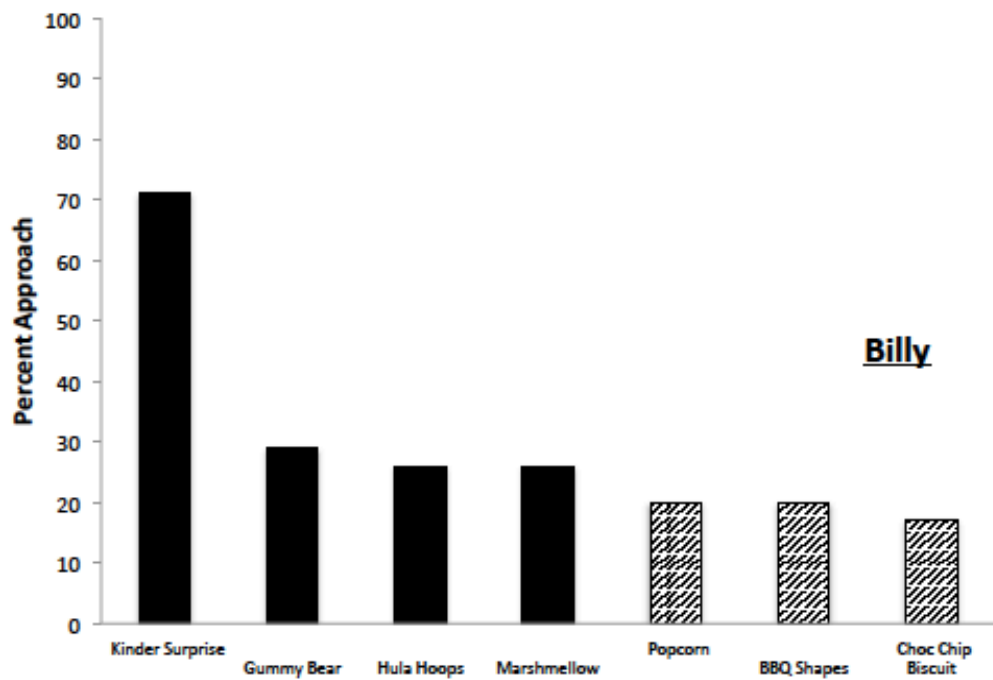


Figure 1. Percentage of approaches for each of the edible items in the MSWO preference assessment for Billy and Chuck. Items are displayed highest ranked on the left to lowest ranked on the right. The four highest ranked items (solid bars) were selected for use in the choice assessments.

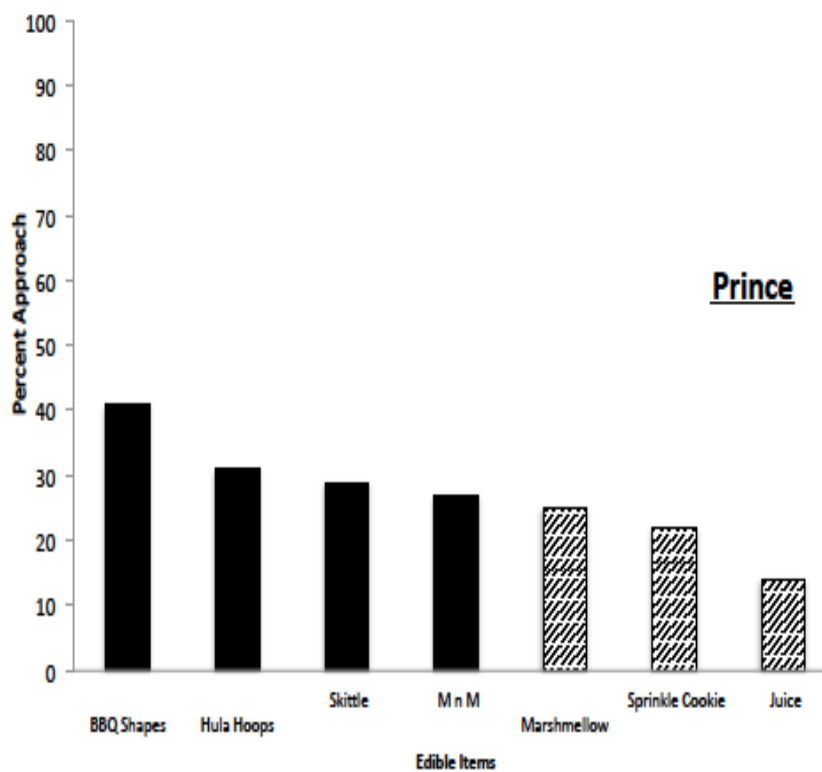
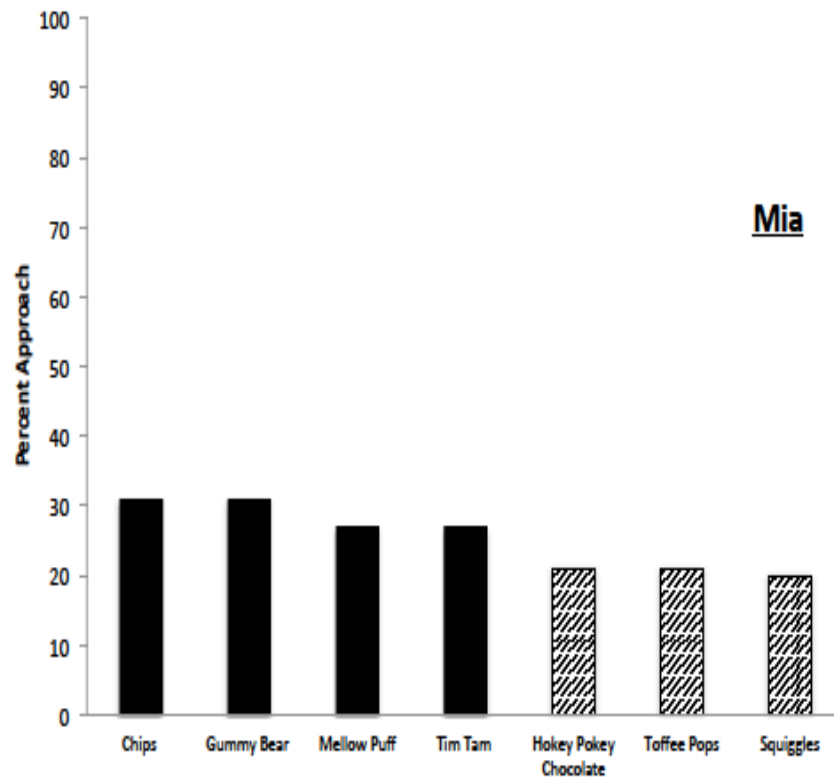


Figure 2. Percentage of approaches for each of the edible items in the MSWO preference assessment for Mia and Prince. Items are displayed highest ranked on the left to lowest ranked on the right. The four highest ranked items (solid bars) were selected for use in the choice assessments.

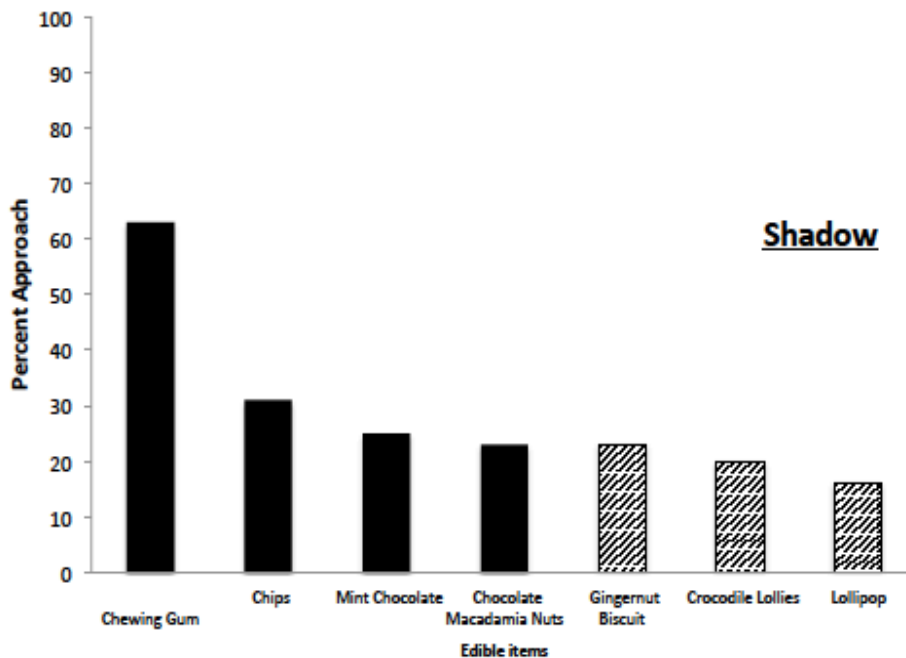


Figure 3. Percentage of approaches for each of the edible items in the MSWO preference assessment for Shadow. Items are displayed highest ranked on the left to lowest ranked on the right. The four highest ranked items (solid bars) were selected for use in the choice assessments.

The three coloured boxes functioned as discriminative stimuli for the concurrent schedules: choice (green box), no-choice (yellow box), and control (red box). At the beginning of each trial the researcher would ask the participant to choose from three discriminative stimuli. The participant would indicate their selection by selecting and opening a box and pulling out a worksheet.

Following a selection of the choice initial link (green), the participant opened the green box and took out a worksheet. The participant completed the worksheet by writing an answer related to the question/s presented on the worksheet. Following the completion of the worksheet the participant was provided access to the terminal link of the chain. The choice terminal link was an array of identical edible items (e.g., Jaffas). The participant was then able to select one item from the array and consume the edible immediately.

Any selections of the no-choice initial link (yellow) resulted in the participant opening the box and taking out a worksheet, completion of the worksheet resulted in the participant being provided one edible item to select from. The edible item was identical to that available in the choice terminal link (e.g., a Jaffa).

Selections of the control initial link (red) allowed the participant to open the box and take out the worksheet, if the participant completed the worksheet then the participant was presented an empty tray, and no other programmed reinforcement was provided.

### **Shape Sorter Group**

In the initial link of the chain the participants were sitting on the floor approximately 1.5 m in front of the three coloured boards, mats and the shape sorters. Each shape sorter had a shape or shapes places next to them. The shapes only differed by colour. The colour of the shapes matched the colour of the board and mat. The three coloured boards and mats functioned as discriminative stimuli for the concurrent schedules: choice (green shapes, board and mat), no-choice (yellow shapes, board and mat), and control (red shapes, board and mat). At the beginning of each trial the researcher would ask the participant to choose from three discriminative stimuli. The researcher would say “which one do you want to choose” or “choose one” or something to that effect. The participant would indicate their choice by moving towards a board and mat, and beginning the shape sorter task.

Following a selection of the choice initial link (green), the participant completed the shape sorter by placing the shape into the corresponding hole in the lid. Following the completion of the shape sorter the participant was provided access to the terminal link of the chain. The choice terminal link was an array of identical edible items (e.g., Jaffas). The participant was then able to select one item from the array and consume the edible immediately.

Any selections of the no-choice initial link (yellow) and the participant completing the shape sorter resulted in the participant being

provided one edible item to select from and consume. The edible item was identical to that available in the choice terminal link (e.g., a Jaffa).

Selections of the control initial link (red) and completion of the shape sorter meant the participant was then presented with an empty tray, and no other programmed reinforcement was provided.

### **Prompting Procedure**

During the initial link of the concurrent chain the participants were given the instruction “choose one” (or something of similar effect). Following their selection the participant was expected to complete the task (i.e., either the shape sorter or the worksheet). If the participant did not respond or complete the task within 5 s of the instruction the experimenter implemented a three-step graduated prompting procedure (vocal, vocal & gesture, and vocal & physical guidance). That is the experimenter said “do the worksheet/shape sorter”. If the participant did emit the response after 5 s of the vocal prompt, the experimenter said “do the worksheet/shape sorter” and gesture to the worksheet/shape sorter. If the correct response was not emitted after 5 s of the vocal prompt & gesture prompt, the experimenter then guided the participant’s hand to complete the response while saying “do the worksheet/shape sorter”. The completion of the task (regardless of the prompting) resulted in the consequence programmed for the selected initial link.

### **Training Trials**

Prior to Experiment 1, training trials were conducted with each of the participants. The participants were prompted through each of the concurrent chains so that they are exposed to the correlated contingencies within each condition.

Each participant was prompted to select one of the three initial links, complete the task and receive the programmed consequence. Each participant underwent five training trials with each of the concurrent schedules. For all fifteen trials the experimenter would gesture prompt or physically guide the child to make the initial selection and would

implement the previously discussed three-step graduated prompting procedure if the participant did not complete the task within 5 s.

Brief training trials were conducted at the beginning of every session during the all the experiments, to expose the participant to each of the contingencies again. That is, the participant was prompted to select each of the initial link stimuli, complete the task and receive the programmed consequences once before starting the experimental trials for that session.

### **Response Measurement**

Sessions were divided into fifteen trials. Each participant's initial link selection was recorded. For the worksheet group a selection was defined as the participant opening a box and taking out the worksheet and placing it on the writing surface. For the shape sorter group a selection was defined as the participant moving in front of or sitting in front of the board and mat. For Billy on occasions due to her having difficulties with gross motor coordination, in particular standing up and sitting down, following several eye surgeries selections for Billy were defined as a either pointing towards the coloured board and/or vocally indicating her selection by stating the colour (e.g., by saying "yellow" if she wanted to select the yellow, no-choice initial link).

During the assessments the participants were expected to engage in a response related to their assigned academic task. A response was considered correct once the child had provided a text response in the space provided or placed the 3D shape through the corresponding hole in the lid, for the worksheet group and shape sorter group respectively. A response was considered correct regardless of any prompts required for the participant to complete it.

The response distribution (i.e., the number of selections of each coloured stimuli) in the initial links was used as a measure of preference for the events programmed in the terminal links.

Each of the conditions, choice, no-choice and control, were evaluated in a repeated-measurement concurrent-operants design.

## **Reliability**

Interobserver agreement (IOA) was assessed during at least 20% of sessions by having a second observer independently watch recorded videos of the sessions and collect data on the participants selections and task completion. Agreement selections were calculated by comparing records on a trial-by-trial basis. An agreement was defined as both observers scoring the same initial link selection for the same trial, as well as the same type of prompt, if any, that preceded the task completion. The number of trials scored as agreements were summed and divided by the total number of trials. The result was then multiplied by 100 in order to calculate the percentage of the trial-by-trial IOA.

## **Experiment 1: Evaluating the preference for choosing**

The purpose of this experiment was to replicate the Tiger et al. (2006) study, by determining the participant's preference for situations in which they can choose among multiple, yet identical reinforcers (i.e., choice) compared to situations in which the same reinforcers are delivered by the experimenter (i.e., no choice).

## **Method**

Mia, Billy, Prince and Chuck completed ten sessions, and Shadow twelve in order to evaluate their preference for choosing. During each session the participant's were presented with fifteen opportunities to select among the three concurrently available alternatives. The first experimental sessions were conducted over 12 weeks. No more than one session was conducted each week. The sessions were terminated after the participant completed all fifteen trials, if more than 30 min elapsed, or if the child requested to end the session, which ever came first.

For Billy at the beginning in Session 6, the experimenter provided additional social praise and physical interaction into the choice and no-choice terminal links in order to over shadow any possible reinforcing effects that were in the control terminal link. In addition, during control

terminal links a short 40 s period of silence was instated and any attempts to interact with the experimenter were ignored. The experimenter would avert eye contact with the participant during the “black out” period. For Billy praise was provided in the form of a short statement, three statements were rotated across sessions. These statements were “good job”, “well done” and “awesome”. The physical interaction was in the form of picking the participant up and spinning her around once. Following the praise and physical interaction the participant was provided the edible items as described previously.

For Mia at the beginning of Session 6 we added social praise for the choice and no-choice terminal links, and a 40 s “black out” in the control link. That is, following correct responses in the choice and no-choice terminal links the experimenter would say a short praise statement. The statements and “black out” period were identical to those described above for Billy.

For Shadow at the beginning of Session 5 we added in social reinforcement into the choice and no-choice terminal links. For Shadow social reinforcement was in the form of a high five. A high five was delivered in the choice and no-choice terminal link following correct responding and was given along with the edible items.

Interobserver agreement was collected during 20%, 25%, 40%, 50%, and 50% of sessions for Mia, Shadow, Billy, Chuck and Prince respectively. Agreement was calculated at 100% for initial link selections across participants.

## **Procedure**

During the choice preference evaluation the participants were given the opportunity to choose between the three concurrently available alternatives. In the choice terminal link, a single correct responses resulted in access to tray of ten identical edible items (e.g., Jaffas) from which the participant was able to choose one item. Any attempts to select multiple items were blocked. In the no-choice terminal link, correct responses resulted in access to a single edible item presented on a tray, identical to

those available in the choice link. During the control terminal link, correct responses resulted in the presentation of an empty tray and no programmed reinforcers. The choice, no-choice and control links were correlated with green, yellow and red discriminative stimuli respectively, for all participants. In the initial link the experimenter instructed the participant to make a choice. The instruction “choose one”, “which would you like to choose”, or “pick one” was given vocally to the participant. If the participant selected the choice (green) initial link, then the participant would have to complete the task, then the participant would be provided with the array of ten identical edible items and the participant was able to select one of the items and consume it. If the participant selected the no-choice (yellow) initial, the procedures were identical, except in participant was presented with only a single item on the tray. The participant was allowed to consume the edible item. Finally if the participant selected the control (red) initial link, the procedures were identical except the participant was provided no edible items on the tray. The choice, no-choice and control conditions were evaluated in a repeated-measurement concurrent operants design.

## **Results**

Data from Experiment 1 are shown in Figures 4, 5 and 6. Additional summary data for all participants are displayed in Figure 7.

Chuck selected the choice link the most. He selected the choice link over half the time across all ten sessions compared to just under a  $\frac{1}{4}$  of the time of the no-choice link and control link. The summary bar graph in Figure 7 suggests that Chuck had a clear preference for the choice link, however the results depicted in Figure 4 illustrate the variability in his responding across sessions. The bottom of Figure 4 shows that Billy selected the choice link slightly less overall than the no-choice and control link. She selected the no-choice and control link equally overall. Initially Billy was selecting all links nearly equally. After the addition of praise and physical interaction, and the “black out” in Session 6 there was initially a decrease in control-link selections, followed by a sharp increase, then a

descending trend for control link selections. Choice and no-choice link selections continued to be relatively evenly selected for Billy throughout the assessment.

The top panel of Figure 5 shows Prince selected the no-choice link 63% of occasions throughout the ten sessions, far more than her choose to select the choice or control link, which were selected 34% and 3% of the time, respectively. Prince's results were variable, despite having a clear preference overall for the no-choice link (as seen in Figure 7) on some occasions he selected the choice link more frequently than the no-choice link (e.g., Sessions 2, 4 and 8).

The bottom panel of Figure 5 shows Mia selected the choice link only 5% more often than the no-choice link. Initially she had a high number of selections of the control link. Following the addition of social praise and the black out period on Session 6, Mia's control link selections decreased. Mia continued to respond to both the choice and no-choice conditions relatively equally throughout the assessment.

Figure 7 shows Shadow selected the choice link for 58% of the time throughout the assessment. Initially selections were fairly equally distributed across all three alternatives. Following the addition of social praise for choice and no-choice responding in Session 5, Shadow decreased his selections of the control condition, and we saw an increase in allocation to the choice link. Eventually Shadow showed exclusive allocation to the choice link (see Figure 6).

## **Discussion**

Based on these results we concluded that 4 of the 5 participants did not demonstrate a clear preference for the choice conditions. In fact, Prince appeared to have a slight preference for the no-choice condition.

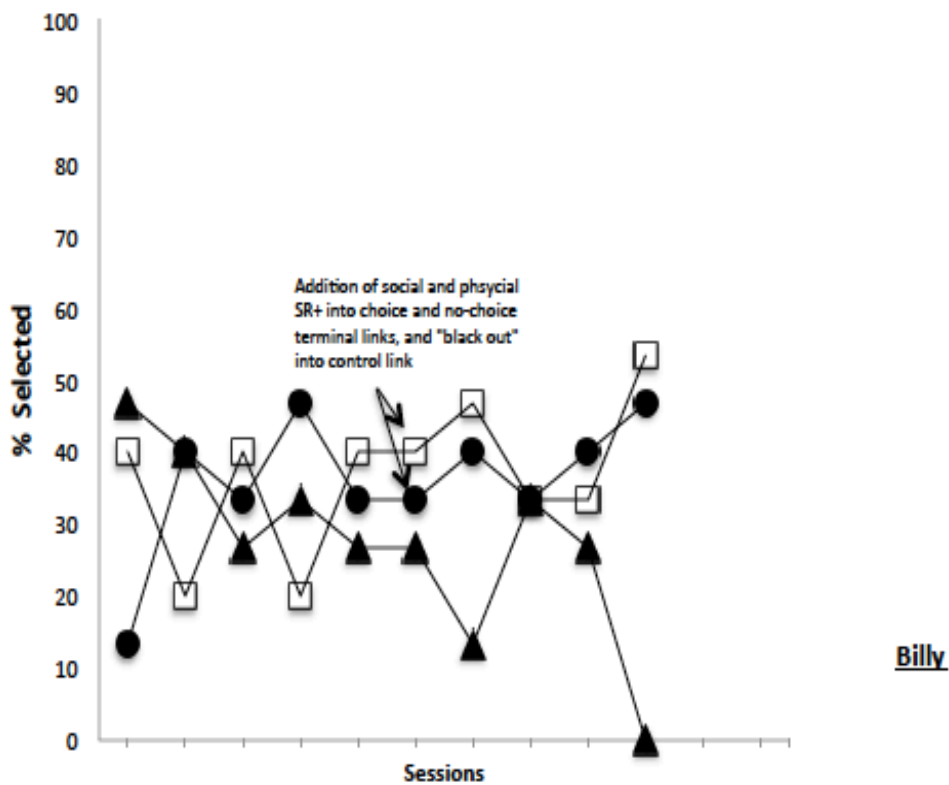
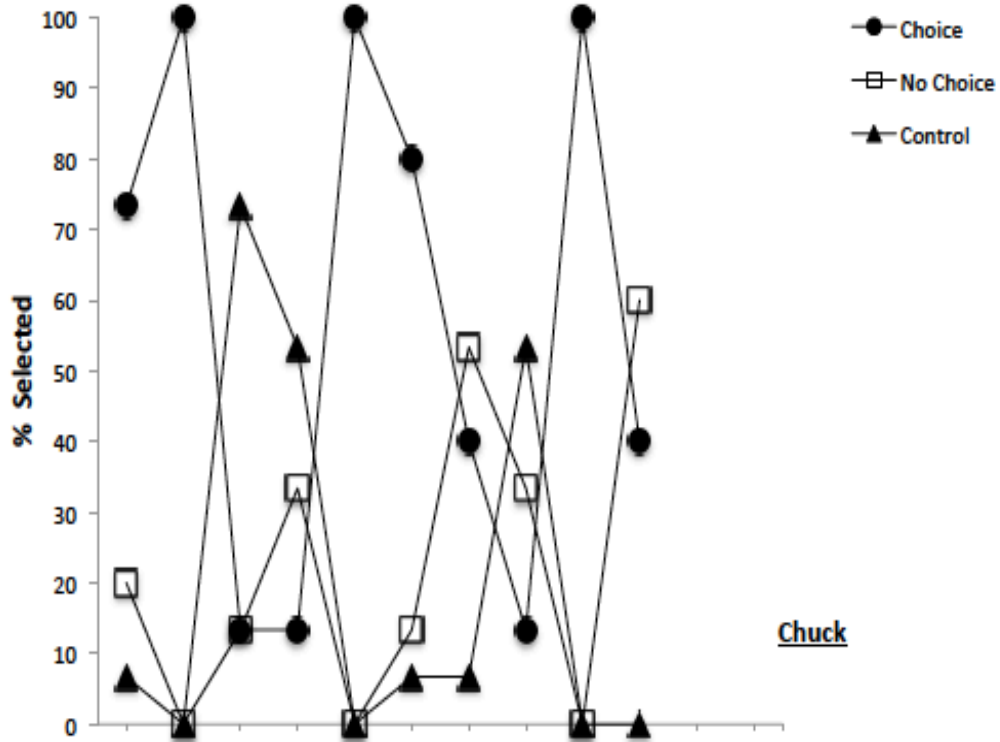


Figure 4. Percentage of sections for choice (10 identical edibles), no-choice (1 edible identical to those available in choice terminal link), and control (no edible) selections in the initial link for Chuck and Billy in Experiment One.

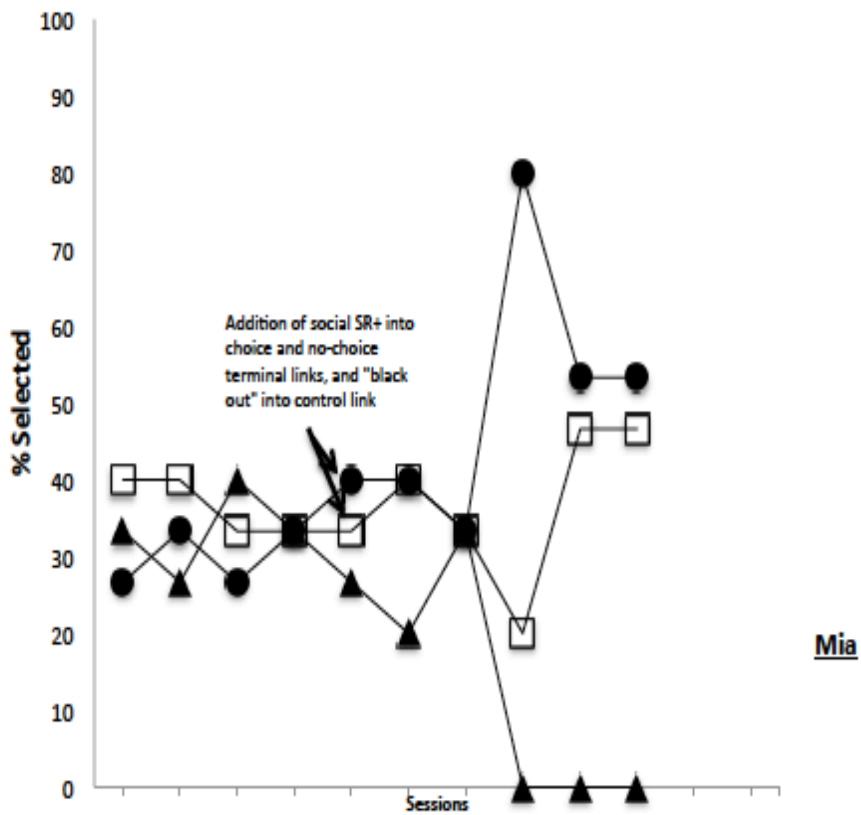
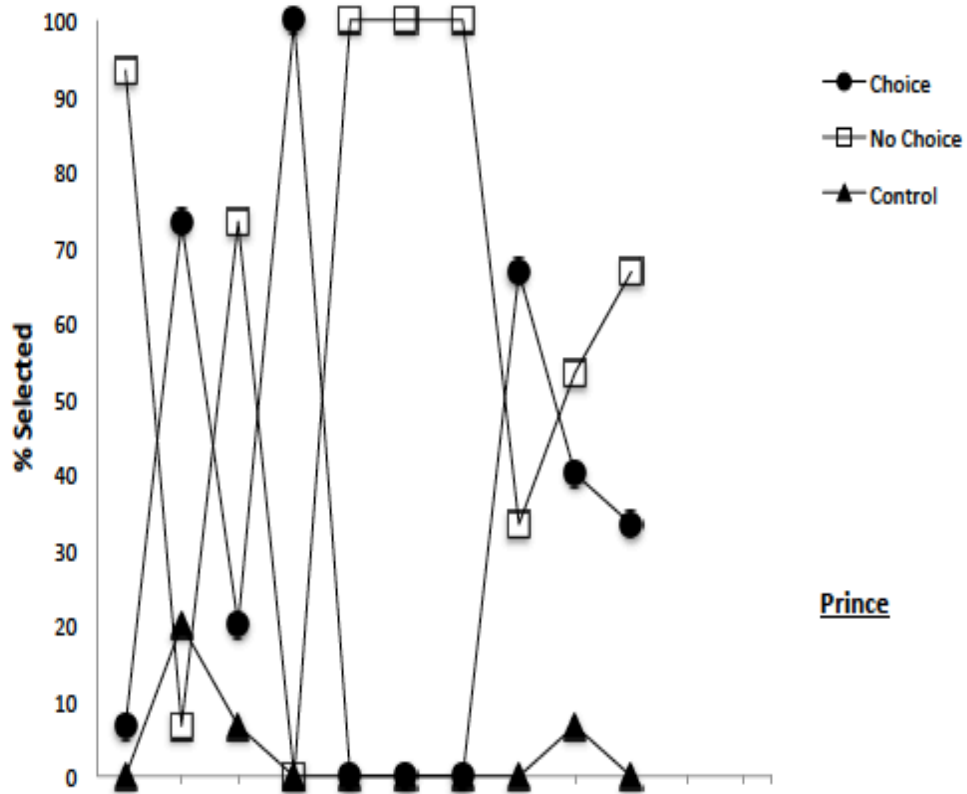


Figure 5. Percentage of sections for choice (10 identical edibles), no-choice (1 edible identical to those available in choice terminal link), and control (no edible) selections in the initial link for Prince and Mia in Experiment One.

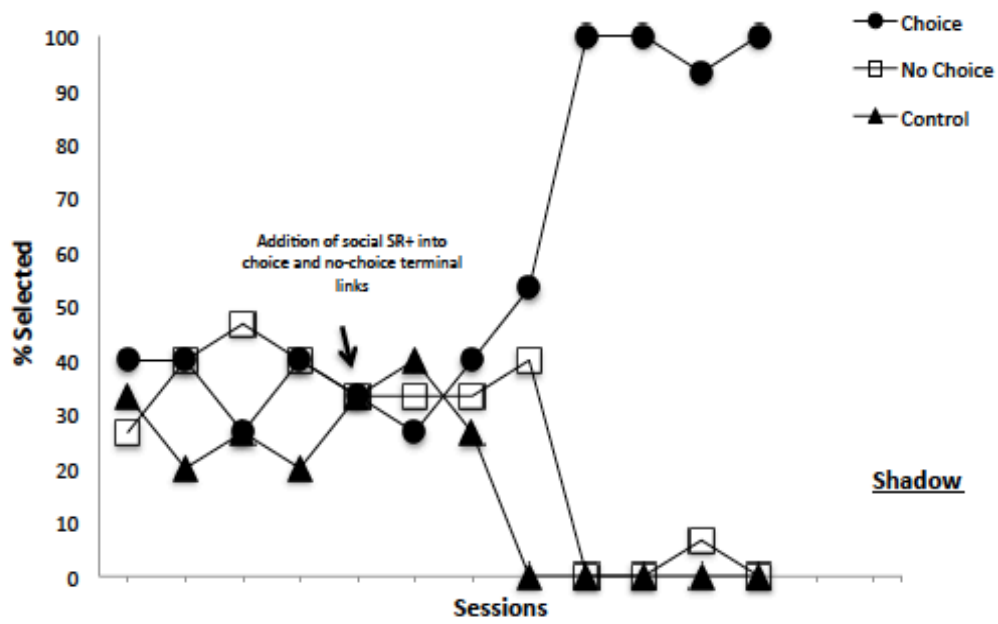
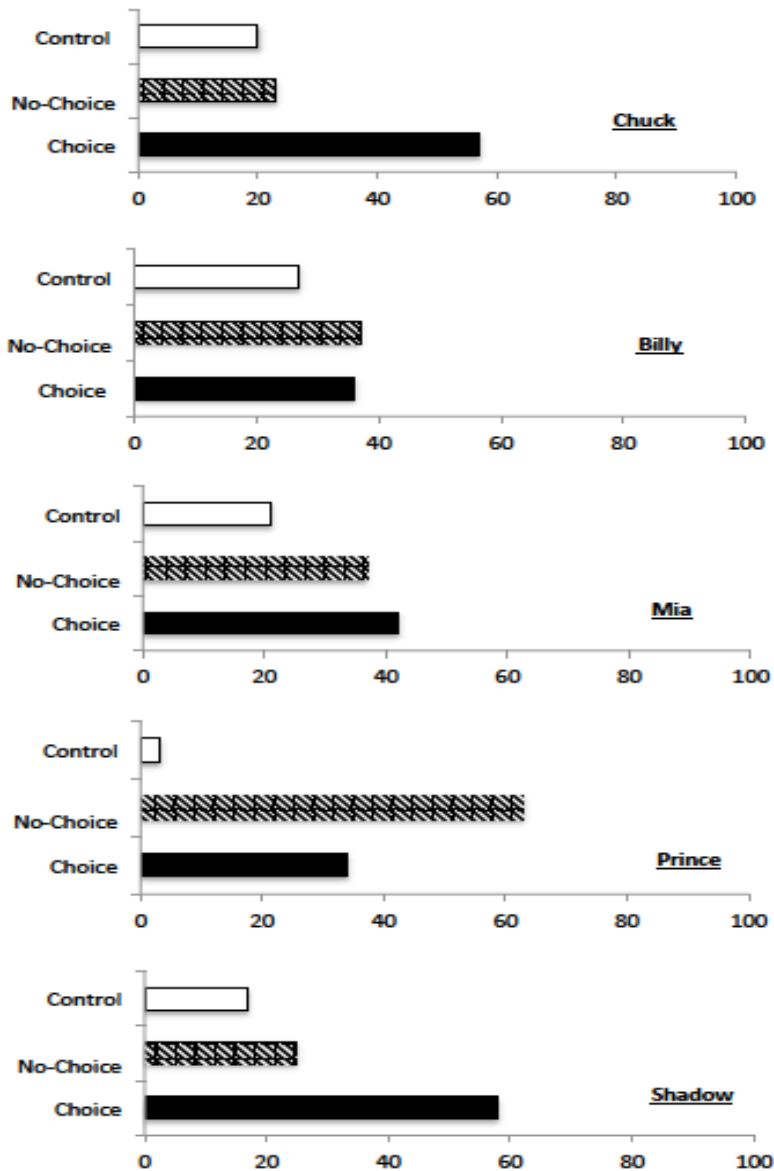


Figure 6. Percentage of sections for choice (10 identical edibles), no-choice (1 edible identical to those available in choice terminal link), and control (no edible) selections in the initial link for Shadow from Experiment One.



*Figure 7.* Experiment one total percentage of selections across all sessions for choice (10 identical edibles), no-choice (1 edible, identical to those available in choice terminal link), and control (no edible) selections in the initial link for Chuck, Billy, Prince, Mia and Shadow.

Initially Mia, Billy and Shadow were selecting the control conditions frequently until the addition of social reinforcers and “black out” periods. We hypothesized that for Mia, Billy and Shadow their initial selections of the control conditions may have been due to a previous history of intermittent (or naturally occurring) schedules of reinforcement for

completing similar tasks, as well as a history of compliance with academic tasks given by to them by an adult.

Another potential influence on the control link selections, which could have confounded the results, may have been that the participants were following an arbitrary verbal rule. That is, the participants had a verbal description of an arbitrary behavioural contingency that the experimenter was unaware of. This certainly seemed apparent for Mia and Billy who exhibited behaviours that suggested they were following a verbal rule. For example Mia would consistently select each initial link in an order (despite the position of the stimuli being rotated within and across sessions). The order of the pattern would be developed in the first three trials of the session, then from that point she would maintain that pattern of responding throughout that sessions. For example, she would select the no-choice link, then the control link followed by the choice link for the first three trials. She would then continue to select each of the links in that exact order for the rest of the session. On occasions she appeared to have lost track of the order and would say out loud “which one did I just do?” and would look at the experimenter for answer. The experimenter did not respond to the questions or provide any prompts. On other occasions Mia was observed to be verbally rehearsing the order (possibly to aide in remembering). She would whisper the order in which she selected the links in the first three trials (e.g., she would whisper “yellow, red, green” a few times in a row).

Billy on the other hand had slightly different verbal rules she appeared to be following. She too would generally select the links in the same pattern within a session. However, she would verbally comment to the experimenter throughout the sessions that she loved all the colours the same, and that she had to be fair to all the colours and choose them all equally. In addition to this rule, following correct responses in the terminal link when Billy was provided the empty tray she would say to the experimenter “Don’t be naughty, next time I choose the red one you have to make sure that there is food on the tray, I will be checking” or something

similar to this statement. The experimenter did not respond to Billy's verbal comments.

It was beyond the capacity of this thesis study to explore these verbal rules further, but perhaps future research could explore the influence that such rule governed behaviour has over preferences and preference assessment outcomes. The rules may have decreased in influence on Mia and Billy's selections as we saw a decrease in control link selections when additional reinforcement in the choice and no-choice links was added. The social praise (Mia and Billy), physical praise (Billy and Shadow) may have increased the magnitude or quality of reinforcement available when selecting the choice and no-choice, thus overshadowing any potential reinforcement available for selecting the control terminal link. The "black out" period (Mia and Billy) may have acted as a punisher for selecting the control link, thus decreasing control link selections and increasing the relative preference to the choice and no-choice link.

Chuck appeared to have a preference overall for the choice link, however, his selections were variable so it was concluded that he did not demonstrate a clear preference for the opportunity to choose relative to not choosing. Chuck was also observed on some occasions to select the control link (e.g., Sessions 3, 4 and 8). Anecdotal observations suggest that during these sessions Chuck was sampling the control condition and exhibiting extinction bursts following this sampling. Extinction bursts have been hypothesized because there were sudden increases in Chuck's selections of that condition and aberrant behaviour/s occurred only during these sessions (i.e., Sessions 3, 4 and 8). Following correct responding in the control terminal link when the empty tray was presented Chuck would repetitively request for the edible items, paired with screaming and crying. When Chuck was asked if he would like to finish the session he would say no and ask for the "yummy food" to indicate his desire to continue the session. This behaviour was never observed during any of the other sessions. Chuck's results suggest that the opportunity to choose functioned as a reinforcer sometimes, however on occasions accessing a

reinforcer delivered without the opportunity to choose functioned as a reinforcer.

Mia and Billy did not demonstrate a preference for either the choice or no-choice link, with nearly equal selections across both the links. These results suggest that the opportunity to choose may serve as a reinforcer, but it was no more preferred than being provided a reinforcer in absence of the opportunity to choose.

Prince's results showed a preference for no-choice conditions over choice conditions even when the outcomes for choice and no-choice selections were equated. Results similar to this have been demonstrated with one participant in the first experiment seen in Tiger et al. (2006).

Shadow was the only participant who demonstrated a consistent preference for the opportunity to choose. This suggests that for Shadow, the opportunity to choose functioned as reinforcer, and choice as reinforcer was preferred despite the absence of differential consequences (e.g., access to more preferred reinforcers). Shadow's results replicated that of three participants in Tiger et al. (2006) in an identical choice assessment, and one participant in Sellers et al. (2013) choice assessment. The results are also similar to the Tiger et al. (2010) experiment on choice making opportunities. This experiment differed slightly from our Experiment in its methodology as it used a modified concurrent chains procedure and a paired preference assessment to evaluate participant's preference for choice making opportunities compared with task-choice, no-choice, and control conditions. Three of their four participants in the study showed a preference for choice, even when choice selections resulted in an array of identical edible items. Shadow's results also replicated similar basic research (e.g., Catania et al., 1980, Voss et al. 1970), which found the pigeons and rats had a preference for choice making opportunities even when outcomes were equated across choice and forced choice conditions.

In sum the opportunity to choose was more preferred for two participants (Shadow and Chuck), although the preference for choosing was inconsistent for Chuck, and two participants (Mia and Billy) showed

almost equal preferences for choice and no-choice conditions, while Prince demonstrated a preference for no choice.

## **Experiment 2: Assessing the effects of the number of stimuli on the preference for choice**

The previous experiment and other research (e.g., Tiger et al., 2006, Fenerty et al., 2010) evaluated an individuals' preference for choice compared to a no-choice alternative. In these experiments the number of items from which the individual could select from in the choice terminal links varied across studies. The purpose of the present experiment was to replicate Tiger at al.'s (2006) third experiment, which aimed to assess if the number of items that were available to choose when the participants selected the choice condition increased their preference for the opportunity to choose.

### **Method**

The four participants who were indifferent in their preference for choice compared to no-choice conditions in Experiment 1 (Mia, Billy, Prince and Chuck) were selected to participate in this assessment. The aim was to assess if the number of stimuli from which the participant's could choose would have an effect on their preference for choosing.

For Billy the experimenter provided additional social praise and physical interaction into the choice and no-choice terminal links as described in Experiment 1. The edible items were provided immediately following the praise and physical interaction. In addition, during control terminal link selections a short 40 s "black out" period was added, this was identical to those described in Experiment 1.

For Mia social praise was provided in the choice and no-choice terminal links, and a 40 s "black out" in the control link. That is, following correct responses in the choice and no-choice terminal links the experimenter would say a short praise statement The statements and "black out" period were identical to those described in Experiment 1.

Interobserver agreement was collected during 33%, 25%, 25%, and 25% of sessions for Mia, Billy, Chuck and Prince respectively. Agreement was calculated at 100% for initial link selections across participants.

## **Procedure**

The same discriminative stimuli used for the initial-links in the first experiment were used in this experiment. There were three terminal links that correlated with the different coloured stimuli. During the choice (green) link, correct responses resulted in ten identical edible items being presented to the participants, from which they could select only one. In the no-choice (yellow) link, correct responses resulted in one edible item being presented to the participant, the edible item was identical to that available in the choice link. During the control (red) link, correct responses resulted in the participant being presented with an empty tray and no other programmed consequences.

The number of items from which to choose was systematically increased. The relative quantity of the items presented in the terminal link for the choice condition was the independent variable. The array size in the choice terminal link was systematically increased from 10 to 20, 30 and 40 items. The effect of the relative quantity was assessed in a non-concurrent multiple baseline across participants, and with an embedded reversal design for Chuck.

## **Results**

Data from Experiment 2 are shown in Figure 8. Control link selections are not shown, but they averaged 8.66%, 8.46%, 7.55% and 9.09% of selections across the assessment for Mia, Billy, Prince, and Chuck respectively. When there were 10 items (i.e., baseline) from which to choose in the choice link Mia choose both the choice ( $M = 37.77\%$ ) and no-choice ( $M = 37.77\%$ ) equally. When the number of items in the array from which to choose increased from 10 to 20, Mia selected the choice link ( $M = 53.33\%$ ) slightly more frequently than the no-choice link ( $M = 46.66\%$ ). When the number of items from which to choose increased

from 20 to 30, Mia selected the choice link ( $M=48\%$ ) again slightly more frequently than the no-choice link ( $M= 37.77\%$ ). No significant changes in this pattern of selections occurred when the number of items increased from 30 to 40, however she did choose the no-choice link slightly more ( $M= 51.10\%$ ) more than the choice link ( $M=48.88\%$ ).

Billy selected the no-choice and choice links near equal ( $M = 38.33\%$  and  $36.66\%$ , respectively) when there was 10 items in the array in which the participant could choose in the choice link. When the number of items of which to choose increased to 20, Billy continued to choose the no-choice link slightly more ( $M = 51.10\%$ ) than the choice link ( $M = 48.88\%$ ). When the number of items increased to 30 this pattern remained exactly the same. When the items in the array increased to 40 we observed a slight increase in selections towards the choice link ( $M = 52.33\%$ ) compared with the no-choice link ( $M = 46.66\%$ ).

Prince selected the no-choice link ( $M = 54.44\%$ ) more often than the choice link ( $M= 49\%$ ) when there were 10 items of which to choose available in the choice link. When the number of items in the choice link was increased from 10 to 20, we observed that Prince continued to choose the no-choice link slightly more ( $M = 44.44\%$ ) than the choice link ( $M =42.22\%$ ). Prince continued to allocate his responding toward the no-choice link ( $M = 51.11\%$ ) compared with even as we increased the array size in the choice link to 30. We increased the number to choose to 40. The choice link was selected slightly more ( $M = 53.33\%$ ) than the no-choice link ( $M = 46.66\%$ ). However, the last data point in this phase showed a shift back to a slight preference back to the no-choice link.

Figure 8 shows Chuck selected the choice link 34% more frequently than the no-choice link with 10 items (i.e., baseline) from which to choose. When the number of items was increased from 10 to 20, we observed an increase in choice link selections ( $M = 68.88\%$ ), but also an increase in no-choice selections ( $M = 51.10\%$ ). This preference towards the choice link remained when the number of items was increased to 30, the choice

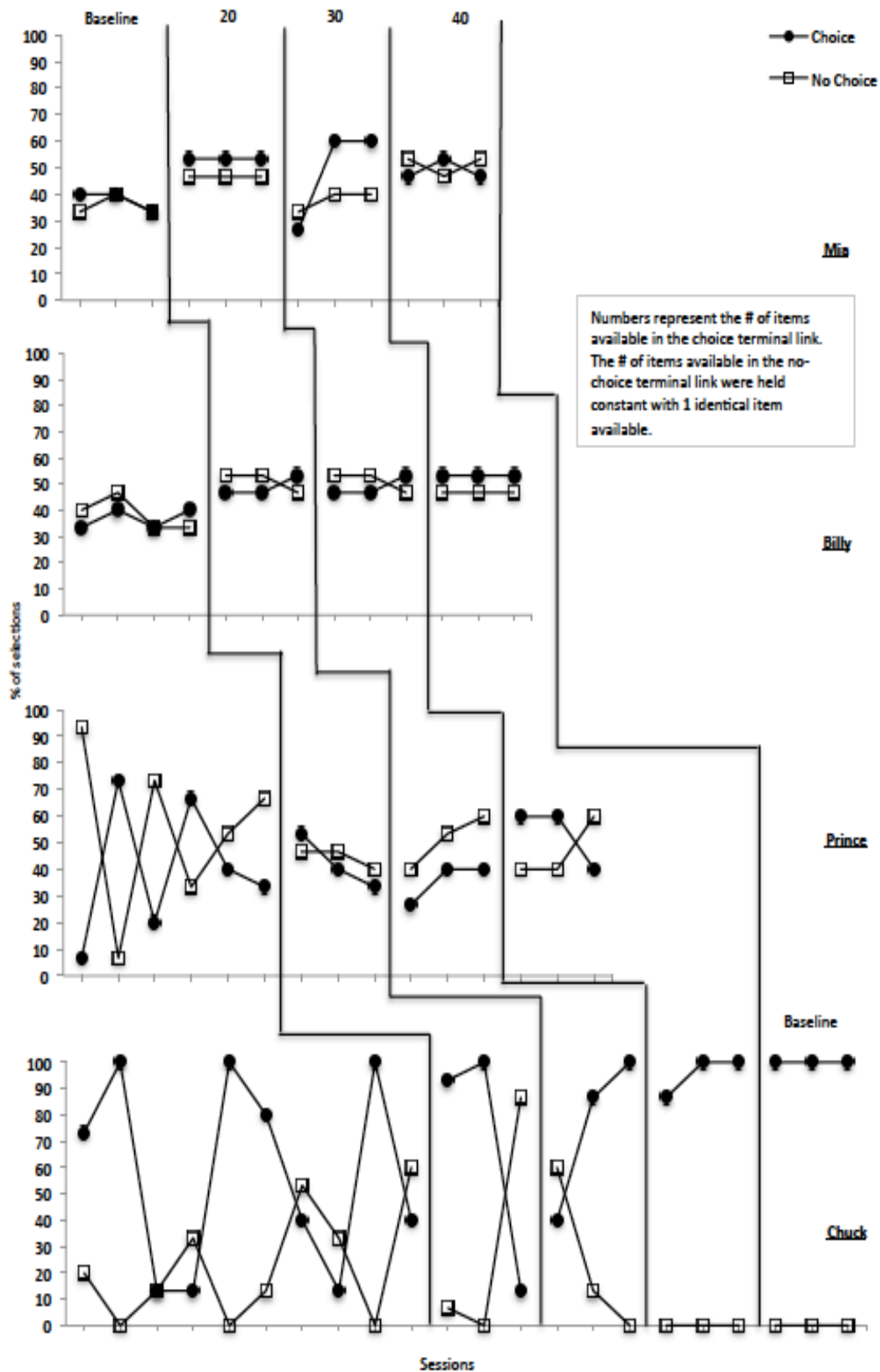


Figure 8. Percentage of choice and no-choice selections in the initial link when the number of items in from which to choose in the choice terminal link were systematically increased across phases for Mia, Billy, Chuck and Prince. Control-link selections are not shown

link selections also increased ( $M = 75\%$ ) compared to no-choice links ( $M = 24.44\%$ ). When number of items was increased to 40 Chuck continued to prefer the choice link ( $M = 95.55\%$ ) compared to no-choice ( $M = 0\%$ ). After decreasing the items from which to choose back down to 10 in the choice link we did not observe a change in Chuck's responding, in fact we saw stable responding for three sessions, with all his allocations towards the choice link ( $M = 100\%$ ).

## **Discussion**

Results from Experiment 2 suggest that the opportunity to choose from a larger array of items was no more preferred or no more reinforcing than a choice of items smaller array. The only participant who increased their selections of the choice link as a function of the number of items in the array was Chuck, however, his increase in selections of the choice link appears to be unrelated to increases in array size. It is hypothesized that Chuck may have had a preference for the opportunity to choose in Experiment 1, and his responding simply became stabilized over the course of the sessions in Experiment 2. The other participants followed a similar pattern in that their responding became more stable over the course of this assessment.

These results differ from an identical assessment conducted in Tiger et al. (2006), which showed that when the number of items in the array increased so did the participant's preferences for the choice condition. However, our results fit more closely those found in with that of basic research (e.g., Catania, 1975) that suggest that the number of alternatives available does not have any consistent effect over the preference for the free choice condition. Other authors (e.g., Schmidt et al., 2009) have conducted choosing to choose research where they controlled for illusory stimuli while also equating the outcomes across choice and no-choice conditions. The authors did this by presenting the child the plate of five identical edible items following correct responding in both the choice and no-choice links. The difference between the conditions were that during the choice condition the child was able to

select the item from the plate, and during the no-choice condition the experimenter selected one item from the plate and delivered it to the child. Thus, isolating the variable of choosing while equating any possible effects of illusory stimuli. In that study the results demonstrated that participants had a preference for the opportunity to choose or that choice functioned as reinforcer. This supports our results in that if an individual has a preference for choice, this preference is likely not controlled by or a function of the number of alternatives available when choosing.

In sum, the findings of this experiment suggest that there maybe a preference for the opportunity to choose, however, the generality of this preference is limited. Thus far only two of our participants have demonstrated a preference for choice when outcomes are equated across choice and no-choice conditions. The preference for choice, at least for Chuck, appeared not to be influenced by the number of alternatives (albeit equal alternatives) that were made available in the choice condition. Other participants also continued a similar pattern of responding despite increases in the number of alternatives available, suggesting that their occasional preference for choice was not influenced (positively or negatively) by an illusory discriminative stimulus that signaled the availability of a larger magnitude of reinforcement.

### **Experiment 3: Quantifying the value of choosing**

Results from Experiment 1 and 2 identified that having the opportunity to choose was a preference for two of the participants, Chuck and Shadow. Despite the demonstration for their preference for choice, it was not clear how valuable the opportunity to choose was for each of the participants. One way which we can quantify the value of a reinforcer is to examine responding for that reinforcer while systematically increasing the response effort (Hursh, 1980). Hence, this experiment aimed to identify the value of the choice as a reinforcer by progressively increasing the response requirements in the terminal link associated with the opportunity to choose.

## **Method**

Two participants Chuck and Shadow participated in this experiment. The other participants did not demonstrate a preference for choice and therefore did not participate in this experiment. All materials were identical to the previous studies.

Interobserver agreement was collected during 20% and 20% of sessions for Chuck and Shadow respectively. Agreement was calculated at 100% for initial link selections across participants.

## **Procedure**

The initial link stimuli and conditions remained the same in this experiment. During baseline participants completed a single response (i.e., one worksheet or posting a single shape sorter piece) in the terminal link in all conditions, choice, no-choice and control. The number of responses required to produce reinforcement in the choice terminal link was then progressively increased to 2, 4, 8 and 16 responses across sessions for each participant. The response requirements were held constant for the no-choice and control conditions, in that only one response was required in the terminal links through the assessment. The number of identical edible items of which to choose (i.e., ten items) was held constant in the choice link. Responding in the no-choice terminal link produced one identical edible item, and responding in the control terminal link produced an empty tray and no programmed reinforcement as in previous experiments. The choice, no-choice and control conditions will be evaluated in a repeated-measurement concurrent-operants design. The percentage of selections of each initial link will be used to measure the relative preference of each terminal link. A reversal design was used to demonstrate experimental control of the effects of increasing the response requirements in the choice link.

## **Results**

Data from Experiment 3 are shown in Figure 9 presented as a function of percentage of selections plotted against schedule requirements. Control-link selections are not presented in Figure 9 but averaged 0.55% and 0% for Chuck and Shadow, respectively. Neither of the participants required any prompting during the 390 terminal-link responses.

The top panel in Figure 9 shows that during baseline Chuck exclusively choose the choice-link. As the choice-link schedule requirements increased, no choice selections became more evident. When the choice-link fixed ratio (FR) value reached 16, Chuck selected the no-choice link exclusively. Baseline conditions were then reestablished, in which Chuck mostly selected the choice-link ( $M = 83.33\%$ ), and then the FR schedule in the choice-link was progressively increased. Choice-link selections were disrupted during the initial change from the FR1 to the FR 2 schedule, and at the FR 16 schedule 66.66% of selections were made of the no choice-link, and the control and choice-link was intermittently selected throughout this condition.

An initial baseline was established in which Shadow selected the choice-link almost exclusively ( $M = 98.33\%$ ). This pattern continued until the FR schedule in the choice terminal link was FR 8, and exclusive selection of the no-choice terminal link occurred when the choice-link was at a FR 16. We reestablished baseline in which Shadow exclusively selected the choice-link. Preference for the choice link was disrupted again at a FR 4 schedule. Shadow demonstrated an exclusive preference for the no-choice link at the FR 16 schedule.

## **Discussion**

The data from this experiment demonstrates that the participants selected the choice link even when the responding to the choice-link required a bigger response effort than that of the no-choice link. These

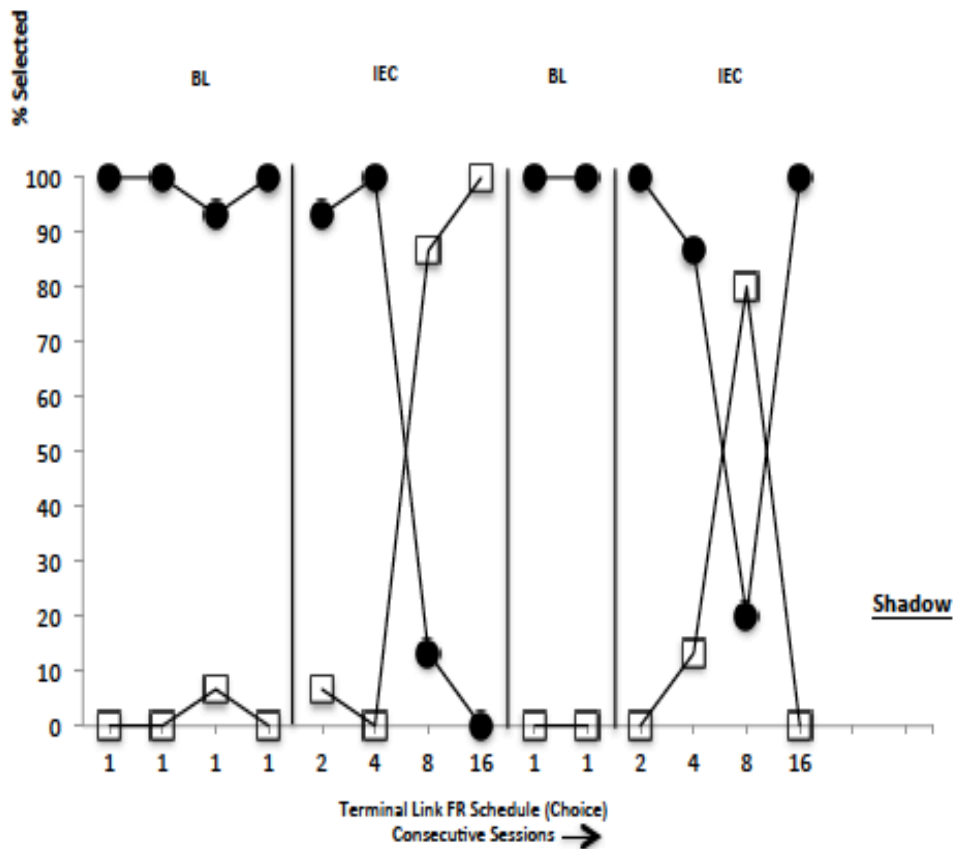
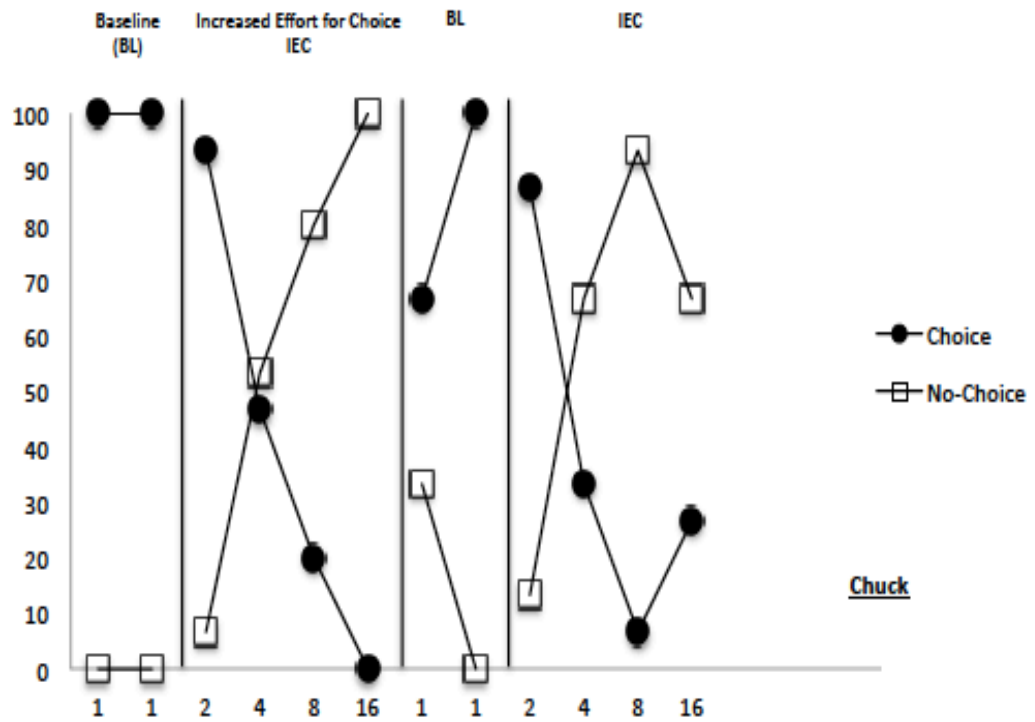


Figure 9. Percentage of choice and no-choice selections in the initial link when the work requirement in the choice terminal link was progressively increased for Chuck and Shadow. Control-link selections are not shown.

selections were made even though the outcomes (i.e., the edible items) provided in the choice link were of equal quality and magnitude of that available in the no-choice link. Additionally, these data suggest that the preference for the opportunity to choose was quantifiable and relatively reliable, in the switchover points for Chuck and Shadow occurred at similar points in the progression during within-subject reversals. These results were similar to those obtained in Tiger et al. (2006).

One limitation of the methods employed in both the Tiger et al. (2006) experiment and our own was that participants could have contacted reinforcement even if they did not respond independently. That is, if a child did not emit a response the experimenter would begin the three-step graduated prompting sequence described previously. This sequence could have potentially ended in the participant being physically prompted through the entire response, thus decreasing the response effort. If this were the case, then the effort variable would be redundant. However, this was not shown to be an issue in the current experiment because 0 of the 390 terminal-link responses across the two participants were prompted.

#### **Experiment 4: Assessing the opportunity to choose from a variety of highly preferred stimuli compared no-choice**

Past research that has assessed if the opportunity to choose is preferred typically involved providing differential outcomes in choice conditions (e.g., Fisher et al., 1997). Many of these studies have shown there is a preference for choice opportunities. These types of assessments were potentially confounded by the presence of multiple alternatives and differential outcomes, hence the methodology employed in the first two experiments of this thesis. In Experiments 1 and 2 “choice” as an independent variable was isolated (i.e., participants were provided qualitatively equal outcomes in choice and no-choice conditions). The results from these experiments identified that having the opportunity to choose was not a preference for three out of five of our participants. An inconsistent preference for the choice condition was also seen for two of

the participants in the Tiger et al. (2006) study. Thus, the purpose of this next experiment was to examine the influence of differential outcomes on Mia, Billy and Prince's selections of conditions.

## **Method**

All materials were identical to the previous studies. Additional social praise was provided for Billy and Mia as in previous experiments during choice and no-choice selections. "Black out" periods following control selections also continued as previously described.

Interobserver agreement was collected during 20% and 20%, and 20% of sessions for Billy, Mia and Prince respectively. Agreement was calculated at 100% for initial link selections across participants.

## **Procedure**

The initial link stimuli remained the same in this experiment as previous experiments. In the choice terminal link correct responding (i.e., completion of worksheet or placing a shape in the shape sorter) resulted in the participant being presented with an array of ten highly preferred items. The items were made up of a combination of the participants four top ranked items identified in the previously conducted MSWO (see Table 1 for summary of each participants edible items). Some of the items presented were identical and some were identical in type, but varied in colour. For example an array of varied items for Prince may have consisted of: two pieces of Hula Hoops, two pieces of BBQ shapes, one blue MnM, one red MnM, one yellow MnM, one red skittle, one purple skittle and one yellow skittle. In the no-choice terminal link correct responding resulted in the participant being presented with a one of their top four ranked edibles on a yoked schedule. That is, the edible chosen by the participant in the choice terminal links in each of the sessions (in this experiment) were recorded and then presented in that order for no-choice selections in the following session. The control terminal link remained the same as in the previous experiments and had no programmed reinforcers following correct responding.

The choice, no-choice and control conditions were evaluated in a repeated-measurement concurrent-operants design. The percentage of selections of each initial link was used to measure the relative preference for each terminal link. Experimental control was demonstrated using a non-concurrent multiple baseline across participants.

## Results

Data from Experiment 4 are shown in Figure 10. Control and no-choice link selections were omitted from Figure 10 to ease visual inspection. Control link selections averaged 19.99%, 0.66% and 7.69% for Mia, Prince and Billy respectively.

During baseline Mia selected the choice and no-choice link relatively equally. Following the introduction of the variety of edible items into the choice-link we continued to see the same pattern of responding. She had a slight preference overall for the choice link ( $M = 45.33\%$ ) compared to the no-choice link ( $M = 38.66\%$ ), and this was similar to her overall preference for the choice condition observed in Experiment 1 ( $M = 42\%$ ).

Prince had an equal preference for the choice and no-choice link during baseline. In Phase 2 he continued this pattern of selections and this resulted in a slight preference for the choice condition ( $M = 53.32\%$ ) compared to the no-choice condition ( $M = 46.66\%$ ).

During baseline Billy initially choose all links nearly equally. Following the phase change she demonstrated a preference for the choice condition, allocating  $M = 69.62\%$  of her responding to the choice-link and only  $M = 30.36\%$  of selections were on the no-choice link.

## Discussion

When adding in stimulus variation into the choice terminal link we expected to see a greater preference for the choice condition for all participants. However the opportunity to choose from qualitatively different stimulus was only significantly more preferred for one participant (Billy). The other two participants (Mia and Prince) only showed a small

preference for varied stimuli in the choice condition. Preference for varied choice has been demonstrated in other studies (Brandt et al., 2015; Fisher et al., 1997; Geckeler et al., 2000; Graff et al., 1999; and Sellers et al., 2013). However, within some of these studies, there were a small number of participants who did not demonstrate a preference for the opportunity to choose (e.g., in Brandt et al., 2015). We hypothesize that there could be two reasons why Mia and Prince did not show a preference for the choice (varied) condition in the current study. Firstly, both the participants showed similar amounts of responding across all of the stimuli presented in the MSWO preference assessment (see Figure 1, 2 & 3). This indifference to the stimuli available in the choice array may impact on the effects that differential outcomes would normally have for an individual. In other words, a choice is between items of differing qualities, with the opportunity to choose ensuring the acquisition of the more valuable option. If the items from which to choose differ very little in terms of value (as seen in Prince and Mia's preference assessment), then any choice is likely to result in access to an item of relatively equal value. The lack of differential outcomes for Mia and Prince may have been a confounding variable in this experiment.

Secondly, it is possible that their responding was influenced by their learning history within the context of choice situations. As other authors have suggested preference for choice may be due to the individuals' history (Catania, 1975, 1980; Catania et al., 1980; Karsina et al., 2011; Brandt et al., 2015). We were limited by time and were not able to explore these two confounding variables further with Prince and Mia. Future research should be conducted to understand the extent that disproportionate differential outcomes could have on choice making, as well as investigating the effects of an individuals learning history.

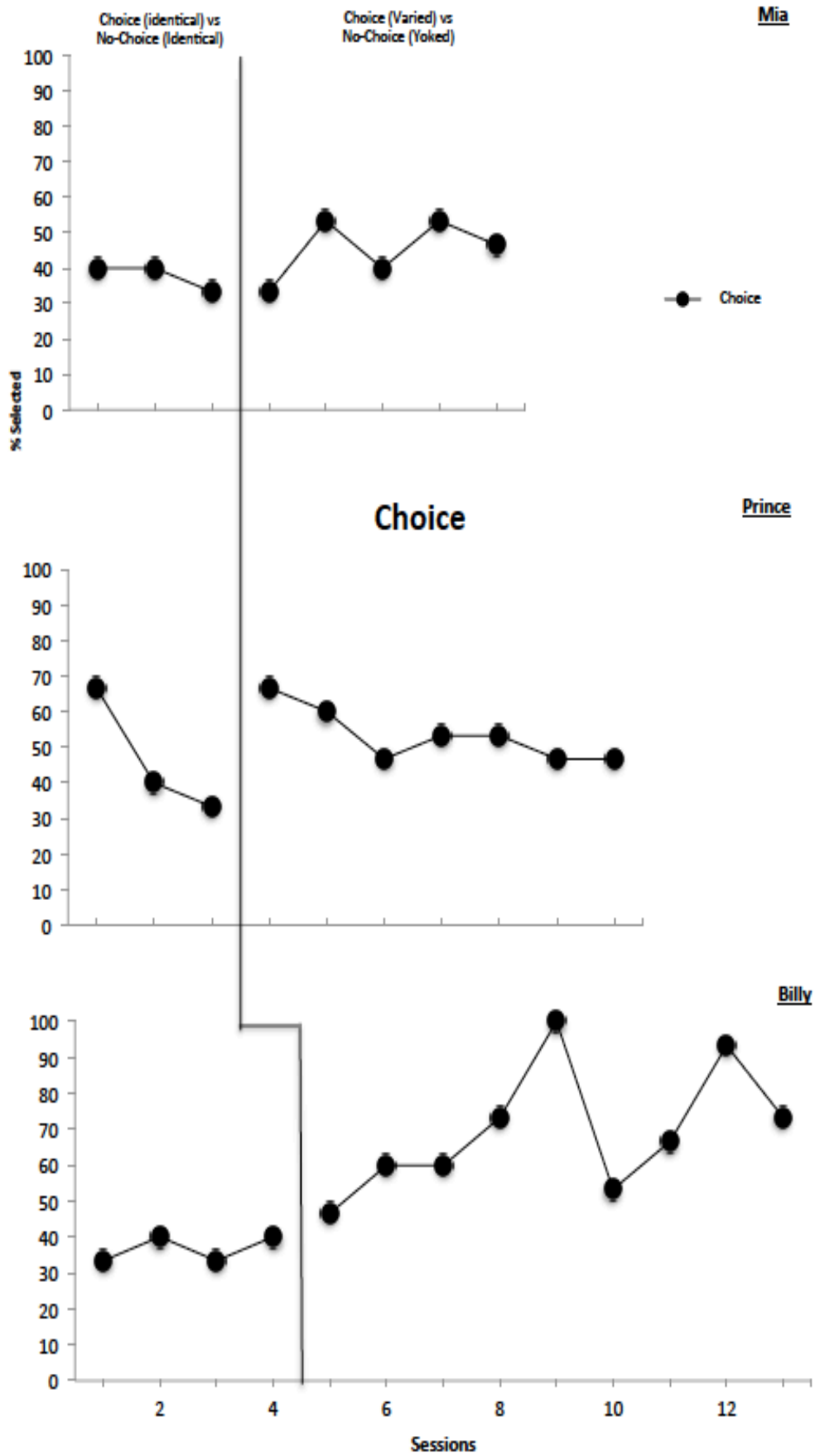


Figure 10. Percentage of choice-link selections in the initial link for choice (identical stimulus) vs no-choice (identical) in the first phase, and choice-link (varied stimulus) vs no-choice (yoked) in the second phase for Mia, Prince and Billy. No-Choice and control not graphed

As Billy showed a consistent and strong preference for the choice condition (varied outcomes) we next chose to explore the value of her preference for choice

### **Experiment 5: Quantifying the value of choosing when choosing results in differential outcomes**

Results from Experiment 4 identified that having the opportunity to choose maybe preferred when choosing involved access to differential outcomes in choice conditions for one of our participants. Despite the demonstration for the Billy's preference for choice, it was not clear how valuable the opportunity to choose was for her. As in Experiment 3 one way that we could quantify the value of a reinforcer is to examine responding for that reinforcer while systematically increasing the response effort (Hursh, 1980). Hence, this experiment aimed to replicate the methods employed in Experiment 3 to identify the value of choice as a reinforcer by progressively increasing the response requirements in the terminal link associated with the opportunity to choose.

#### **Method**

Billy was the only participant in this experiment. The other participants did not demonstrate a preference for choice even with the addition of qualitatively different items in the choice terminal link, thus they did not participate in this experiment. All materials were identical to the previous studies. Billy was provided social praise and physical interaction during the choice and no-choice terminal links, as in previous experiments. The "black out" during control link selections was also identical to previous experiments. Interobserver agreement was collected during 35% of sessions. Agreement was calculated at 100% for initial link selections.

#### **Procedure**

The initial link stimuli remained the same in this experiment. During baseline Billy completed a single response in the terminal link in all

conditions, choice, no-choice and control (i.e., posting a single shape sorter piece). The number of responses required to produce reinforcement in the choice terminal link was then progressively increased to 2, 4, 8 and 16 responses across sessions. The response requirements were held constant for the no-choice and control conditions, in that only one response was required in these terminal links through the assessment. As in the previous experiment in the choice terminal link correct responding resulted in the participant being presented with an array of 10 highly preferred items. The items were made up of a combination of the participants four top ranked items identified in the previously conducted MSWO. In the no-choice terminal link correct responding resulted in the participant being presented with a one of their top four ranked edibles on a yoked schedule. The yoked schedule was identical to that described in the previous experiment. Responding in the control terminal link produced an empty tray and no programmed reinforcement as in previous experiments.

The choice, no-choice and control conditions were evaluated in a repeated-measurement concurrent-operants design. The number of selections of each initial link was used to measure the relative preference of each terminal link. A reversal design was used to demonstrate any effects of increasing the response requirements in the choice link. Unfortunately only one reversal phase was conducted due to Billy's ongoing medical issues and hospitalisations throughout the research.

## **Results**

Data from Experiment 5 are presented as a function of percentage of selections plotted against schedule requirements in Figure 11. Control link selections are not presented to aid visual inspection. The control link was not selected during baseline conditions or during the experimental phase. The participant required no prompting throughout this experiment.

During baseline Billy had variable responding, but showed an overall preference for the choice (varied) link. As the choice link schedule requirements increased no-choice selections increased. When the choice-

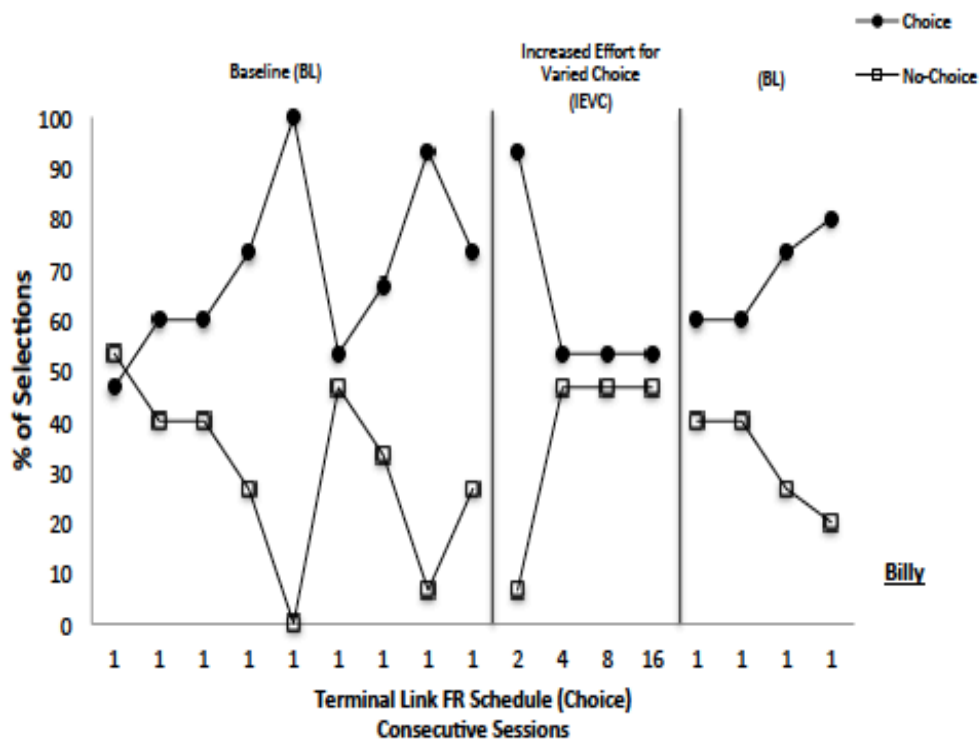


Figure 11. Percentage of choice (vaired stimulus) and no-choice (yoked) selections in the initial link when the work requirement in the choice terminal link was progressively increased Billy. Control-link selections are not shown.

link fixed ratio (FR) value reached 4, Billy selected the choice-link and the no-choice link relatively equally, this pattern maintained over the subsequent increases in the FR schedule to 8, then 16. Baseline conditions were reestablished, in which Billy began to select the choice-link more often than the no-choice link.

## Discussion

The data demonstrates that Billy selected the choice link even when responding to the choice-link required a bigger response effort than that of the no-choice link. She even continued to select the choice-link when schedule requirements reached sixteen times that of the no-choice condition. This data is similar to that obtained in Experiment 3, in that the preference for the opportunity to choose was quantifiable and relatively reliable as the participant reestablished baseline conditions following the progressive ratio evaluation.

## General Discussion

Our experiments demonstrated that the opportunity to choose was preferred for some of our participants. Their preference for choice was apparent even when their choice making didn't result in qualitatively differential outcomes. In addition our results showed that when the opportunity to choose functioned as a reinforcer it was also more valuable than no-choice. This preference was apparent even though choice making resulted in identical outcomes to the no-choice condition. In sum the opportunity to choose as an isolated variable was found to be both preferred *and* worth more to some participants. Our evaluations also showed that for some participant's choice was no more preferred than no-choice when the outcomes of each were equated. This indifference remained for a couple of participants even after the addition of qualitatively differential outcomes. For one participant the addition of qualitatively differential outcomes effected her preference, in that she initially selected both the choice and no-choice conditions fairly equally and when we added in varied reinforcement into the choice condition she began to allocate her responding primarily to choice. Thus, indicating that she had a preference for choice of varied stimuli relative to (equated) no-choice varied stimuli. Following further assessment this participant also demonstrated that varied choice was not only more preferred, but also more valuable compared to the no-choice condition.

This thesis attempted to replicate previous research that evaluated the preference for choice-making opportunities while isolating choice as an independent variable (Fenerty et al., 2010; Thompson et al., 1998; Tiger et al., 2006; Tiger et al., 2010), and to replicate the method used for quantifying the value of the opportunity to choose in Tiger et al. (2006). In addition to replicating previous research the experiments looked to explore variables that may have influenced the participants responding within the choice assessments. We attempted to rule out confounding variables such as illusory discriminative stimuli.

Our assessments found that the number of items of which to choose did not impact on the participant's preference either way. This

finding was contrary to that found in Tiger et al. (2006). Their study found that increasing the items of which to choose in the choice terminal link increased participant's preference for the opportunity to choose. Our results however were in line with other applied and experimental research, which showed that illusory discriminative stimuli held no bearing on preference for choice (Catania, 1980; Schmidt et al., 2009).

Our studies also extended prior research to a larger range of ages and developmental types, as well as using socially valid materials and response topographies (e.g., shape sorters and worksheets).

We also extended previous research (e.g., Tiger et al. 2006) in that we continued to examine the various variables of choice with our participants who did not initially demonstrate a preference for the opportunity to choose during the (equal outcomes) choice preference assessment. These participants went through additional assessments in which we added in differential alternatives into the choice condition in order to assess how this effected their responding and consequent preference. The results of this assessment suggest that for some of our participants the addition of differential outcomes increased the preference for choice, for others preference remained indifferent. It was difficult to pinpoint the exact reason for the difference among participants and the minimal influence stimulus variability had on the preference for choice for Mia and Prince. However our results indicate that it is likely due to the minimal qualitative differences of each of the food items available in the choice condition for these participants. Another possible explanation of the results could be the participant's history of learning with choice situations. As suggested by Ackerlund Brandt et al. (2015) preference for choice can develop through a history of differential reinforcement following choice situations. The limited time frame for the current investigation meant that this possible explanation couldn't be explored further.

The results of our experiments support previous assertions that the preference for choice is due to both phylogenic (i.e., evolution and genetics) and ontogenic (i.e., conditioning) sources. The phylogenic perspective suggests that organisms who prefer the availability of

alternative sources of reinforcement or have the opportunity to access reinforcement through variable behavioural responses may have an evolutionary advantage. In the natural environment a food supply may be lost or competition for the same food could mean a shortage in supply. Therefore, an organism that chooses environments that have multiple alternatives for food may have an advantage of survival over one that prefers a single food supply. For example, a predatory animal that prefers a hunting area with several different types of prey available than an area with a single prey source, is more likely to survive if one prey source is diminished (Catania, 1975; Tiger et al., 2006; Voss et al., 1970).

With over half of our participants having a strong preference for the opportunity to choose, and the other half presenting with a slight preference for choice, our results can be interpreted as evidence for phylogenetic sources of influence. An ontogenic perspective on choice proposes that an organism experiences better outcomes following opportunities to choose, therefore a personal history of improved outcomes exists in choice situations. Outside the experimental environment choice situations for our participants would involve a selection of alternatives, with the opportunity to choose resulting in the acquisition of the more valuable alternative (in that moment). There was evidence in our results of ontogenic influences, as some of our participants showed a preference for choice and considered choice more valuable, even when the outcomes were equated in both the choice and no-choice links. This suggests participants may have experienced a history of differential reinforcement in choice-making situations, thus preferring and valuing choice over no-choice.

The fact that choosing in and of itself is a reinforcer suggests that for many there may be a history of experiencing differential reinforcement in choice situations. Akerlund Brandt et al. (2015) conducted a study that supports a combination of both ontogenic and phylogenetic variables at play in the preference for choice. In the second experiment in their paper they selected participants who previously showed no preference for choice or no choice conditions. These participants went through conditioning phases

in an attempt to condition either choice or no-choice as a preference. The experimenters were successful in conditioning choice as a preference for most participants, but were unsuccessful at conditioning no-choice as a preference in any participants. That is, participants who initially showed an indifference for choice and no-choice situations, did not change their preference even after experiencing conditioning phases that heavily favoured the no-choice condition. This implies that humans have two factors that might determine a preference for choice. It is the combination of both the predetermined preference for choice (i.e., phylogenic) and the experience of choice situations that result in beneficial outcomes, or access to preferred stimuli (i.e., ontogenic) that makes choice preferred. However, there still remains residual clarifications regarding the behavioural principals underlying the conditions in which an organism prefers the opportunity to choose, and related outcomes (i.e., variability and differential values).

Others have suggested that the opportunity to choose may function as an establishing operation (e.g., Tiger et al., 2006; Romaniuk et al., 2001). An establishing operation is an environmental event that is both value-altering and behaviour-altering. In the context of choice, choice-making opportunities may have an establishing effect on the reinforcing consequence of the stimuli available to select from, and therefore increase the frequency of behaviours that are reinforced by those stimuli (available in the choice situation). For example, in Dunlap et al. (1994), when participants were able to choose their academic tasks it was observed that there was an increase in their on-task behaviour and a decrease in problem behaviour compared to no-choice conditions. These results suggest that choice of task has an establishing effect on the reinforcing consequences of engaging in one of the available tasks that were available in the choice condition. Further, the opportunity to choose evoked task engagement behaviours (e.g., asking relevant questions). Evidence that the choice making opportunities functioned as establishing operations in this study is further strengthened by the outcomes in the no-choice condition. During the no-choice condition participants task

engagement decreased and problem behaviour increased, despite the tasks in the no-choice condition being yoked to the preceding choice phase. This indicates that the absence of the opportunity to choose (i.e., no-choice) may function as an abolishing operation, in that the task provided had an establishing effect on the aversive/punishing effects of that task. In addition it was observed there was a decrease in the frequency of task engagement (i.e., an abative effect). If indeed the opportunity to choose functions as an establishing operation, this could describe the results of the current study too.

It is likely that some of our participants had a history of conditioning where choice allowed them to modify their reinforcer in relation to their momentary changes in motivation, increasing the value the reinforcers available in the choice condition and increasing the frequency of responding in the choice condition. This could be an explanation as to why they allocated more of their responses to the choice condition over the no-choice condition, and this type of relative responding is then deemed a preference for choice. Although the opportunity to choose may somewhat fit the definition of a motivating operation, there is little empirical evidence available to conclude that choice opportunities do actually function as establishing operations. Further research will need to be conducted in order to demonstrate this relation (Cooper et al., 2007; Fagerstrøm et al., 2010; Fisher et al., 1997; Michael, 1993; Romaniuk et al., 2001).

The underlying behavioural factors for the preference for choice that have been observed across a range of research studies (e.g. Ackerlund Brandt, 2015; Catania, 1975, 2007; Fenerty et al. 2010, Tiger et al. 2006; Tiger et al. 2010; Sran et al. 2010) may not exhaustive. However, there is plenty of evidence that shows the positive implications that choice can have when added into a behaviour change intervention, and these outcomes can easily be discussed. Firstly, providing individuals with the opportunity to choose provides an easy way to create variation and increase reinforcer effectiveness for behaviour change interventions. Research has shown that varied reinforcement is preferred, and produces increases in responding compared with constant reinforcement (Egel,

1980, 1981; Bowman et al., 1997). In behaviour change interventions the addition of choice as a reinforcer is an easy and effective way to increase an individual's responding. Choice, in this case, allows an individual to select a reinforcer, which means that the most preferred reinforcer may be selected in that moment, and naturally be able to control the variation of reinforcement.

As our data and others (i.e., Fenerty et al., 2010; Schmidt et al., 2009; Sellers et al., 2013; Tiger et al., 2006) suggest, both the differential outcomes that choice provides and the opportunity to choose, have independent reinforcing value. In the applied setting providing a choice among an individual's preferred items would be more effective in producing behaviour change than providing a highly preferred item on its own. It appears that the addition of choice into an individual's learning environment is a relatively sound option to recommend to teachers, therapists and practitioners. In addition to increasing the effectiveness of a reinforcer, the opportunity to choose may also provide an individual with the ability to exert control over their environment. That is, choice gives the individual the ability to escape aversive situations or gain access to reinforcing situations. Many authors have found that choice consistently increases on-task behaviour and decreases problem behaviours in individuals with developmental disabilities (e.g., Dunlap et al., 1994; Dyer et al., 1990; Kern et al., 2001; Tasky et al., 2008; Vaughn et al., 1997). Tasky et al. (2008) found that participants who had the opportunity to choose from a list of tasks showed an increase in on-task behaviour. Kern et al. (2001) demonstrated that choice making was an effective intervention to reduce problem behaviour and increase appropriate behaviour. In this study participants were found to engage in problem behaviour during task demand situations. The intervention consisted of adding in a choice of order in which they had to complete tasks. The intervention resulted in significant increases in task engagement and decreases in problem behaviours. Vaughn et al. (1997) conducted a study that showed participants had lower rates of problem behaviour when they could choose between pairs of lower or higher preferred tasks compared

to when the teacher selected the same task. Dunlap et al. (1994) and Vaughn et al. (1997) concluded that the decrease in problem behaviour observed with their participants was the result of providing choice of tasks, which allowed the individual to avoid aversive stimuli (e.g., avoid no-preferred or difficult tasks by choosing a more preferred or easier alternative). These results indicate that individuals who have problem behaviour maintained by escape/avoidance may be more likely to benefit from interventions involving the opportunity to choose (Berotti, 1996; Romaniuk et al. 2001). These studies highlight the importance of conducting a functional analysis before implementing choice interventions. In addition, these studies show that the opportunity to choose (either task or reinforcer choice) as an intervention tool is effective for both increasing socially significant behaviours and decreasing problem behaviour.

Another practical implication of the current research applies to how preference and reinforcer assessments are used in clinical practice. Preference assessments are generally used to identify preferred stimuli. Stimuli that have been identified as preferred in a preference assessment have frequently been shown to also function as a reinforcer (Piazza et al. 1996). Reinforcer assessments are conducted to order to identify if the preferred stimuli actually functions as a reinforcer. In a reinforcer assessment the preferred item is presented contingent upon an operant response on a continuous schedule of reinforcement (CRF). Practitioners use the information gathered in these assessments to program interventions utilizing positive reinforcement. Our results suggest that preference and reinforcer assessments should go a step beyond just identifying items as preferences and reinforcers under CRF. Considering that choice *can* be both a preference and function as a reinforcer for some individuals, we suggest that practitioners should follow the typical procedures to identify preferences (i.e., stimulus preference assessments), and conduct additional assessments in order to identify if the individual has a preference for choice as a reinforcer. If it is identified that choice is a preference, further assessments should be conducted to assess if choice functions as a reinforcer under PR schedules.

There are two main reasons for this recommendation. Firstly, identifying if the opportunity to choose is preferred by an individual could be effective in guiding a practitioner in selecting the most appropriate intervention. Adding choice-making opportunities into interventions and hoping that it has a positive effect on an individuals' behaviour, without first identifying if the person prefers choice could lead to negative outcomes. Practitioners also may waste precious time and resources or lose the confidence of parents or other professionals when an intervention plan is not effective. Hence it is important to first identify if choice-making *is* preferred before making the decision about adding choice to an intervention plan.

Further to this, it is recommended, following preference assessments stimuli identified as preferred (whether this be a stimulus or choice-making itself) should undergo reinforcer assessments. In particular it is suggested that we should use reinforcer assessments that examine stimuli under increasingly more difficult response requirements. In the context of choice-making it is advantageous to identify 1) how much harder the individual will work for choice compared to no-choice situations, and 2) if choosing is more valuable than other reinforcers (i.e., its differential reinforcement value). Before adding in choice-making opportunities into intervention plans practitioners should have a sound understanding of how effective choice as a reinforcer will be under differing schedule requirements, as this will have important implications for the use of choice as a reinforcer.

Our results also suggest that reinforcer assessments that use dense schedules of reinforcement (e.g., continuous reinforcement) may have limited generality to intervention plans, particularly during schedule thinning phases of intervention. For example, Roane et al. (2001) found that items that were selected equally in a preference assessment resulted in different reinforcement values as the response requirements increased over sessions. Thus, exemplifying the need to evaluate all reinforcers, including choice as a reinforcer under increasing schedule requirements.

Identifying if choice as a reinforcer will maintain responding under increasingly harder requirements rather than a identical forced-choice reinforcer will help the practitioner program the most appropriate reinforcer and reinforcer presentation (i.e., opportunity choice-making) for that individual. For example, it is common for behaviour acquisition programs to contain procedures that require the practitioner to reserve the most valuable reinforcers for independent responding, particularly during errorless learning and prompt fading methods of teaching.

Using a differential reinforcement procedure has been shown to be effective in producing skill acquisition and reducing prompt dependency (e.g., Clark & Green, 2004; Karsten & Carr, 2009; Olienick & Pear, 1980; Touchette & Howard, 1984). Karsten et al. (2009) conducted a study that evaluated the effects that two different reinforcement conditions had on participants acquisition rate. In the differential reinforcement condition they provided the highest quality reinforcement for correct independent responses and lower quality reinforcement for prompted responses. In the non-differential reinforcement condition they provided the highest quality of reinforcement for independent correct and prompted responses. The results showed the differential reinforcement (DR) procedure was identified as the more effective and preferable teaching method. In the context of the current investigation if choice-making as a reinforcer is identified through a PR reinforcer assessment to be differentially more valuable than no-choice, then this information can be used to guide differential reinforcement procedures within skill acquisition programs. For example, lets say for one child it was identified that the highest quality reinforcer was the opportunity to choose (among the individual's most preferred reinforcers) and the lower quality reinforcer was access to only one highly preferred reinforcer (without the opportunity to choose). This information should be considered when developing a teaching program that required DR for this individual.

The inclusion of choice and no-choice within DR procedures may also mitigate some of the potential side effects of these procedures, such as prematurely extinguishing correct prompted responses. That is, many

DR procedures are practically difficult to use a hierarchy of reinforcement, so typically DR means reinforcement and extinction are the differential outcomes that an individual may be provided following a programmed response. Extinction can result in a complete reduction in responding or even cause problem behaviour (i.e., extinction burst) to occur. However with the use of choice and no-choice as the DR hierarchy then even prompted responses can still be provided some level of reinforcement, albeit reinforcement of a lesser value. This DR hierarchy will still result in differential outcomes, while avoiding the use of extinction and its potential negative side effects.

In any case, the evidence is positive, and suggests that in order to identify if choice-making is preferred practitioners should use preference assessments and PR reinforcer assessments. These assessments will help identify if choice functions as a reinforcer and what value it might hold for that individual. These are both integral assessments to perform before choice-making is incorporated into a behavioural change program.

Given both the current and previous research on choosing to choose, it can be concluded that in general choice-making opportunities are more preferred by some individuals, even when the outcomes are equated. In addition choice is considered more valuable for these individuals, and therefore is likely to function as a more effective reinforcer. The reason these individuals have a preference for choice is likely due to both phylogenic and ontologic factors, as well as motivating operations.

In general, the research shows that choice-making opportunities provide an individual with the ability to select their reinforcers and therefore access differential outcomes. This may lead to access of their most preferred reinforcer at any given time. Choice can also provide an individual control over their environment by allowing opportunities to escape/avoid aversive situations. In essence this suggests that choice-making opportunities may enrich an individual's quality of life.

## References

- Akerland Brandt, J.A., Dozier, C.L., Juanico, J.F., Laudont, C.L., & Mick, B.R. (2015). The value of choice as a reinforcer for typically developing children. *Journal of Applied Behavior Analysis, 48* (2), 344-362.
- Bowman, L.G., Piazza, C.C., Fisher, W.W., Hagopian, L.P., & Kogan, J.S. (1997). Assessment of preference for varied versus constant reinforcers. *Journal of Applied Behavior Analysis, 30*(3), 451-458
- Catania, A.C. (1975). Freedom and knowledge: an experimental analysis of preference in pigeons. *Journal of the Experimental Analysis of Behavior, 24*, 89-106.
- Catania, A.C. (2007). *Learning*. Cornwall-on-Hudson, NY: Sloan Publishing.
- Catania, A.C. & Sagvolden, T. (1980). Preference for free choice over forced choice in pigeons. *Journal of Experimental Analysis of Behavior, 34*(1), 77-86
- Cerutti, D., & Catania, A. C. (1997). Pigeons' preference for free choice: Number of keys versus key area. *Journal of the Experimental Analysis of Behavior, 68*, 349-356
- Clark, K.M., & Green, G. (2004). Comparison of two procedures for teaching dictated-word/symbol relations to learners with autism. *Journal of Applied Behavior Analysis, 37*, 503-507
- Cooper, J.O., Heron, T.E., & Heward, W.L. (2007). *Applied behavior analysis*. New Jersey, USA: Pearson Education, Inc.

- DeLeon, I.G., Iwata, B.A., Goh, H.-L., & Worsdell, A.S. (1997). Emergence of reinforcer preference as a function of schedule requirements and stimulus similarity. *Journal of Applied Behavior Analysis, 30*, 439-449
- Dunlap, G., DePerczel, M., Clarke, S., Wilson, D., Wright, S., White, R., & Gomez, A. (1994). Choice making to promote adaptive behavior for students with emotional and behavioral challenges. *Journal of Applied Behavior Analysis, 27*, 505-518
- Dyer, K., Dunlap, G., & Winterling, V. (1990). Effects of choice making on the serious problem behaviors of students with severe handicaps. *Journal of Applied Behavior Analysis, 23*, 515-524
- Egel, A.L. (1980). The effects of constant vs varied reinforcer presentation on responding by autistic children. *Journal of Experimental Child Psychology, 30*, 455-463
- Fagerstrøm, A., Foxall, G.R., & Arnstzen, E. (2010). Implications of motivating operations for the functional analysis of consumer choice. *Journal of Organizational Behavior Management, 30*, 110-126
- Fenerty, K.A. & Tiger, J.H. (2010). Determining preschoolers' preferences for choice-making opportunities: choice of task versus choice of consequence. *Journal of Applied Behavior Analysis, 43*, 503-507
- Fisher, W., Piazza, C.P., Bowman, L.G., Hagopian, L.P., Owens J.C., and Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*(2), 491-498.
- Fisher, W.W., & Mazur, J.E. (1997). Basic and applied research on choice responding. *Journal of Applied Behavior Analysis, 30*, 387-410.

- Geckler, A.S., Libby, M.E., Graff, R.B., & Ahearn, W.H. (2000). Effects of reinforcer choice measured in single-operant and concurrent-schedule procedures. *Journal of Applied Behavior Analysis, 33*, 347-351
- Green, C.W., Reid, D.H., White, L.K., Halford, R.C., Brittain, D.P., & Gardner, S.M. (1988). Identifying reinforcers for persons with profound handicaps: staff opinion versus systematic assessment of preferences. *Journal of Applied Behavior Analysis, 21*, 31-43
- Herrnstein, R.J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior, 13*, 243-266
- Hursh, S.R. (1980). Economic concepts for the analysis of behavior. *Journal of Experimental Behavior Analysis, 34*, 219-238.
- Jolivette, K., Wehby, J.H., Canale, J., & Massey, N.G. (2001). Effects of choice-making opportunities on the behavior of students with emotional and behavioral disorders. *Behavioral Disorders, 26*, 131-145
- Kamil, A.C., Krebs, J.R. & Pulliam, H.R. (1987) *Foraging Behavior*. New York, NY: Plenum Press.
- Karsina, A., Thompson, R.H., & Rodreiguez, N.M. (2011). Effects of a history of differential reinforcement on preference for choice. *Journal of the Experimental Analysis of Behavior, 95*, 189-202
- Karsten, A.M. & Carr, J.E. (2009). The effects of differential reinforcement of unprompted responding on the skill acquisition of children with autism. *Journal of Applied Behavior Analysis, 42* (2), 327-344

- Kern, L., Mantegna, M.E., Vorndran, C.M., Bailin, D., & Hilt, A. (2001). Choice of the task sequence to reduce problem behaviors. *Journal of Positive Behavior Interventions*, 3, 3-10
- Michael, J. (1993). Establishing operations. *The Behavior Analyst*, 16(2), 191-206
- Milo, J.S., Mace, F.C., & Nevin, J.A. (2010). The effects of constant versus varied reinforcers on preference and resistance to change. *Journal of the Experimental Analysis of Behavior*, 93 (3), 385-394
- Neef, N.A., Mace, F.C., Shea, M.C., & Shade, D. (1992). Effects of reinforcer rate and reinforcer quality on time allocation: extensions of matching theory to educational settings. *Journal of Applied Behavior Analysis*, 25 (3), 691-699
- Neef, N.A., Mace, F.C., & Shade, D. (1993). Impulsivity in students with serious emotional disturbance: the interactive effects of reinforcer rate, delay, and quality. *Journal of Applied Behavior Analysis*, 26 (1), 37-5
- Olenick, D.L., & Pear, J.J. (1980). Differential reinforcement of correct responses to probes and prompts in picture-name training with severely retarded children. *Journal of Applied Behavior Analysis*, 13, 77-89.
- Pace, G.M., Ivancic, M.T., Edwards, G.L., Iwata, B.A., & Page, T.J. (1985). Assessment of stimulus preference and reinforce value with profoundly retarded individuals. *Journal of Applied Behavior Analysis*, 18, 249-255

- Paclawskyj, T. R., & Vollmer, T.R. (1995). Reinforcer assessment for children with developmental disabilities and visual impairments. *Journal of Applied Behavior Analysis, 28*, 219-224
- Perdue, B.M., Evans, T.A., Washburn, D.A., Rumbaugh, D.M. & Beran, M.J. (2014). Do monkeys choose to choose?. *Learning and Behaviour, 42*, 164-175.
- Piazza, C.C., Fisher, W.W., Hagopian, L.P., Bowman, L.G., Toole, L. (1996). Using choice assessment to predict reinforce effectiveness. *Journal of Applied Behavior Analysis, 29*, 1-9
- Rachlin, H. & Green, L. (1972). Commitment, choice, and self-control. *Journal of Experimental Behavior Analysis, 17*, 15-22
- Ramsey, M.L., Jolivette, K., Patterson, D.P., & Kennedy, C. (2010). Using choice to increase time on-task, task completion, and accuracy for students with emotional/behavior disorders in a residential facility. *Education and Treatment of Children, 33*, 1-21
- Rispoli, M., Lang, R., Neely, L., Camargo, S., Hutchins, N., Davenport, K., & Goodwyn, F. (2013). A comparison of within- and across-activity choices for reducing challenging behavior in children with autism spectrum disorder. *Journal of Behavior Education, 22*, 66-83
- Roane, H.S., Lerman, D.C., & Vorndran C.M. (2001). Assessing reinforcers under progressive schedule requirements. *Journal of Applied Behavior Analysis, 34* (2), 145-167
- Romaniuk, C. & Miltenberger, R.G. (2001). The influence of preference and choice of activity on problem behavior. *Journal of Positive Behavior Interventions, 3* (3), 152-159
- Roscoe, E. M., Iwata, B. A., & Kahng, S. (1999). Relative versus absolute

reinforcement effects: implications for preference assessments. *Journal of Applied Behavior Analysis*, 32(4), 479–493.

Schmidt, A.C., Hanley, G.P., & Layer, S.A. (2009). A further analysis of the value of choice: controlling for illusory discriminative stimuli and evaluating the effects of less preferred items. *Journal of Applied Behavior Analysis*, 42, 711-716

Sellers, T.P., Bloom, S.E., Samaha, A.L., Dayton, E., Lambert, J.M., & Keyl-Austin, A.A. (2013). Evaluation of some components of choice making. *Journal of Applied Behavior Analysis*, 46, 455-464

Shogren, K.A., Faggella-Luby, M.N., Bae, S.J., & Wehmeyer, M.L. (2004). The effect of choice-making as an intervention for problem behavior: a meta-analysis. *Journal of Positive Behavioral Interventions*, 6, 228-237

Solnick, J.V., Kannenberg, C.H., Eckerman, D.A., & Waller, M.B. (1980). An experimental analysis of impulsivity and impulse control in humans. *Learning and Motivation*, 11, 61-77

Sran, S.K. & Borrero, J.C. (2010). Assessing the value of choice in a token system. *Journal of Applied Behavior Analysis*, 43, 553-557

Tasky, K.K., Rudrud, E.H., Schulze, K.A., & Rapp, J.T. (2008). Using choice to increase on-task behavior in individuals with traumatic brain injury. *Journal of Applied Behavior Analysis*, 41, 261-265

Thompson, R.H., Fisher, W.W. & Contrucci, S.A. (1998). Evaluating the Reinforcing Effects of Choice in Comparison to Reinforcement Rate. *Research in Developmental Disabilities*, 19 (2), 181-187.

- Tiger J.H., Hanley, G.P., & Hernandez, E. (2006). An evaluation of the value of choice with preschool children. *Journal of Applied Behavior Analysis, 39*, 1-16.
- Tiger, J.H., Toussaint, K.A., & Roath, C.T. (2010). An evaluation of the value of choice-making opportunities in single-operant arrangements: simple fixed- and progressive-ratio schedules. *Journal of Applied Behavior Analysis. 43*, 519-524
- Touchette, P.E., & Howard, J. S. (1984). Errorless learning: Reinforcement contingencies and stimulus control transfer in delayed prompting. *Journal of Applied Behavior Analysis, 38*, 261-188
- Tustin, R.D (1994). Preference for reinforcers under varying schedule arrangements: a behavioral economic analysis. *Journal of Applied Behavior Analysis, 27*, 597-606
- Vaughn, B.J. & Horner, R.H. (1997). Identifying instructional tasks that occasion problem behavior and assessing the effects of student versus teacher choice among these tasks. *Journal of Applied Behavior Analysis, 30*, 299-312
- Vollmer, T.R. & Iwata, B.A (1991). Establishing operations and reinforcement effects. *Journal of Applied Behavior Analysis, 24 (2)*, 279-291.
- Voss, S.C. & Homzie, M.J. (1970). Choice as a value. *Psychological Reports, 26*, 912-914
- Watanbe, M. & Sturmey, P. (2003). The effect of choice-making opportunities during activity schedules on task engagement of

adults with autism. *Journal of Autism and Developmental Disorders*,  
33, 535-538

Wehmeyer, M.L., Agran, M., Hughes, C., Martin, J.E., Mithaug, D.E.,  
Palmer, S.B. (2007). Assessing preferences and teaching choice-  
making. *Promoting self-determination in students with*  
*developmental disabilities* (pp. 17-32). New York: Guilford Press

**Appendix 1**  
**Email Advertisement**

To (Parent's Name/s),

You are receiving this email because I would like to offer (child's name/s) the opportunity to participate in my Master's Thesis research that I am completing this year.

I have attached a brief explanation of the research and instructions of the next step if this is something you would be interested in having (child's name/s) take part in.

Please don't hesitate to give me a call if you have any questions.

Warm Regards

Jenna Penman  
Ph: 021 1151354

## **Appendix 2**

### **Email Attachment**

You are invited to take part in a study on “Choosing Choice: An Assessment of Children’s Preference to Choose”.

The purpose of this study is to assess children’s preference to make choices. The research seeks to find out whether or not children prefer to complete academic tasks and be provided a choice of their reward or just be given a single reward (no choice). It further investigates how much a child values this ability to choose, and why they might value choice.

The expected contribution of this research will help educators and other related professionals set up the most positive and valuable learning environments for children in order to facilitate learning. If in fact, children do prefer to choose, then this is integral that educators are aware that setting up multiple opportunities for children to choose in their learning environment is “best practice”.

If you would like to take part in this study or would like more information on participating in this study please contact the researcher (Jenna Penman), and she will provide you with a Participant Information Sheet, which will help you decide if you’d like your child to take part. It sets out why we are doing the study, what your child’s participation would involve, what the benefits and risks to your child might be, and what would happen after the study ends. I will go through this information with you and answer any questions you may have. You do not have to decide today whether or not you will participate in this study. Before you decide you may want to talk about the study with other people, such as family, whānau, friends, or healthcare providers. Feel free to do this.

Whether or not you want your child to take part is your choice. If you don’t want your child to take part, you don’t have to give a reason. If you do want to take part now, but change your mind later, you can pull out of the study at any time.

Please contact the researcher, Jenna Penman.

[jennapenman@gmail.com](mailto:jennapenman@gmail.com)

021 1151354

This study has been provided approval from the ethics committee at the University of Waikato. If you, however, have any questions about the nature of this study please contact *John Perrone*, email: [jpnz@waikato.ac.nz](mailto:jpnz@waikato.ac.nz)

### Appendix 3 Multiple Stimuli without Replacement (MSWO) Data Sheet

Child's Name: \_\_\_\_\_

Evaluator: \_\_\_\_\_

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

List of Items:


Preference Assessment #1	
Order of items selected	# times chosen/ # of times available
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Preference Assessment #2	
Order of items selected	# times chosen/ # of times available
1.	
2.	
3.	
4.	
5.	
6.	
7.	

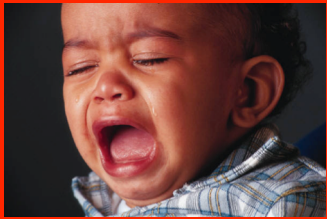
Preference Assessment #3	
Order of items selected	# times chosen/ # of times available
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Preference Assessment #4	
Order of items selected	# times chosen/ # of times available
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Preference Assessment #5	
Order of items selected	# times chosen/ # of times available
1.	
2.	
3.	
4.	
5.	
6.	
7.	

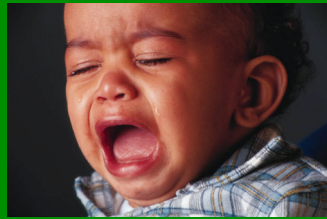
Summary (high to low)	
Item	Total % Selected
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Appendix 4  
Worksheet examples




What is the baby doing?

---



What is the baby doing?

---



What is the baby doing?

---

What is your favourite colour?

---

What is your favourite colour?

---

What is your favourite colour?

---

$4 + 18 = \underline{\hspace{2cm}}$

$4 + 18 = \underline{\hspace{2cm}}$

$4 + 18 = \underline{\hspace{2cm}}$

## Appendix 5

Picture of initial link stimuli for the worksheet group

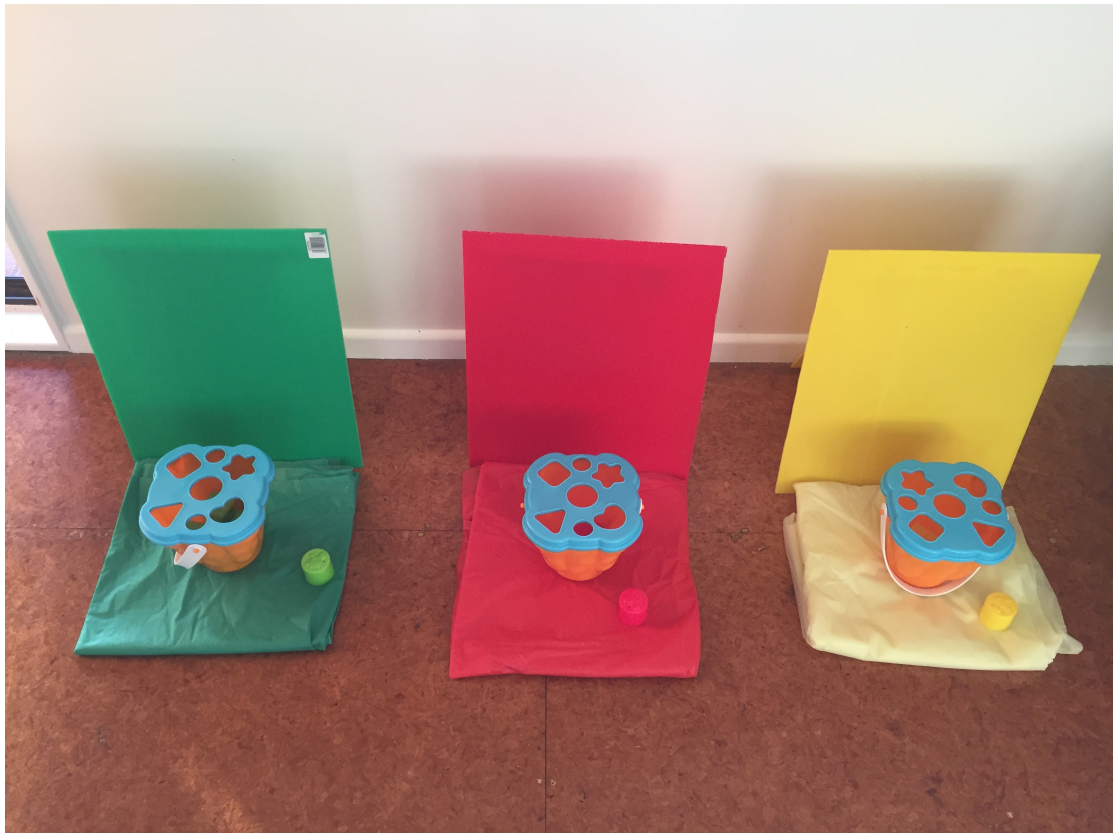


**Appendix 6**  
**Picture of shape sorter and 3D shapes**



## Appendix 7

### Picture of initial link stimuli for the shape sorter group



## Appendix 8

### Data Sheet for Experiment 1

Child's Name: \_\_\_\_\_

Session #: \_\_\_\_\_

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

Task: \_\_\_\_\_

IOA: \_\_\_\_\_

Training Trials: \_\_\_\_\_

Reinforcer: \_\_\_\_\_

Trial	Initial Link Selections			Reinforcer selected
	Choice	No Choice	Control	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
% SELECTED				

## Appendix 9

### Data sheet for Experiment 2

Child's Name: \_\_\_\_\_ Session #: \_\_\_\_\_  
 Date: \_\_\_\_\_ Task: \_\_\_\_\_  
 IOA: \_\_\_\_\_ Training Trials   
 # of items in Choice Terminal Link: \_\_\_\_\_ Reinforcer: \_\_\_\_\_

Trial	Initial Link Selections			Prompt Required
	Choice	No Choice	Control	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
% SELECTED				

**Appendix 10**  
**Experiment 3, 4 & 5**

Child's Name: \_\_\_\_\_ Session #: \_\_\_\_\_  
 Date: \_\_\_\_\_ Task: \_\_\_\_\_  
 IOA: \_\_\_\_\_ Training Trials   
 PR Schedule: \_\_\_\_\_  
 Reinforcer array: \_\_\_\_\_

Trial	Initial Link Selections			Prompt Required	Reinforcer selected in Choice
	Choice	No Choice	Control		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
% SELECTED					