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**Improving prospective memory in normally developing
pre-school aged children.**

A thesis

submitted in partial fulfilment

of the requirements for the degree

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Abstract.

Prospective Memory (PM) is a type of memory where an intention needs to be remembered in the future. As existing literature in the area of PM abilities generally, and improving PM through the delivery of reinforcements, specifically, has been both inconsistent and sparse, this study aims to help clarify and extend this knowledge using three separate PM tasks. In this study I aimed to investigate PM abilities in pre-school aged children and examine whether these abilities could be improved through the delivery of positive reinforcement. A computer-based Shopping trip simulation game was used where I used PowerPoint slides to show pictures of different local locations and children were asked to remember which shops needed to be stopped at. They then were required to state what items were needed in each location, using a Multiple baseline design with four children aged 2-5 years old. Two separate naturalistic PM tasks were also included in order to remove any bias that may have been found with the laboratory-type task. They included a simple recognition task embedded in the Shopping task and a second task where the children were asked to remind the experimenter to ask for stickers at the conclusion of the initial task. Results from the naturalistic tasks showed ceiling or near ceiling effects across all scores in all participants. The results of the 'Shopping trip' task found a positive effect of reinforcement on PM performance with two of the four participants with no to little effect shown with the remaining two children. Possible reasons for those individual differences occurred are discussed.

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Ethical Considerations.

The Research Committee of the Psychology Department of the University of Waikato granted formal approval for this research. Consent to work with children were given by the children's parents.

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Prospective memory (PM) is defined as a type of memory where an intention or act has to be remembered to be performed in the future, or remembering to remember (McDaniel & Einstein, 2007), such as remembering to buy milk when you are at the shop or remembering to collect something at a particular time. Retrospective memory (RM), in contrast, is concerned with the past (for example, memories of a particular birthday from your childhood) and includes all other types of memory including episodic, semantic and procedural memory. Brandimonte and Passolunghi (1994) state that there are six steps that underscore the fundamental features of PM, which are: establishing an intention, remembering what to do, remembering when the action needs to be performed, remembering to perform the action, performing the action at the appropriate time, and in the appropriate place and manner; and finally, remembering that one has performed the action.

The importance of developing PM abilities in young children.

Trying to gain a deeper understanding of how prospective memory works and how we might be able to improve it is crucial and has both theoretical and practical importance, especially as it is relevant to a child's everyday functioning (Kvavilashvili et al., 2001). An early development of prospective memory is important in that it affects a person's ability to cope successfully in a variety of situations such as at school, at home or in the workforce. The transition of a child being in the "here and now" to adaptively tailoring their behavior in anticipation of what lies ahead is important to healthy development and adaptation throughout the lifespan. (Atance & Jackson, 2009; Kliegel, Matthias & Einstein, 2007; Kvavilashvili et al., 2001).

By the time a child starts school they are required to remember to carry out both self-assigned and teacher-set tasks set in the future, when previously these skills have been most commonly left only to parents or caregivers to initiate (for example, reminding children to brush their teeth, put shoes on and so forth). Helping a child to improve these abilities becomes important for pre-school aged children specifically. Causey and Bjorklund (2014) noted that children who have difficulties with PM performances were more likely to have trouble interacting with their peers, parents and teachers and as such, it is important for current and future research on PM to focus on pre-school aged children and how we might improve their PM abilities. Importantly, Dockett and Perry (2010) also noted that the consensus of research regarding transitions to school agrees that a successful transition has a significant effect on a child's first year of school and in later school achievements, both academically and socially.

Existing literature in PM abilities in other populations.

PM in adulthood.

Multiple studies have stated that anywhere between 50-70% of memory errors made in adulthood can be attributed to prospective memory. (Crovitz & Daniel, 1984; Mateer, Sohlberg, & Crinean, 1987; Terry, 1988). It is not only academic abilities which may be affected by Prospective memory. Mahy, Moses and Kliegel (2014) noted that situations such as forgetting to wear a helmet or forgetting to bring a present to a friend's birthday may have negative consequences for an individual's health and social relationships respectively and scenarios such as needing to take medications at a certain time could have serious implications if not remembered.

Prospective memory also has clinical significance in special populations such as children with ADHD, Autism, or Traumatic brain injuries (Hannon, Adams, Harrington, Fries-Dias, & Gipson, 1995; Shum, Valentine & Cutmore, 1999, Walsh et al., 2014).

PM and Autism.

There is a substantial amount of research in the area of RM and Autism related disorders, however, there is somewhat less in the area of PM and Autism. Much of the conclusions drawn in both RM and PM research are similar in that those who are on the Autistic spectrum show poorer PM performance than those not on the Spectrum (Brandimonte et al, 2011; Williams et al., 2012). These conclusions of impaired performance with those with Autism Spectrum Disorder (ASD) are not the case in every instance however as Atgassen, Kleigel and Koban (2012) investigated event-based PM performance with individuals with ASD and interestingly found no significant differences between the ASD group and the control group in event-based PM performance.

On a similar topic, Baltruschat et al. (2011) investigated the effects of reinforcement on Working memory with three participants who were on the Autism scale using a behavioural task called 'Counting span'. Results showed significant improvements in performance for all participants and these results displayed maintenance and generalization to untrained stimuli and untrained responses.

PM and ADHD.

Previous research has demonstrated prospective memory impairments in children with attention deficit/hyperactivity disorder (ADHD) which largely

focuses on the intention initiation and execution stages (Kliegel, Ropeter, & Mackinlay, 2006). Kerns and Price (2001) investigated whether ADHD did actually have an effect on PM function and found that while prospective memory performance correlated significantly with clinical measures of ADHD (as assessed by the Conners' Parent Rating Scale) Hyperactivity Index, it was unrelated to intellectual ability and although psychometric measures of attention correlated with prospective memory performance in this study, they did not account for the differences in prospective memory that were observed between the ADHD and control groups. Zinke et al. (2010) also investigated the possible link between ADHD and PM performance and found that children with ADHD had fewer correct PM responses than controls and Kliegel et al. (2006) concluded that children with ADHD may demonstrate difficulties forming delayed intentions, and that this may have further implications for the retention and implementation of those delayed intentions.

PM and Traumatic Brain Injuries (TBI).

There have been few studies which investigate the role of reinforcement on the PM performance of those with Traumatic brain injuries (McCauley et al., 2011; Shum, Levin & Chan, 2011; McCauley, McDaniel, Pedroza, Chapman, & Levin, 2009). McCauley et al. (2009) found incentive effects on PM performance in children with traumatic brain injury where both children with mild and severe traumatic brain injury as well as children in the control group (orthopaedic injuries) showed better PM performance in an experimental, non-computerized PM task when incentives were high (dollars), compared to when incentives were low (pennies). However, the severe TBI group's high-motivation condition

performance stayed significantly below the low-motivation condition abilities of the orthopaedic injury group. PM scores were also positively and significantly related to age-at-test, but there were no age-at-injury or time-post-injury effects noted. McCauley et al. (2011) extended these results by finding significant effects for age-at-test, motivation condition, period, and group. They also found that Orthopaedic injuries and moderate TBI groups performed significantly better under the high- than under the low-incentive condition, but the severe TBI group demonstrated no significant improvement. This study involved two levels of monetary incentives being used to improve EB-PM in children ages 7 to 16 years with orthopaedic injuries which were labelled as either moderate or severe Traumatic brain injuries (TBI) at approximately 3 months' post-injury. The EB-PM task used consisted of the child giving a specific verbal response to a verbal cue from the examiner while performing a battery of neuropsychological measures (ongoing task). Results showed that EB-PM could be significantly improved at 3 months' post-injury in children with moderate, but not severe, TBI.

While research on prospective memory has gradually been increasing, especially over the last 25 years, little is still known about this type of memory with children and many inconsistencies are seen across different research studies. (Kvavilashvili et al., 2001). In particular, little is known about pre-school aged children's PM abilities and how to improve them.

Existing literature in PM abilities in young children

Different variables affecting prospective memory have been investigated in previous research including factors such as age, task importance, cue saliency, task interruption and rewards and incentives, however almost all prospective

memory tasks consist of two features: the PM task and an on-going task (OT). The PM task is something the participant needs to remember and the OT fills intervals between presentations of the PM task and gives the task a context (Kvavilashvili et al., 2001). There are also two different types of PM tasks: event-based, which is where an intention is carried out in response to the occurrence of an external event such as remembering to get a particular item while at the supermarket, and time-based tasks, which involve the completion of a task at a designated time, for example, remembering to take medication at 8am every day (Causey & Bjorklund, 2014).

The results of the existing research on prospective memory in pre-school aged children, in regards to age effects, show some inconsistencies. While most show significant age differences across age spans, (Dismukes, 2012; Geurten, Lejeune & Meulemans (2016); Kleigel & Jager (2007); Kliegel et al. 2010), with an improvement shown as age increased across the preschool years (and also throughout later childhood), there are some studies where this difference is not so apparent (Somerville et al., 1983; Wang , Kliegel, Liu , & Yang, 2008). Walsh et al. (2014) argue that these inconsistent findings may be due to a number of variables such as the nature of the task, for example whether it is too difficult or too easy for an individual; the requirements of the ongoing primary task and the characteristics of the contextual cues. In regards to the requirements of the ongoing primary task, it is argued that the more resource demanding, complex, or novel an ongoing task is, the more difficult it becomes for a child to perform. This is also true for when success on the task has a high incentive value, where Walsh et al. (2014) note "children are less likely to notice the PM cue that something else needs to be done than when the task is simple, familiar, less demanding, or

uninteresting" (p. 10). Contextual cues can affect results when the cues are distinctive, specific, novel, and focal to the task. Participants are found to be more likely to attend to a cue if it is routine, general, familiar, and peripheral to the task.

Difficulty of the task or the demand of the task is another variable that has been investigated in PM research. The collective consensus of results has been that with an increase in demand or difficulty, there is a decrease in memory abilities (Kerns, 2000; Marsh & Hicks, 1998; Yang et al., 2011). Another common variable to measure has been the importance of a task (Kliegel et al. 2001; Sommerville et al., 1983; Walter & Meier, 2014), typically done by manipulating the attractiveness of a task or by using social motives. Sommerville et al. (1983) manipulated the attractiveness of tasks and assessed effects on PM abilities by instructing 2, 3 and 4 year olds to remember to either clean dishes or buy candies. Results showed an increase in remembering with the more attractive "buy candy" task which suggests that the attractiveness of a task increased the importance and, as a consequence, the likelihood to remember.

Causey and Bjorklund (2014) and Kliegel et al. (2010) also found that children were more successful in PM tasks when motivation for the task was high. This was particularly true with younger children with significant differences seen between 3-year-old and 5-year-old children in the low interest condition. Sheppard et al. (2015) also noted that PM abilities were improved when the intention to perform the task had high personal relevance to the participant.

Kvavilashvili et al. (2001) used a popular type of task in measuring PM performance in their research where the effects of task interruption and age were studied with children aged 4, 5 and 7 years. To investigate these variables a simple laboratory-based game was created where a series of picture cards (the ongoing

task) were presented and the children were asked to name each item on the cards, then the children had to remember to hide the cards on which there was a picture of an animal (the PM task). Task interruption was manipulated by showing the target pictures either in the middle of the stack of cards or as the last picture in the stack. The aforementioned required the interruption of the ongoing card-naming task in order to hide the target card. Kvavilashvili et al. (2001) found that the children who had the no interruption condition performed with a higher level of accuracy than those who had an interruption in their ongoing task. Kvavilashvili et al.'s (2001) picture card task was similar to one used by Walsh et al. (2014) which is discussed in further detail below.

Walsh, Martin & Courage (2014) study.

Two main objectives were investigated by Walsh et al. (2014) which were to examine the effect of cue specificity on preschool children's PM performance and to examine age effects on both PM and RM components of a PM task. Walsh et al. (2014) examined the PM abilities of 3, 4, and 5 year olds in two different experiments using several naturalistic game-like tasks which varied in the explicitness of the cues for retrieval. The first experiment involved the use of a computer-based "Shopping trip" task where participants were shown photos of different shops using a Powerpoint presentation and were told items that they needed to remember to stop and buy at specific shops. This task was a cued PM task as the child was instructed to retrieve a memory to stop once the focal cue (a target location) was noticed and then to attempt to remember and state aloud what the appropriate action or item to be purchased was. In the 'Shopping trip' task the child was invited into a quiet room and seated in front of the computer next to the experimenter who then states the exact instructions: "I want you to pretend that

we are going on a shopping trip. This is our shopping list [holds up the cue cards]. It's got pictures of stores that we need to stop at on our shopping trip and things that we need to buy or do at each store. First, I will show you everything on the shopping list. Then, you'll see pictures of stores come up one at a time on the computer. Some of the stores will be the ones on our shopping list. If you see a store that was on our list, you have to touch it and say 'Stop!' and then you have to try to remember what we were supposed to buy or do at that store. If you see any stores that were not on our shopping list, you have to let those ones go by and not touch them. Now, let's look at our shopping list" (p. 13). Each card is then presented once and the child is asked to repeat the name of each store and each item. The child is then shown an image of Elmo and is told that Elmo might pop up at some of the locations and that the child should try to catch him as quickly as possible by touching him on the screen.

After the explanation of the initial task, the child was then instructed about the third PM task, *Ask for Stickers*. The experimenter states "When we're all done with the computer game, I want you to remind me to let you to pick out a package of stickers from this drawer. I might forget, so make sure you ask me!" (p. 13). The participant is shown the stickers, and they were replaced in the drawer. The child is then asked if they are ready to begin and reminded of the general instructions of the task and then the Shopping trip task is begun. At the conclusion of the task if the child did not immediately ask for stickers then the following successive cues were used: "Was there anything else I asked you to remember?"; "Was there a prize for you?"; and finally, "Where did I put the stickers?" (p. 13).

The secondary sticker task was included as unlike the initial 'Shopping trip' task, it did not provide any visual cues for retrieval and therefore was seen to be a good indicator of PM abilities. In the second experiment, Walsh et al. (2014) further examined the role of cue specificity in preschoolers' PM with two additional naturalistic tasks, 'Find the Yellow egg' and 'Ask for stickers B' which were similar to the initial sticker task as neither task provided explicit visual cues and further investigated any effects of age and cue specificity on PM performance.

Collectively, results were consistent with existing literature (e.g., Atance & Jackson, 2009; Guajardo & Best, 2000; Kliegel et al., 2010; Kliegel & Jager, 2007; Mahy & Moses, 2011 and Wang et al., 2008) which found that there was a significant age difference with younger children not performing as well as the older children in both the RM (retrieval of the associated item) and PM (noticing a target store) components of the 'shopping trip' task and that performance appeared to follow the same developmental trajectory across the ages examined, however, there were no age differences found in the naturalistic tasks in the study. The results were also consistent with that of McDermott and Knight (2004) in that no child reached near ceiling results and also consistent with those of Guajardo and Best (2000) and Somerville et al. (1983) in finding that there were detrimental effects on the PM tasks following an extended delay, particularly with younger children. It is important to note, however, that there were individual differences in successful task performance such that even some 3-year-olds were able to retrieve a PM intention without explicit cues and after a 24-hr delay.

Reinforcement

The term 'reinforcement' refers to the process of increasing the likelihood of a behaviour recurring by delivering consequences for the target behaviour.

There is evidence that incentives (or positive reinforcement) are effective when using in naturalistic 'real-world' settings with parental prompting, (Guajardo & Best, 2000) and many different examples of consequences being used to alter a person's prospective memory abilities are used globally, such as arranging late fees for overdue library books or fines for not paying bills on time. Reinforcement has also been evaluated in regards to whether it can increase RM abilities (Brown & White, 2005, 2009). It is slightly less obvious however, what impact reinforcement has on PM abilities in a controlled experimental environment.

It has been argued that cognitive events such as memory abilities can not or should not be studied using behavioural techniques as cognitive events are considered private behaviours and therefore cannot be studied outwardly (Baltruschat et al., 2011). However, any act that a person does when interacting with their environment is a behaviour, whether it be observable or private, and therefore, behaviours should respond to change through a variety of processes, for example, learning and motivation (Baltruschat et al., 2011). Baltruschat et al. (2011) examined whether working memory could be affected by a behaviourally based technique (in this instance, positive reinforcement). Participants were three males who were at least six years of age and who all were on the Autism spectrum who displayed well-developed language repertoires such as the ability to understand rules and follow complex instructions. Results showed that positive reinforcement effectively improved central-executive Working Memory abilities, at least as measured by 'Counting Span' tasks in all three participants and also concluded that these results included maintenance and generalization to untrained stimuli and untrained responses. This is useful to note as these results provide further evidence that behavioural intervention procedures may be useful and

suggest that executive functioning and Working memory may be amenable to improvement via basic behavioural procedures, such as prompting and reinforcement, particularly with improving skills in children with ASD. It is also important to consider this concept because, as a behavioural technique, positive reinforcement can be simple to implement and non-intrusive, as well as being one of the most fundamental behavioural techniques in behaviour analysis research (Baltruschat et al., 2011) and as such these techniques can be transferred to other areas, such as PM and subsequently, may help to provide reasonable accounts of accuracy of PM abilities.

The reason for introducing the delivery of reinforcements in my study is that research in this particular area of PM is very limited (Sheppard, Kretschmer, Knispel, Vollert & Altgassen, 2015) and the existing research has produced mixed results. Whilst some studies (e.g. Causey & Bjorklund, 2014; Gonen, 2012; Meacham & Singer, 1977; Somerville et al., 1983) indicate that memory performance can be enhanced by increasing the positive value associated with a PM task, Guajardo and Best (2000) found that receiving rewards for correct responses did not produce higher accuracy, however the children did report afterwards that they were, in fact, helpful and Gabel (2010) found mixed results with their study.

Gabel (2010) investigated the neurological effects that reinforcement or motivational aspects may have on prospective memory abilities and questioned whether there were any reward effects found in PM performance, reflected in an individual's brain system. In the study, three different experiments were conducted to firstly, test the effect of incentives on the behavioural markers of PM. The second experiment involved examining the effects of reward anticipation

in the form of monetary incentives on PM by means of functional magnetic resonance imaging (fMRI) and finally, in experiment 3, the concept of motivational incentives was extended to include incentives of both positive and negative valence. Results showed a somewhat indirect effect of the reward magnitude associated with the PM cues in the performance decline on ongoing trials, in the high reward, compared to the ongoing or baseline condition although, accuracy and response times on the PM cues themselves did not show reward-related effects specifically.

Causey and Bjorklund (2014) investigated the effect of incentives and task motivation in pre-school aged children using either a low- or high-incentive condition, where the children were asked to either remember to ask for stickers (high incentive) or remember to hang a sign on the door (low incentive). Results showed that the majority of the participants remembered to get a sticker but forgot to remind the experimenter to change the sign on the door. Participants required few, if any, cues to successfully complete the high incentive task, therefore Causey and Bjorklund (2014) argue that preschool children are also competent to carry out a delayed intention so long as they are motivated to do so.

Meacham and Singer (1977), who were the first to link motivation to prospective remembering, also argued that the promise of reward produced not just an increase in accuracy in their study, but also with the importance that the participants assigned to the task. Meacham and Singer (1977) asked participants to post postcards on specific dates and half of the students were offered a 10% chance to win \$5 each, while the other half received nothing. Participants in the high incentive condition mailed cards fewer days late and remembered more often than the students in the low incentive condition.

In contrast, Somerville et al., (1983) asked children aged 2, 3 and 4 years old to remind their parent or caregiver to perform different tasks, either with high (buying candy at the shop) or low (bringing in the washing) interest to the children and with either a short or long time delay. The study showed mixed results concerning the importance of reinforcement with the research not showing any significant indicators of effects of incentive or external cues enhancing performance on prospective memory tasks, however there was a small increase in PM accuracy in the high-motivation condition.

Half of the children in each age group in Guajardo and Best's (2000) study were asked to select a reward (e.g., goldfish crackers, pennies, fruit chews) that they would be given after each correct response in the computer task and the other half did not. Interestingly, neither the 3 or 5 year old children were significantly influenced by the presence of reinforcement even though the participants did later report them as positively influencing their PM abilities and performance. Although the children chose their own incentives, it could be argued that the rewards offered may have not motivating enough (had enough desirability) and therefore the children did not show an increase in PM performance. Guajardo and Best (2000) also suggested that incentives may be more effective when the task is more challenging.

In one of few studies to focus on the effects of promised extrinsic rewards on younger children (the first being that by Guajardo & Best, 2000), Sheppard et al. (2015) found a positive effect of the promise of reward on prospective memory performance across all age groups in their study. They argue that by providing a more desirable motivating incentive (a surprise from the

"exciting prize box") they were able to contradict the previous findings by Guajardo and Best (2000), and further extend the literature in this particular area.

Kliegel, Brandenberger and Aberle (2010) also used the motivational concept of a 'surprise box' to examine the effects of motivation on preschool-aged children's PM abilities. They did this by asking the children in the high motivation condition to remind the experimenter to give them a present out of a "magic box" after finishing the set task. In the low-motivation condition, the children were asked to remind the experimenter to write down their name on the front of the documents of the next task after finishing the first task. The results showed no difference between the 3 and 5 year old groups in the high motivation condition, however, in the low motivation condition, there was a reduction in performance with the 3 year old participants.

This specific notion of using extrinsic rewards to increase prospective memory performance is of great significance in real-world settings as it could easily be employed as a tool to help remembering in everyday tasks in many different settings, such as schools, and administered by many different people such as teachers, parents or specialty workers.

My Study

I used a version of the Walsh et al. (2014) 'Shopping Trip' task as not only did it use familiar locations and common everyday activities to simulate real-life, which would be easy for the children to understand and interpret, it also was age appropriate using simple pictures and familiar characters (i.e. 'Elmo' from Sesame Street). Walsh et al. (2014) also notes that as the shopping trip task requires the child to both stop in response to a picture and recall an item, that it may provide estimates of both PM abilities (noticing the target store) and RM

components in PM (retrieval of associated item from memory/what item or task is required in each location). The two concepts of the noticing and search components were first noted in Einstein and McDaniel's (1996) multiprocess framework where it was also stated that the relative weights of each were dependent on the specific task characteristics and Walsh et al. (2014), found that the two components appeared to develop in parallel across ages and that there may have been independent (and/or shared) neural processes underlying them that would also change with age. These concepts may then be useful to consider when attempting to understand prospective memory and how we might improve these abilities.

The 'Catch Elmo' component of this task uses the same principle as the task of counting bicycles and strollers in the similar earlier study by McDermott and Knight (2004) which would have been too difficult for pre-school-aged children as it would place too much of a load on their working memory at such a young age and may therefore end up affecting their PM performance results. The Elmo image provides an enjoyable and attention-grabbing distraction to the on-going shopping task, similar to distractions which may occur in real life. The sticker task differs to the Shopping and Elmo tasks as unlike those, it is not explicitly cued and although not particularly difficult for the child, it requires a self-initiated search of memory for the intended action following a delay (shopping task). Guajardo and Best (2000) found more accurate performance for 3 year olds on a naturalistic sticker task compared to more difficult tasks and therefore may also be useful in this study. Yang et al. (2011) argue that to capture the development of PM extensively and effectively, it is important to include more than one PM task as PM abilities are affected greatly by task manipulations and

test settings. It is also very important to not make the PM tasks either too easy nor too difficult for the specific children to be tested as this could compromise the results of true PM abilities as if it is too hard then the child would be allocating their attentional resources elsewhere and if the task is too easy, then ceiling effects could become an issue.

Experimental design.

As the ability to complete a task at a designated time (time-based PM task) reportedly does not develop until middle childhood (Kliegel, Ropeter & Mackinlay, 2006) I chose to use an event-based task in this instance and a within-subjects design was used. I included both a naturalistic task and a structured computer task to counter the potential artificiality of the computer based 'shopping task' (Guajardo & best, 2000). I used a multiple-baseline design where the performance of the participants was measured repeatedly both before and after introducing reinforcers or a reinforcement condition. Once performance in the baseline phase is stable, the second phase is introduced to one individual at a time, in a staggered design. This assists the demonstration of internal validity by demonstrating that any effects are due to the treatment or second phase, rather than to a chance factor (Kazdin & Kopel, 2006). This design was used as it allows an assessment of learning and practise effects. The multiple-baseline design also has many other advantages such as the fact that it does not involve removing someone from a possible effective treatment or intervention or from being in a no-treatment control group. Additionally, because each participant is used as their own control, inter-subject variability may be avoided and also, through repeated measures, the stability of the behaviour over time may be assessed (Butler et al., 2011). In psychological research in general, and prospective memory tasks

specifically (Guajardo & Best, 2000; Somerville et al., 1983), between-group designs tend to be used, however, because I am working with a small number of participants and the dependent variable is not expected to return to baseline after treatment, a within-subjects design was chosen where an individual's progress is measured only against themselves

Aim of study.

It is clear in the existing research that there is a lack of consistency and a general lack of research investigating the efficacy of reinforcement on PM abilities in young children and a lack of research generally on the PM abilities of young children.

As has been noted, developing PM skills is of high importance particularly to those at the age where they are beginning the transition from pre-school to school and therefore in this study I aim to investigate firstly the initial naturally occurring PM abilities in the children in this study to see if these memory skills are apparent at pre-school age. Secondly, I plan to introduce reinforcers to see whether PM performance can be improved with reinforcement as, if this is the case, then this could help children who may be experiencing difficulty in this area at school and may result in less negative behaviours noted to occur later in life when there are earlier difficulties with an individual's PM abilities.

Another aim is to investigate whether the 'Shopping trip' task is at the right level of difficulty for children who are pre-school aged (specifically between the ages of 2 and 5 years old) which will be assessed through the children's baseline performance.

Method

Participants

The participants were four female children currently enrolled at a local Playcentre in a North Island New Zealand town. Participants 1 to 4 were 3.5, 5, 3 and 5 years old. All children were enrolled on different days so sessions were conducted on days and times that were suitable to each participant. Participant 1 and 2 were the first pair of children to begin the study, followed by Participants 3 and 4.

I first emailed the Playcentre President and asked permission to attend a centre meeting where I could approach the parents to which she obliged. I then held a meeting with all parents during session time and handed out the information sheet (Appendix A). I asked parents whether they would like to participate and gave them time to consider their involvement before I visited the centre again a few days later to confirm whether consent was given. Some parents had questions at this stage to which I gave them answers and consent was given for the four children who were the appropriate age to participate. The appropriate age for my study was considered to be once clear verbal behaviour was identified, such as being able to speak in sentences and able to respond to simple questions. As such I limited the ages to between 2.5 years and 5.5 years (when the children would no longer be attending Playcentre). The participants were not offered any monetary rewards for participation.

Apparatus/Materials.**Location.**

The study was conducted at a local Playcentre which is open Monday, Wednesday and Friday 9-12am. I did the testing in the office, which is situated off the kitchen area inside the Play centre. It has enough space for the child, myself and a caregiver to be seated and has a closable door to ensure a quiet and private work area to help focus and concentration. A photo of the layout of the office can be seen in Appendix B

Technology.

There were 18 images shown in a computer slide show using a (computer size and type) using a standard slide-show program. Images were shown for 5 secs at a time.

Stickers.

Various sheets of stickers were available to offer the child after the initial experiment. After they were shown to the child at the beginning of the experiment, they were placed inside a brown paper bag and placed beside the computer screen, out of direct view of the child for the remainder of the computer task. The sticker packs were \$1.00 each and purchased from the Dollar Store.

Puzzle.

A simple wooden puzzle obtained from the Play centre was used in each of the sessions, as the distraction task. The puzzle was placed to the right of the

computer screen until it was given to the child to complete, then once complete it was put out of view for remainder of the session so to not distract the child.

Flashcards/Photos.

Before the electronic trial began, the child was shown eight locations situated in their home town on 9-cm cue cards and told the place names in order to ensure familiarity. A set of flash cards were also shown to the child as an example. Copies of these pictures can be found in Appendix C.

Data sheets.

Data sheets were used to record responses for the Shopping task and the Preference assessment (see Appendix D).

Reinforcements.

Table 1 Shows reinforcement used for each child which were determined by conducting a MSWO (multiple stimulus without replacement) preference assessment with each participant.

Table 1. Reinforcement options for MSWO for Participants 1, 2, 3 and 4.

| | | | | | |
|---------------|------------|---------------|-------------------|---------|--------------|
| Participant 1 | Jellybeans | Potato Crisps | Dried Cranberries | Peanuts | Marshmallows |
| Participant 2 | M&Ms | Potato Crisps | Chocolate Raisins | Cashews | Marshmallows |
| Participant 3 | Jellybeans | Potato Crisps | Dried Cranberries | Cookies | Marshmallows |
| Participant 4 | Jellybeans | Potato Crisps | Raisins | Cookies | Marshmallows |

Procedure

After obtaining verbal consent from the parent or caregiver, I approached the child during Play centre sessions and invited them to enter testing room to start task. I invited the parent or caregiver also. The written consent form was then given and when accepted by both parent and child the test proceeded. The parent could either leave room or sit away from the child during the procedure. The consent form was only given in the initial meeting with the child and parent.

The shopping task is based on research by Walsh et al. (2014), where photos of familiar buildings are used to go on a fictional 'shopping trip' with the child.

I greeted the child and told them that this is a memory-based 'Shopping' game. The child was shown 12 photos on flashcards (referred to as targets) of familiar buildings situated in their home town and items or actions needed from those stores. I labelled each location and the item or action and asked the participant to repeat these back in order to assure comprehension.

I then told the child that when these shop photos are presented they should touch the screen or say "Stop!" and try to remember what item or action is needed from that particular place. The exact instructions were "I want you to pretend we are going on a shopping trip. This is our shopping list here (hold up cue cards). On the computer, you'll see pictures of places come up one at a time. If you see a place that was on our shopping list, you have to touch it or say 'Stop!' and then you have to try to remember what we were supposed to buy or do there. If you see any places that were not on our shopping list, you have to let those ones go by and not touch them."

I presented a picture of Elmo (a TV character from Sesame Street, familiar to most young children) and told the child that if Elmo pops up in any picture then the child should “try to catch him” by touching him as quickly as they can. If he was 'caught' then the child was praised, “Good job catching Elmo!”. Elmo was placed on four different randomized non-target photos, all at least one card apart.

I then asked the child to remind me to give them some stickers once the task was completed. (Stickers were already placed in an envelope on the desk.) I said “When we’re all done with the computer game, I want you to remind me to let you to pick out a pack of stickers from this envelope. I might forget, so make sure you ask me!” I showed the child the stickers, and then the envelope was put next to the computer.

Before the child arrived, I placed a simple wooden puzzle that was mixed up to the side of the desk and asked, “Can you help me by doing this unfinished puzzle while I finish filling out your name before we begin the game. It got all mixed up while I was out of the room”. Once the child had started the puzzle I gave them approximately 30s to complete it before thanking the child and stating that they were now ready to begin. The puzzle acted as a distractor task for the child.

Once the child was reminded of the instructions and one practice card was given, the shopping task was conducted.

After all slides were shown I gave the child 30s to ask for stickers before I gave a prompt, such as “Was there anything I asked you to remember?” If the child still did not ask, I gave a second, more specific verbal prompt, “Was there a

prize for you? (What was it?)”. If the child still did not respond correctly then I gave a final prompt, “Where did I hide the stickers?”

Each session took approximately 10 min and contained a randomised presentation of 24 photographs (12 targets and 12 foils), drawn from a larger collection of different photos so that no two sessions were exactly the same.

As the second pair of participants was both on the lowest and highest ends of the age thresholds (3 and 5 years old respectively) I altered the number of trials for each to better match their abilities. I reduced the number of trials to 18 (8 targets) for Participant 3 and increased the number of trials to 30 (16 targets) for Participant 4. I performed a pilot test to see whether these trial numbers were suitable and both participants achieved 66% accuracy and therefore I decided to continue with these numbers for the remainder of their experimental phase.

I used a multiple baseline design where the first pair of participants took part in the initial procedure once a week until a stable baseline could be established and then the second condition was introduced for one participant and repeated until results became stable and then alternated with the other child. While one child was on the second condition, the other was kept on baseline. Refer to the table below (Table 1).

This design was then repeated for the other pair of participants.

When the second condition was introduced, reinforcers were delivered when correct responses were given. In order to ensure motivation was high to obtain the reinforcers, a preference assessment was conducted with each child before the condition began. In this case, I used a MSWO procedure. The MSWO procedure was chosen because it is easy to understand and to interpret and is efficient. I also talked with the parents before the preference assessment to see if

there is anything I need to know in regards to possible options of reinforcers, such as cultural considerations, allergies and so forth. Food items were chosen as reinforcers as they are quick to deliver and readily available.

MSWO procedure.

In each of the MSWO procedures, five different desirable foods were presented in front of the child, whilst the child was sitting at a table. All items were placed at relatively equal spaces apart and at a similar distance from the child. The child then chose their preferred item each of four times until all items had been chosen. The order of items was then changed until all possible presentation orders had been shown. Results of each participant were recorded on MSWO data sheets (Appendix C).

Multiple Baseline Design.

In this experiment there were two different conditions in which each child was tested, (three for Participants 1 and 2 including the Pilot sessions); Baseline and Reinforcement. Table 2 below shows the list of participants and whether they were on Baseline or Reinforcement phase on each of the 12 weeks of the experiment. Baseline is labelled B and Reinforcement phase is labelled R. The Pilot study phase with Participant 1 and 2 is labelled P.

Table 2. Baseline and Reinforcement phases shown for each week for all Participants.

| | Wk1 | Wk2 | Wk3 | Wk4 | Wk5 | Wk6 | Wk7 | Wk8 | Wk9 | Wk10 | Wk11 | Wk12 |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| P1 | P | P | P | B | B | B | B | B | B | R | R | R |
| P2 | P | P | P | B | B | B | R | R | R | R | R | R |
| P3 | B | B | B | R | R | R | R | R | R | | | |
| P4 | B | B | B | B | B | B | R | R | R | | | |

Review of Procedure.

After three sessions with the initial pair of participants, the results were approaching near ceiling. This could have been because the task was too easy or because the task was already too motivating for the participants. I decided to increase the number of trials from 18 to 24 to increase difficulty in order to remove ceiling effects with as little change to the task as possible. This change appeared to make a difference in performance levels with a small reduction in accuracy shown by both participants.

Data Analysis

Responses were recorded each week on data sheets (shown in appendix D) under four possible categories: Hit (correctly stops and states item/activity), Correct rejection (correctly passes a location not needed to stop at), False Alarm (stopping at an incorrect location), Miss (passing a correct location) and Incorrect Item (correctly stopping at location but stating wrong item/task). Results of the sticker and Elmo task were also both recorded on the data sheet with the sticker task being marked with a pass or fail and what prompt was used, if needed, and a simple tick showed whether each of the four Elmo images were 'caught'.

A measure of accuracy of the participants' performance was conducted by converting correct responses into a percentage correct and was plotted on graphs over time to see whether performance was improving and whether the reinforcement phase had any effects.

Results

Figure 1 illustrates the percentage of correct responses for each of the four children who participated. The scores are shown across the 9 weeks in which the study was conducted and in the case of the first two participants, there were 12 weeks including the three pilot sessions. The pilot stage, baseline phase and reinforcement phase are shown in order of occurrence and differentiated by different symbols. The pilot phase is denoted by diamond symbols, the Baseline phase by squares and Reinforcement phases by triangles.

Participants 1 and 2 were the first pair of participants to begin the study and Participants 3 and 4 were the second pair, beginning trials 8 weeks after the initial pair of children. Participant 1 and 4's scores showed a slight incline during the baseline phase. Baseline results with Participant 2 showed a slight decline however, and Participant 3's baseline scores remained stable.

The scores in the 'Shopping trip' task were recorded as correct if they were a Hit (correctly stops and states item/activity) or a Correct Rejection (correctly passes a location not needed to stop at) and as an incorrect response if one of the other response options were reported (either False Alarm, Miss or Incorrect Item). Table 2 shows the total number of Hits and Correct Rejection responses from each participant out of the possible number able to be acquired, across the entire study.

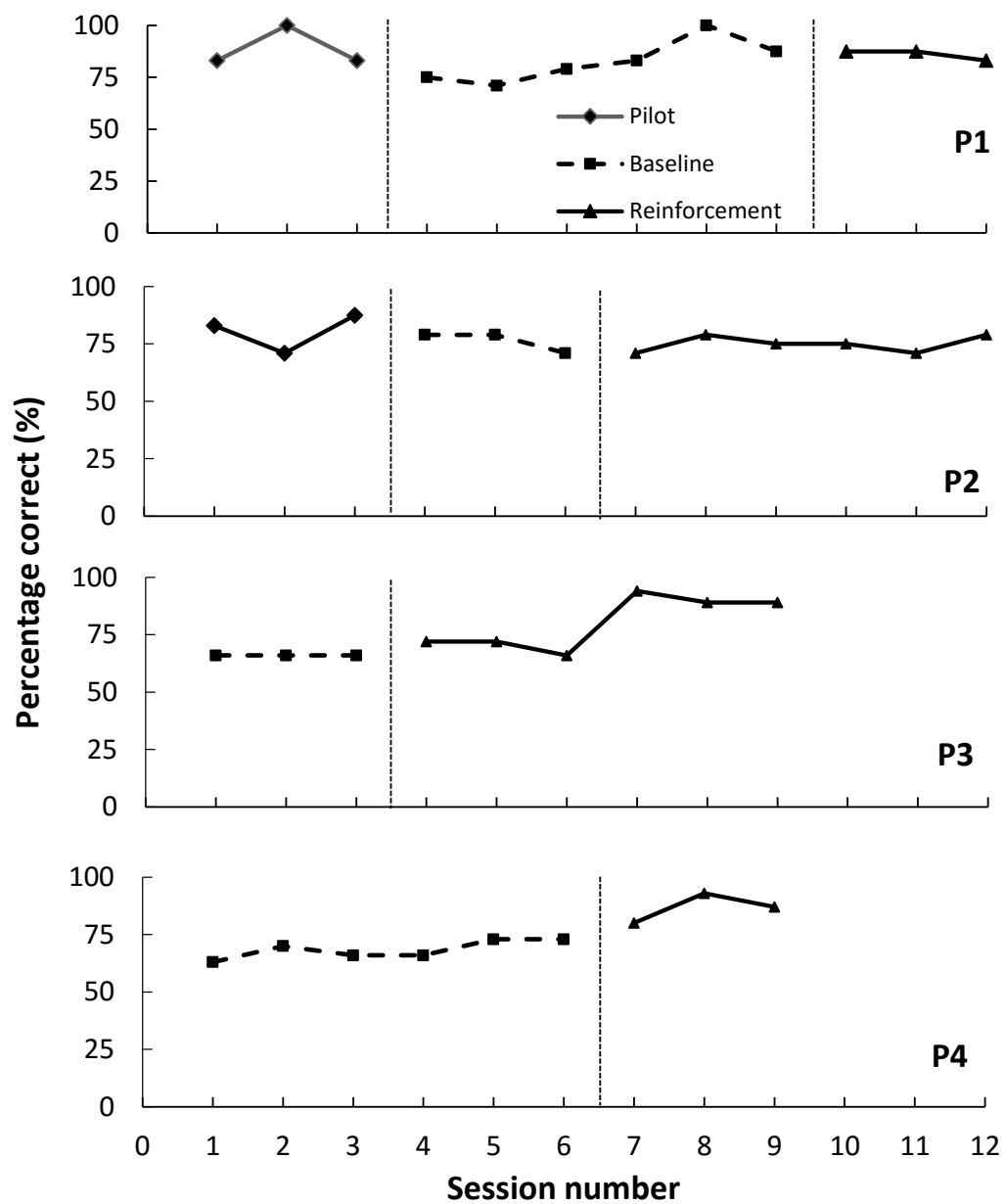


Figure 1. Percentage correct across all sessions for P1 (top panel) to P4 (bottom panel), where diamonds indicate pilot sessions, squares indicate baseline sessions, and triangles reinforcement sessions.

Table 3

Total percentage of Hits and Correct Rejection Responses from Each Participant

| Participant | Hits | Correct Rejections |
|-------------|------|--------------------|
| 1 | 78 | 82 |
| 2 | 56 | 94 |
| 3 | 56 | 92 |
| 4 | 54 | 98 |

Table 3 shows that the majority of the correct responses recorded in this study by all four Participants, were Correct Rejections, rather than Hits.

Participant 2, 3 and 4 correctly “hit” in approximately half of available responses and Participant 1 had just correctly chose ‘Hit’ at least 78% of the time. The Correct Rejection rate recorded by Participants 2, 3 and 4 were all in the 90th percentile. While Participant 1 had a slightly higher success rate in the ‘Hits’ category, her ‘Correct rejection’ rate was slightly less lower than the other participants with 82% of locations for which no response was required being correctly ignored.

Participant 1.

Participant 1 obtained scores of 83%, 100% and 83% consecutively in the three pilot tests which was too high to show any subsequent changes in scores and therefore task difficulty was increased. Participant 1’s initial percentage correct score after the pilot tests were conducted was 75% and the following scores achieved in the baseline phase ranged between 71-100%. After reinforcers were introduced in Week 10, results became more stable with a smaller range of 83-87.5% obtained, however no real effects of reinforcement were seen. In the baseline condition there was a general upward trend, however, this effect seemed to cease once the reinforcement condition was introduced. It can be noted though, that the scores achieved in the reinforcement condition were higher than at least two thirds of the baseline scores so while no effect was sighted, perhaps there was a slight effect on this child's scores.

Participant 2.

Participant 2’s pilot tests scores were 83%, 71% and 87.5% which were also considered too high to show any possible future effects and so task difficulty

was increased as well. Participant 2 had an initial score of 79% after pilot studies were completed and subsequent scores ranged between 71-79%. After reinforcers were introduced in week 7, scores remained between 71-79% with no effect of reinforcement shown. After the pilot tests, all scores remain almost completely stable throughout both conditions therefore showing no effect of reinforcement on this individual's PM performance.

Participant 3.

Participant 3's baseline results were stable with a score of 66% correct being consistently achieved for the first three sessions. When the reinforcement phase was introduced in week 4, percentages correct ranged between 72-94% with a generally upward slope showing week to week, with the exception of week 6 where a slight decline was noted. There was a noticeable jump in success rates in week 4 of the reinforcement phase, with the improvement in performance maintained across subsequent sessions.

Participant 4.

Participant 4's baseline scores ranged from 63-73% and remained relatively stable throughout the first 6 sessions. When reinforcements were introduced in week 7, an increase was apparent with percentages increasing to 80, 93 and 87% respectively, showing an effect of reinforcement on PM abilities on this task. Although a slight incline was seen in the baseline condition, suggesting a natural improvement in PM abilities with this child, it could still be argued that the introduction of the reinforcement phase did have a positive effect as the second phase led to a higher percentage correct scores which continued to increase across sessions.

Some apparent changes were shown in Participant 3 and 4's scores when reinforcers were delivered however there were no positive effects on Participant 1 and 2's performance and while percentage scores did seem to become more stable after the reinforcement phase had been introduced with the first two participants, this does not suggest a relationship between the delivery of reinforcers and prospective memory abilities with Participant 1 and 2.

'Catch Elmo' task.

Participants 1, 2 and 4 achieved ceiling performance in this task with all three children getting 100% correct responses in every trial and within every experimental session. Participant 3 missed one Elmo representation each during both the first and second sessions. As the youngest child of the four, Participant 3 may have been at an age disadvantage, however, by the end of Session 2, she had started to obtain the same scores as the other children which was 100% accuracy on every instance of the task. All children were familiar with the character Elmo and behaved as though they were highly motivated and excited to 'catch Elmo' when the image appeared.

Sticker task. In the sticker task I instructed the child to remind me to give them stickers from a bag placed beside the computer, following the completion of the shopping trip task. If the child did not perform this action independently, then a hierarchy of prompts were delivered until the child was successful in the task. Prompt level 1 involved asking the child "Was there anything I asked you to remember?" Prompt level 2 was asking "Was there a prize for you? What was it??" and Prompt level 3 was "Where did I hide the stickers?" Table 3 shows how many prompts of each type each participant required throughout the experiment. Participant 1 required no prompts throughout the

entire experiment. Participants 2 and 4 showed similar results to each other with the majority of their scores needing no prompt but with a few sessions needing Level 1 prompting. Participant 3 was the only child to require Level 2 prompting on one session. The majority of the sessions conducted, however, did not require any prompting for Participant 3. There was no requirement to prompt at Level 3 with any of the children on any day. Table 4 shows prompts used by each participant.

Table 4.
Level of Prompts Used by Each Participant.

| | No prompt | Prompt level 1 | Prompt level 2 | Prompt level 3 |
|---------------|-----------|----------------|----------------|----------------|
| Participant 1 | 12 | 0 | 0 | 0 |
| Participant 2 | 7 | 5 | 0 | 0 |
| Participant 3 | 5 | 3 | 1 | 0 |
| Participant 4 | 7 | 2 | 0 | 0 |

As also measured by Walsh et al. (2014), I measured estimates of both PM abilities and RM components of PM in order to gain a more extensive insight into the children's PM abilities. The two components are shown in Table 4 with PM abilities (noticing a target store) being determined by the percentage number of both correctly recorded 'Hits' and 'Incorrect Items' achieved by each participant throughout the study. The RM components in PM (retrieval of

associated item from memory/what item or task is required in each location) is determined by the percentage number of ‘Hits’ alone.

Table 5.

Total Percentage of PM abilities and RM components of PM as determined by Total percentage correct of Hits vs. Incorrect Items + Hits

| Participant | RM | PM |
|-------------|-----|-----|
| 1 | 78% | 93% |
| 2 | 56% | 71% |
| 3 | 56% | 75% |
| 4 | 54% | 71% |

What the results of this analysis show is that when RM components of PM are included in the final results, this gives a much higher accuracy rate of PM performance for all four children tested. When analysing the two components separately, the PM component of simply remembering what location to stop at, produced a larger percentage correct than the RM component of needing to remember the exact task that needed to be performed at the specific location.

Summary of results

After the original presentation of the experiment was used over 3 weeks with the first pair of participants, results were too accurate and scores were at risk of reaching ceiling effects which would have made it too difficult to establish any effects of reinforcement so a decision was made to increase difficulty of the task by increasing target numbers. These numbers were altered again with the second pair of participants to attempt to counter any age effects, which involved increasing target numbers to 16 for Participant 4 and decreasing them to 8 for Participant 3, which was effective. All children participated in the experiment for 9 weeks and apart from an occasional deviation, scores for all participants either

remained relatively stable or improved over that time period. The majority of the results show that offering positive reinforcement can have a positive, albeit small at times, effect on normally developing pre-school aged children's PM abilities. The results of the two naturalistic tasks show that PM abilities are apparent in children in this age group and can be improved with repeated exposure over time as was seen with the 'Catch Elmo' task with Participant 3.

Discussion

In this study, I aimed to extend the existing research on PM with pre-school children by introducing a reinforcer condition where children were given a desired food immediately after each correct response of a target location using a Multiple baseline design. My main goal was to establish whether the delivery of reinforcers would improve PM performance of the young children tested. I was also interested in seeing the capacity of PM abilities already apparent in pre-school-aged children and to test whether the tasks used in my study were age and situation- appropriate.

The main finding of the 'Shopping trip' task was that there was a mixed result produced with half of the participants showing a positive effect on accuracy when reinforcers were introduced while the other half of participants did not. All four children tested did show an adequate level of existing PM abilities, and in some instances a slight incline was also noted, as shown by their baseline scores of the 'Shopping trip' task and also through the ceiling effects shown in the two naturalistic tasks conducted. The increase in baseline performance may indicate that PM abilities in pre-school-aged children will improve on their own, simply with repeated exposures. If this is the case, it would be meaningful to consider in

real-world applications such as educational settings where these techniques could be implemented to support children.

Results of the 'Shopping trip' task in this study were in line with other relevant studies in this area (Gabel, 2010; Guajardo & Best, 2000), in that it too found mixed results. While a positive effect was found with two of the participants between the delivery of reinforcements and PM performance, which is similar to findings of other studies (such as Causey & Bjorklund, 2014; Gonen, 2012; Meacham & Singer, 1977; Sheppard et al., 2015), with Meacham and Singer (1977) also finding a link not only between reinforcement and PM performance, but also with task importance and Sheppard et al. (2015) finding a positive effect of reinforcement across all ages group that were tested. The positive results found with two of the participants in my study were not apparent in the other two children however, which is more indicative of the results attained from the aforementioned studies by Gabel (2010) and Guajardo and Best (2000). It is also important to consider the results obtained by Somerville et al. (1983) where mixed results were also seen when there were no significant indicators of effects of incentive or external cues enhancing performance on prospective memory tasks, however there was a small increase in the high-motivation condition. Individual differences were found among the participants in this study with some performing much higher or lower than those of the same or similar ages and some children's results showing some inconsistencies across different weeks which was also reported in similar studies, with Walsh et al. (2014) also finding individual differences among the participants in their study. It is important to note however, that in my study, the abilities of each child were not directly compared with one

another and therefore it is not possible to completely compare achievement across the children tested.

In regards to the two naturalistic tasks, the 'Catch Elmo' task also yielded similar results to tests by McDermott and Knight (2004) and Walsh et al. (2014) in that there was an almost 100% accuracy rate across all four participants. The 'Ask for stickers' task also produced a very high level of accuracy in its' results across all children, with no participant at any point needing more than a level 2 prompt, and in most cases needing no prompt at all, to successfully complete the task. These results may have occurred because these tasks are too easy for children of the ages tested in my study, just as the initial 'Shopping trip' task pilot test results proposed. The two naturalistic tasks might therefore need to be revised in order to make them more difficult if they are intended for future use in measuring PM abilities. This could be done in the 'Ask for stickers' task by replacing the stickers with something less motivating for the children such as reminding the experimenter to perform a neutral task such as turning a sign on the door.

The results founded also showed similarities to those found by Walsh et al. (2014) in that there were no age differences found in the naturalistic tasks in the study and also similar to those of Guajardo and Best (2000) who found that there was a higher performance rate for 3 year olds on their sticker task compared to the more difficult tasks which is also applicable in this study.

The two different components of PM abilities were also analysed in the results. The total percentage of correct 'Hits' alone was determined as the RM component of PM where the child remembered not only what locations to stop at but also what item or action was required at each image. The total percentages of correct 'Hits' and 'Incorrect Items' combined were considered the PM abilities of

simply remembering when to stop at a correct location. There was an increase in percentage correct scores noted across all participants in their PM abilities generally compared to the RM components of PM analysed alone. By analysing both of these components, it helps to give a wider view of the participants PM abilities.

This study adds to the existing information known about PM abilities in pre-school-aged children by showing firstly, that children at this young age have already developed some competencies in this area of memory and secondly, that, with at least half of the children tested, that reinforcement can have a positive effect on an child's PM performance.

Limitations.

Ceiling effects.

There was an issue with the first pair of participants tested reaching results initially that were considered too accurate, so in an attempt to counteract this, the number of targets were extended in order to increase difficulty of the shopping task. This appeared to work with results immediately decreasing to a slightly lower performance result, however lowering the performance results even further would have perhaps given more room for the reinforcers to improve performance. Similar issues were also found with Kliegel and Einstein (2015) and Mahy and Moses (2011) where they encountered ceiling effects as the young children they were working with were “too motivated” and “excited” with the PM task required of them. To counter the excitement Kliegel and Einstein (2015) replaced the original task with another more arbitrary task however performance levels were still unacceptably high so they modified the task further by making it more difficult and only by doing both of these things did they successfully remove

the ceiling effects. Kvavilashvili et al. (2007) attest that it is especially difficult to design suitable tests that avoid ceiling effects and at the same time preserve sensitivity to detect subtle developmental changes, specifically in developmental PM research. The ceiling effects found in my study relate back to one of the initial aims of this research which was to examine whether the 'Shopping trip' task would be a suitable measure of PM abilities in pre-school-aged children. While it provided an accurate measure of the participants PM abilities, the original task used in this study was obviously too easy for the participants to perform and therefore did not leave enough room to show any improvements that the delivery of reinforcements. Even after adjusting the number of tasks for each participant to attempt to counteract these effects, correct responses were very high. The option of lowering the age of the participants was not possible in my study as, because the youngest child was 2.5 years old, any younger than that then we would have encountered verbal communication difficulties such as not being able to speak in full clear sentences or fully comprehend what is required of them.

Individual differences.

There are many different theories to explain why individual differences may occur in research, particularly when examining PM abilities. Yang et al. (2011) found that both IQ and levels of inhibition were correlated with PM performance scores and argue that therefore general cognitive ability may serve as a basis for planning and successful completion of PM tasks. Personality traits have also been reported as having a possible effect on PM competency, with Searleman (1996) stating that 'Type A personalities' (people who display high time urgency and a high need to complete tasks) showed enhanced PM abilities in interpersonal PM tasks and PM tasks that were of personal importance to

themselves. However, performance on a task that was neither interpersonal nor of personal interest was not related to differences in personality. Cutler and Graf (2007) also noted personality traits as possibly contributing to individual differences in PM scores among individuals, finding that the personality dimensions of conscientiousness and neuroticism predicted performance on two or one of the naturalistic PM tasks, respectively in their study. It was also reported that PM failures and self-reports of PM failures were associated with indicators of obsessive-compulsive disorder (OCD), in sub-clinical compulsive checkers in laboratory PM assessments. McDaniel and Einstein (2000) found people who were recorded as having high levels of conscientiousness and compulsivity were thought to exhibit generally higher PM performance, but even more so when monitoring demands are high. When demands were low however, those dimensions may make the individual more likely to adjust their strategy and employ monitoring techniques. There may also be biological reasons for individual differences, for example, Kerns (2000) stated that prospective memory is dependent, at least somewhat, on skills such as initiation, anticipation, temporal monitoring and self-monitoring and said to rely on the frontal systems of the brain. One or many of these different theories to explain individual differences could possibly be applied to the participants in my study who did not show a positive effect of reinforcement on their PM abilities and also throughout their baseline condition, however, further examination would be needed to further investigate this.

Motivation issues with Reinforcement.

In the cases where no effect of reinforcement on PM abilities was found there could have been an issue with the type or delivery of reinforcement. Sheppard et al. (2015) argue that the same mixed results that were found in Guajardo and Best's (2000) study were perhaps because of the fact that the reinforcers were simply not desirable or motivating enough to cause an effect. In my study, the same could be argued, however, a MSWO preference assessment was performed with each child after a discussion with the individual and their parent to discuss food options, so this should have not been a problem. It was also apparent that the children were excited about the concept of receiving the reinforcers and ate them eagerly as they were delivered.

In the study by Kliegel et al. (2010), in which they used the same reinforcers as Sheppard et al. (2015), they also state that the process of manipulating motivation could be a factor in how effective it is. In order to measure PM performance and the influence of motivation in this study, they used the motivational concept of a 'surprise box' where they asked the children in the high motivation condition to remind the experimenter to give them a present out of a "magic box" after finishing the set task. Results showed no difference between the 3 and 5 year old groups in the high motivation condition. Interestingly, in the low motivation condition however, there was a reduction in performance with the 3 year old participants but not with the 5 year old participants. This suggests that motivation may have a more profound effect on those in a younger age-group compared with older children. This conclusion from the Kliegel et al. (2010) study helps to argue the concept that in order for reinforcements to have a significant effect on PM performance in pre-school aged

children, the reinforcers themselves need to be extremely motivating for the individual.

Guajardo and Best (2000) externally rewarded correct performance in a computer-based task that may be seen as rather neutral, whereas Sheppard et al. (2015) directly asked children to remember to execute an action that itself was internally more or less motivating. As my study used the same computerized technique as Guajardo and Best (2000) it could be argued that the computer task in this study was also seen as too neutral, however as evidenced by the high accuracy scores in the baseline condition of my study, this is most probably not the case here.

What could be of relevance in this specific study is the concepts of extrinsic and intrinsic motivation which could be interesting to consider in evaluating the individual differences and lack of effects of reinforcement on some of the participants, found in this study. Extrinsic motivation is defined as when we are motivated to perform a behaviour in order to earn a reward or avoid punishment, while intrinsic motivation can be described as engaging in a behaviour because it is internally rewarding, or, at least, the rewards are not outwardly obvious (Ryan & Deci, 2000). For example, doing something because you enjoy it rather than doing it for any external rewards. The participants who were positively influenced by the introduction of reinforcers were perhaps more extrinsically motivated and therefore performed with higher accuracy when they were rewarded. Conversely, the other two participants could have been more intrinsically motivated and therefore their results would not have been as affected by the reinforcers. The concept of the two different types of motivation may be a useful variable to consider with any further research conducted in the area of PM abilities and reinforcement as the differences between these two types of

motivation may explain why there are so many individual inconsistencies found, not just in this specific study, but also in other similar studies of this type. Intrinsic motivation may be determined prior to PM testing in future studies by using some form of Psychological questionnaire or scales such as the Academic Motivation Scale (Vallerand, Pelletier, Blais, Briere, Senecal & Vallieres, 1992)

Conclusion/Future considerations.

The results of this study shows some promise of helping to strengthen the argument that reinforcement can have a significant effect on a young persons' PM abilities. The results also showed a clear competence in the young children tested when it comes to PM performance before the introduction of any intervention. Having good PM skills can help a child in their everyday functioning (Atance & Jackson, 2009; Kliegel, Matthias & Einstein, 2007; Kvavilashvili et al., 2001), and my study showed that pre-school children have already developed some PM skills. There were, however, some inconsistencies shown across participants. Factors such as IQ, executive functioning and motivational issues have been found in other research to have factored into individual differences found in other studies (Cutler & Graf, 2007, McDaniel & Einstein, 2000) and may have possibly been a factor in my study. My recommendation would be to further extend these research ideas by examining motivation and other individual differences in the children to be tested first and attempt to have these personal attributes defined or considered before the PM tasks are conducted. This may help to eliminate some of the inconsistencies shown in previous research. Extending the information gathered in previous research in the area of improving PM through the delivery of reinforcers could have lifelong effects on children both academically and socially and therefore should be of great interest to any future research performed.

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APPENDIX A.

IMPROVING PROSPECTIVE MEMORY IN PRE SCHOOL AGED CHILDREN

Overview

My name is Chelsea Hamling and I am currently undertaking a master's degree thesis investigating the prospective memory of pre-school children (aged 2.5-5.5 years old).

Prospective memory is the ability to plan, hold, and recover an intention to perform a task. For example, remembering to pick up milk from the supermarket while shopping. Prospective memory is very relevant to children's everyday functioning therefore it would be beneficial to try and find a way to improve these memory abilities.

What will you have to do and how long will it take?

During regular Play centre session times I will have a quiet room set up with a computer to complete the task. During the task I will show your child some pictures and ask them to remember tasks associated with the pictures, to perform when they see those places. This should take approximately 15 minutes and will be done once a week for 4-6 weeks at which point a second phase may be introduced.

The second phase involves completing the same task but also giving the child the chance to earn reinforcers for any correct responses to help increase aptitude. These reinforcers will be tailored to your child so that we know they are suitable and motivating for them specifically. Examples are food, a favourite toy or a favourite activity.

You are invited into the experiment room also but will be asked to be quiet during the task so not to distract the child. You are also welcome to see the game beforehand so you know exactly what I will be asking of your child and any questions will be gladly answered.

What will happen to the information collected?

Only the supervisors and I will have access to the information you provide me. Afterwards, all questionnaires and notes will be destroyed. I will keep a copy of the data on file but will treat them with the strictest confidentiality.

Examiners and supervisors will see a copy of the final thesis and a copy will be placed in the University of Waikato's library catalogue. However, participants will not be named in the research reports, codes will be used instead. This is to ensure anonymity.

Declaration to participants

If you take part in the study, you have the right to:

Refuse to answer any particular question.

To withdraw from the study once data is collected, up to one week after sessions have ended.

Ask any further questions about the study that occurs to you during your participation.

Be given access to a summary of the findings from the study when it is concluded.

If you have any questions about this research project, you can contact me on 0220874507 or email me at c.hamling@windowslive.com. My research is being supervised by Rebecca Sargisson whose details are listed below:

Dr. Rebecca J. Sargisson

Senior Lecturer

School of Psychology

University of Waikato

Ph: +64 7 557 8673

TAURANGA 3112

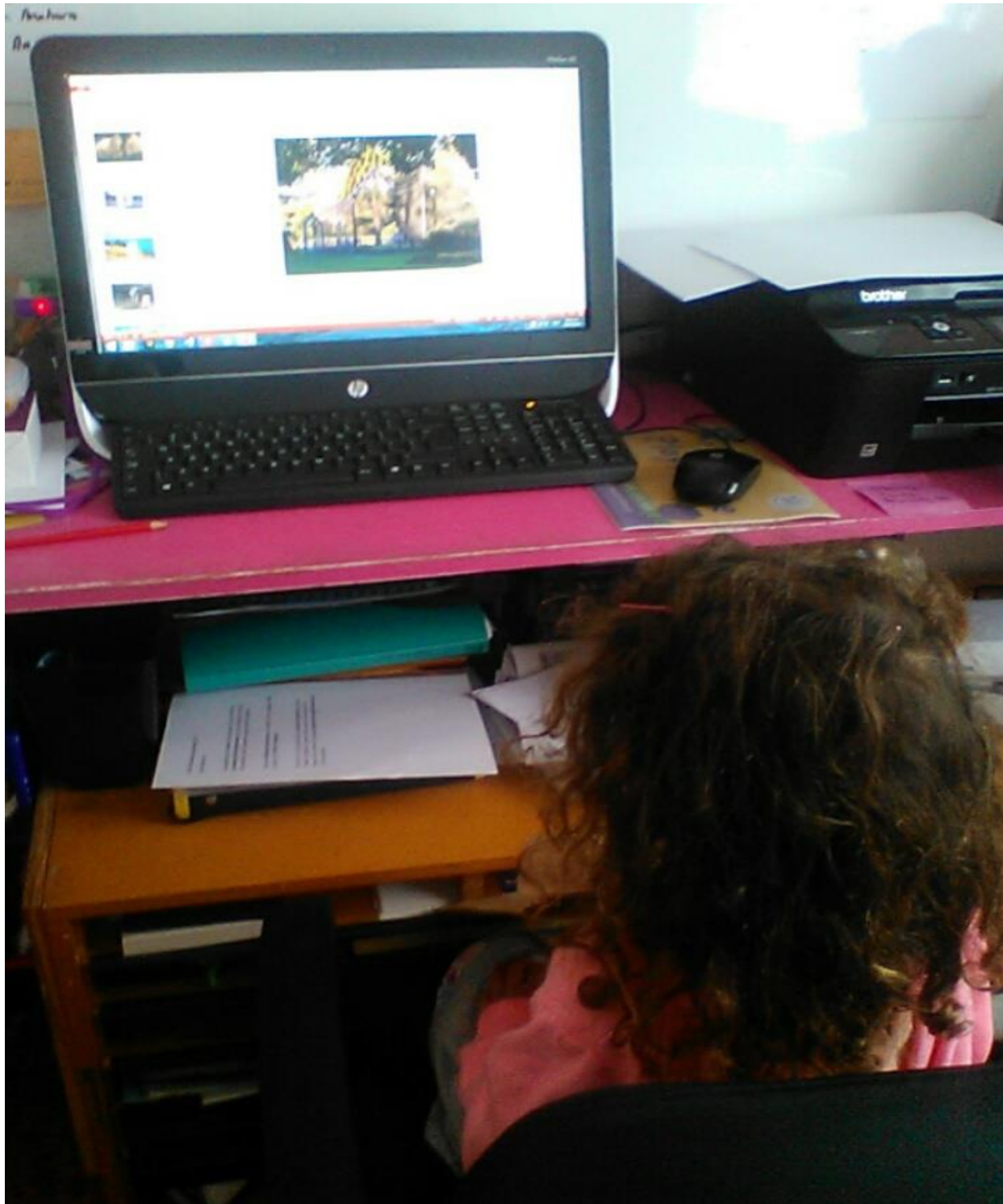
NEW ZEALAND

This research project has been approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Any questions about the ethical conduct of this research may be sent to the convenor of the Research and Ethics Committee (currently)

Dr James McEwan, phone 07 838 4466 ext. 8295, email :

jmcewan@waikato.ac.nz)

APPENDIX B.



APPENDIX C.







APPENDIX D.**Name/Code number:** _____**Date:** _____**Session number:** _____

| | Hit | Miss | False Alarm | Pass | Incorrect Item |
|-------|-----|------|-------------|------|----------------|
| Trial | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |

| | | | | | |
|----|--|--|--|--|--|
| 24 | | | | | |
|----|--|--|--|--|--|

Number of correct trials: Percentage correct:

Elmo task: 1 ()

2 ()

3 ()

4 ()

Sticker Task: Pass/Fail

Prompt level used:

APPENDIC E.

Multiple Stimuli without Replacement (MSWO) Data Sheet

Child's Name: _____

Leisure/Food

(Circle one)

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/ # times available |
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |

| Preference Assessment #3 | |
|--------------------------|---|
| Order of items selected | # times chosen/ # of times available |
| 1. | |
| 2. | |
| 3. | |

| Preference Assessment #4 | |
|--------------------------|--------------------------------------|
| Order of items selected | # times chosen/ # times available |
| 1. | |
| 2. | |
| 3. | |

| | |
|----|--|
| 4. | |
| 5. | |
| 6. | |
| 7. | |

| | |
|----|--|
| 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 F.

| <u>TARGETS</u> | <u>ITEMS/ACTIONS NEEDED</u> |
|-----------------------|------------------------------------|
| Playground | Have a swing/Have a slide |
| Beach | Build a sandcastle/Go swimming |
| Bike Shop | Buy a helmet |
| Bunnings | Buy tools/Buy plants |
| The Warehouse | Buy shoes/Buy TV |
| Supermarket | Buy bananas/Buy yoghurt |
| Odeon Theatre | Buy movie tickets |
| Dollar Store | Buy blowing bubbles |
| Petrol Station | Fill up petrol can |
| Optometrists | Get glasses |
| Information centre | Play Mini golf |
| Vets | Pick up puppy/Pick up kitten |
| Pizza Hut | Get pizza |
| Captain Morgans | Get an ice cream |
| Airport | Watch planes |
| Fire station | Look at Fire trucks/Spray hose |
| Botanical Gardens | See birds'/Feed ducks |
| The Wharf | Go Fishing |
| Pizza Hut | Get Pizza/Get chips |
| Library | Get books out |
| Olympic Pools | Go swimming |

APPENDIX G.



THE UNIVERSITY OF
WAIKATO
Tē Whare Wānanga o Waikato

CONSENT FORM

A completed copy of this form should be retained by both the researcher and the participant.

Research Project: Prospective remembering in Preschool aged children

| Please complete the following checklist. Tick (✓) the appropriate box for each point. | ES | O |
|---|----|---|
| I have read the Participant Information Sheet (or it has been read to me) and I understand it. | | |
| I have been given sufficient time to consider whether or not to participate in this study | | |
| I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet | | |
| I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without penalty | | |
| I have the right to decline to participate in any part of the research activity | | |
| I know who to contact if I have any questions about the study in | | |

| | | |
|--|--|--|
| general. | | |
| 7. I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study. | | |
| 8. I wish to receive a copy of the findings | | |

Declaration by participant:

I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Psychology Research and Ethics Committee (Dr James McEwan, Tel: 07 838 4466 ext.

8295, email: jmcewan@waikato.ac.nz)

Participant's name (Please print):

Signature: _____ Date: _____

Declaration by member of research team:

I have given a verbal explanation of the research project to the participant, and have answered the participant's questions about it. I believe that the participant understands the study and has given informed consent to participate.

Researcher's name (Please print):

Signature: _____ Date: _____
