PRESCHOOLERS' METAMEMORY ABOUT THE INFLUENCE OF EFFORT AND ANTICIPATED REWARD VALUE ON RECALL

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BY

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ABSTRACT

Two experiments were conducted to examine the validity of preschoolers' beliefs about the influence of effort and anticipated reward value on recall. In Experiment 1 preschoolers judged the individual and combined effects of high versus low memory effort, and high versus low anticipated reward value, on recall. The results indicated that preschoolers believe that recall increases with effort and with reward value. They also believe that the anticipation of a high value reward will elicit higher effort, and result in superior recall than the anticipation of a low value reward. The validity of these beliefs was investigated in Experiment 2 by examining preschoolers' actual recall performance and strategic effort (study time and study behaviour) when promised a reward of either high or low value. Subjects recalled significantly more toys when they anticipated receiving a high relative to a low value reward. However, the value of the anticipated reward had no observable effects on study effort. The results are discussed in terms of the importance of preschoolers' beliefs about memory effort.

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INTRODUCTION

Overview

Preschoolers usually perform more poorly than older children on memory tasks. One reason for preschoolers' poorer performance is that they use fewer mnemonic strategies than older children. Furthermore, even when preschoolers use strategies on memory tasks, those strategies are often ineffective. That is, they do not lead to superior recall. Several hypotheses have been advanced to explain preschoolers' strategic processing on memory tasks (Baker-Ward, Ornstein, & Holden, 1984; Bisanz, Danner, & Resnick, 1979; Bjorklund, 1987; Brown, 1978; Flavell, 1971; Hagen, Jongeward, & Kail, 1975; Howe & O'Sullivan, 1990; Kail, 1988; Kintsch, 1970; Kreutzer, Leonard, & Flavell, 1975; Kurtz & Borkowski, 1984; Miller, 1990; Moely, 1977; O'Sullivan, 1993; Shiffrin & Dumais, 1981; Wellman, 1977, 1988). These include hypotheses about the role of processing resources, conceptual knowledge, and metamemory in preschoolers' strategic processing. Most researchers have focused on the contributions of processing resources and conceptual knowledge. Recently, however, there has been increasing

attention placed on the role of metamemory in directing preschoolers' strategic mnemonic efforts.

Metamemory is knowledge and beliefs about memory, and considerable research indicates that what children believe about memory influences their behaviour on memory tasks (Pressley, Borkowski, & Schneider, 1987). Relatively little is known about preschoolers' metamemory, although it seems that effort plays a pivotal role in their beliefs about memory, and that these beliefs about effort influence preschoolers' strategic memory behaviour (O'Sullivan, 1993, 1994). A major challenge for researchers is to map out preschoolers' beliefs about the role of effort in memory and the impact of those beliefs on strategic memory behaviour and performance. In this study, preschoolers' beliefs about the influence of effort and anticipated reward value on recall were measured and the validity of those beliefs established.

This introduction is arranged in the following order. First, the literature on mnemonic strategic processing in preschoolers is reviewed. This includes an examination of the effectiveness of preschoolers' strategic efforts on memory tasks, as well as an

exploration of the various hypotheses concerning their strategic effectiveness. Then, preschoolers' metamemory about the impact of strategic effort on memory is discussed, together with the influence of those beliefs on memory behaviour and performance. Finally, the present study is introduced.

Strategic Behaviour Displayed By Preschoolers

Memory strategies are plans of action (such as visually examining, naming, and categorizing items) which children generate to facilitate the storage and retrieval of information (Howe & O'Sullivan, 1990). During the early 1970s the development of memory strategies was considered predominantly responsible for developments in children's memory performance (Brown, 1978; Hagen et al., 1975; Kintsch, 1970; Kreutzer et al., 1975; Moely, 1977). Research conducted during that decade was concentrated on the memory development of school-aged children. In general, researchers concluded that strategies typically begin to emerge during the early school years, and become increasingly sophisticated thereafter, with corresponding increases in memory performance.

Preschoolers were viewed for the most part as being non-strategic, non-planful, and even deficient in terms of their memory strategy capability (Perlmutter & Myers, 1979; Ratner, 1980). This point of view was quite prevalent until challenged by researchers who began to uncover strong evidence of strategic ability at the preschool level (Baker-Ward et al., 1984; Deloache, Cassidy, & Brown, 1985; Pressley et al., 1987; Wellman, Ritter, & Flavell, 1975; Yussen, 1974; Yussen, Kunen, & Buss, 1975). Wellman et al. (1975), for example, reported that 3-year-olds instructed 'to remember' exhibited certain simple memory strategies such as touching a hiding place or marking a location with a cue, whereas children instructed 'to wait' did not. Furthermore, children who used these strategies recalled more items in comparison with others instructed simply 'to wait'.

Baker-Ward et al. (1984) also reported the use of strategies by preschoolers. In their study 4-, 5-, and 6-year-olds were asked either to play with or to remember a group of toys. In general, children instructed to remember exhibited a more deliberate approach to the task than childrer instructed to play. That is, they named

and visually scanned the array of toys more, and played with the toys less, than subjects instructed to play. Despite these demonstrated differences in strategic activity during the study period, recall differences between the remember versus play conditions were only evident for the oldest subjects, where recall was significantly higher in the remember condition. Baker-Ward et al. (1984) concluded that although preschoolers did not display adult strategies (e.g., categorization) they were, nevertheless, strategic and used developmentally appropriate strategies such as object manipulation, labelling, and visual examination.

Even toddlers as young as 18 months of age have been observed using strategy-like activities when instructed to remember. Deloache et al. (1985) conducted a study in which a toy was hidden (e.g., a Big Bird toy is hidden under a chair cushion) and, following a delay of 1-4 minutes, the child had to find the toy. These 18- to 24-month-old children displayed rehearsal-like activities during the delay, such as referring to the hidden toy (e.g., "Big Bird"), to the hiding place (e.g., "Big Bird chair"), and to eventually revealing the toy (e.g., "find Big Bird"). The children also made visual contact with

the toy's hiding place by looking, pointing, or peeking at the toy. According to Deloache et al. (1985) these behaviours are very similar to the more complex mnemonic strategies exhibited by older children such as rehearsal and self-monitoring (checking). These results provide further evidence that even very young children possess a rudimentary capacity for using mnemonic strategies and a basic awareness of the need to do something special to remember.

Collectively, these and other studies of preschoolers' strategic behaviour provided evidence that preschoolers can engage in various strategies in order to remember. When these studies were published they challenged the more traditional view from the 1970's that preschoolers are non-strategic. Still, preschoolers are not consistent in their use of strategies. For example, variations in the memory task, or in the to-be-remembered items, are associated with variations in preschoolers' tendency to be strategic (e.g., Isotomina, 1975; Newman, 1990; Schneider & Brun, 1987; Weissberg & Paris, 1986). Furthermore, simply using a memory strategy does not guarantee effective memory performance. In the next

section, the effectiveness of preschoolers' memory strategies on recall tasks will be discussed.

Effectiveness of Preschoolers' Strategic Memory Behaviour

Given that preschoolers are strategic on recall tasks what impact do their strategies have on recall performance? That is, does strategy use facilitate preschoolers' recall performance? Most researchers have failed to find significant relationships between strategy use and recall performance among preschoolers. Baker-Ward et al. (1984), for example, found no correspondence between overt strategy use and recall except among the older 6-year-old subjects. Although the 3- and 4-year-olds were strategic they did not seem to derive any benefit from their efforts in terms of recall performance. O'Sullivan (1993) also reported that differences in the strategic behaviours used by preschoolers during a free-recall task were not associated with differences in recall. Such findings have been further corroborated by Lange, MacKinnon, and Nida (1989) who found no significant relationships between individual study behaviours and recall for 4-

year-olds. However, Lange et al. (1989) derived a weighted strategy summary score for each subject, calculated to give most weight to the use of "mature" strategies such as naming and grouping. Lange et al. (1989) found a significant positive relationship between this weighted strategy summary score and recall. Overall, although there is little doubt that preschoolers can be strategic, the weight of the evidence at the present time suggests that their strategic behaviour is not associated, in any straightforward way, with their recall performance (Baker-Ward et al., 1984; Miller, 1990; Wellman, 1988).

When preschoolers use memory strategies that fail to influence recall performance, those strategies are referred to as faulty or ineffective strategies. Wellman (1988) argued that while on the road to strategic expertise, preschoolers execute many unsuccessful or faulty strategies. Faulty strategies are also used by older children, however, preschoolers are apparently such amateurs to memory tasks that the strategies they display tend to be more faulty than effective, overall (Wellman, 1988). Similarly, Miller (1990) recently introduced the concept of utilization deficiency to explain the lag

between using a strategy and benefitting from it. According to Miller (1990) when children first use a strategy deliberately, recall does not improve immediately. But, following persistent strategy use, it improves eventually. Although, utilization deficiencies are demonstrated by older children, for specific strategies it seems that preschoolers have widespread utilization deficiencies in their strategy use.

Why do preschoolers frequently produce faulty or utilization deficient strategies, and how do preschoolers develop into effective strategy users? A number of hypotheses have been advanced. These include hypotheses concerning the role of processing resources, conceptual knowledge, and metamemory. According to the resources argument, preschoolers exert a greater amount of mental effort when producing a strategy than school-aged children (Bisanz et al., 1979; Bjorklund, 1987). Furthermore, producing a strategy is often so effortful for preschoolers that few resources are left for utilization (Miller, 1990). As children develop, execution of strategies becomes increasingly automatized and less effort is required for strategy execution. As

a result, more resources are made available for utilization (Howe & O'Sullivan, 1990).

Conceptual knowledge also plays a significant role in children's strategy use and recall performance. Preschoolers are more likely to use strategies effectively when they possess considerable knowledge and experience with the memory task and the to-be-remembered material (Howe & O'Sullivan, 1990). Conceptual knowledge appears to enable or ease strategy use, in that, when to-be-remembered items are activated with ease, resources are freed for strategy production and utilization (Pressley et al., 1987). Conceptual knowledge develops with age, influencing how easily information can be accessed, which in turn influences the amount of information processing capacity that is available for various other cognitive operations such as employing memory strategies (Bjorklund, 1987).

The third factor that is related to preschoolers' strategic effectiveness is metamemory - or knowledge and beliefs about memory. It is argued that preschoolers' beliefs about memory are related to their use of strategies on memory tasks (Miller, 1990; O'Sullivan, 1993). In particular, preschoolers may have naive

beliefs about memory that are associated with their use of faulty strategies. Less is known about the role of metamemory in preschoolers' strategic processing than about resources or conceptual knowledge. Recently, however, the impact of metamemory on preschoolers' effective and ineffective strategic processing has received increasing attention. Metamemory will be discussed in detail in the next section.

In summary, the body of research on strategic mnemonic processing among preschoolers portrays a transitional period that involves the gradual development of an appropriate strategy, followed by gradual improvement in recall performance (Demarie-Dreblow & Miller, 1988; Miller, 1990). Resources (Kail, 1988), conceptual knowledge (Bjorklund, 1987), and metamemory (Flavell, 1971) are implicated in preschoolers' faulty strategy use, and developments in these areas are associated with developments in strategic effectiveness (Howe & O'Sullivan, 1990).

Preschoolers' Beliefs About Strategic Memory

Metamemory (Flavell, 1971), refers to knowledge and awareness of memory. Metamemory involves children's

beliefs about their own and other's memory, including how best to approach and complete a variety of different memory tasks. Most research on children's metamemory has involved school-aged children (Pressley et al., 1987), and relatively few studies have focused on preschoolers. Consequently, we know relatively little about preschoolers' beliefs about memory in general, or their beliefs about strategic processing in particular (Fabricius & Cavalier, 1989; Yussen & Levy, 1975). Nonetheless, preschoolers do have personal "theories" about memory, theories that include beliefs about the individual and combined effects of different variables on memory (Naus & Ornstein, 1983; Wellman, 1988) and these beliefs may influence preschoolers' strategy use (Fabricius & Hagen, 1984; O'Sullivan, 1993; Wellman, 1988).

What do preschoolers believe about strategic memory? For example, what do they believe about the need to be strategic, and about how different strategies might help or hinder their memory performance? Moreover, how do these beliefs influence their strategic behaviour? Pressley et al. (1987) hypothesized that preschoolers first come to believe that exerting effort (a general

strategy) increases performance on memory tasks before they understand that effort deployed into specific strategies is usually better than hard work. This belief in amount of effort encourages continued strategic effort, which eventually leads to the discovery of specific strategies and beliefs about their effectiveness. Although this illustrates the potentially powerful influence of preschoolers' beliefs about strategic effort on their strategic development, few studies exist where these hypothesized relationships have been investigated directly.

Most of what is known about preschoolers' beliefs about strategic memory has been inferred from preschoolers' study behaviour on memory tasks. For example, recall that when instructed to remember, preschoolers took a more deliberate approach to the recall task in that they engaged in more study behaviours (e.g., visual examination, rehearsal), and played considerably less with the to-be-remembered items than children instructed to play (Baker-Ward et al., 1984; Deloache et al., 1985; Lange et al., 1989; Wellman et al. 1975). These behaviours have been interpreted as evidence that young children believe that effort

facilitates memory and that they deliberately use effort to help themselves on memory tasks (Wellman, 1988).

Studies such as these provide indirect evidence of preschoolers' beliefs about the role of effort in memory and suggest that they have some intelligent insights into the relative importance of strategic effort during recall tasks. Some of their beliefs may, however, be naive (O'Sullivan, 1993). For example, on memory-for-location tasks 2- and 3-year-olds display numerous strategies, such as pointing at the location of the hidden toy, which in hindsight are unnecessary since most of these children could easily locate the hidden toy even without such painstaking strategic effort (Deloache et al., 1985). Such needless expenditure of strategic effort into faulty (i.e., unnecessary) strategies has been interpreted as evidence that 2- and 3-year-old's believe memory is a process which always necessitates the use of effort.

There are a few studies where children's beliefs about effort have been measured directly. Findings indicate that 5-year-olds believe that amount of effort expended is one of the most important factors (if not the most important) in determining memory performance, and

more important than the amount of information to be remembered for example (Wellman, Collins, & Glieberman, 1981). Furthermore, preschoolers believe that the amount of time spent studying or the effort exerted during study is more important than how that time is spent or effort used (i.e., categorization strategies) (Fabricius & Hagen, 1984).

It would seem that preschoolers believe that memory requires effort and that their understanding of memory effort is focused on quantity rather than quality (i.e., specific strategies) of effort expended. How then, do these beliefs influence preschoolers' strategic memory behaviour and performance? The only study where this issue was addressed directly was reported by O'Sullivan (1993). In that study, 4-year-old's beliefs about the influence of memory effort and anticipated reward value on recall were examined, together with the actual effects of effort and reward on recall. The results indicated that the 4-year-olds believed they would work harder and remember more if promised a high versus a low value reward. However, it turned out that although reward did effect effort expenditure as the subjects predicted (i.e., high reward elicited more looking at and attention

to the to-be-remembered items than low reward), differences in effort did not effect recall. Thus, the belief that reward would influence effort was valid, but the belief that effort would influence recall was naive because increased effort (in the high reward condition) was deployed into faulty strategies.

Using a similar methodology, O'Sullivan (1994) also demonstrated that preschoolers have valid beliefs about the effects of interest on memory effort (4-year-olds use more effort to remember interesting than boring toys), but naive beliefs about relations between effort and recall (their extra efforts do not effect recall). O'Sullivan (1993, 1994) concluded that beliefs about the value of expending effort motivate preschoolers to be strategic on memory tasks. However, because they have not established beliefs about the effectiveness of deploying effort into specific strategies, their effort is deployed into faulty, ineffective memory routines.

How do children develop their beliefs both accurate and naive, about strategic memory effort? The value of effort appears to be embedded in many social demands placed on children (O'Sullivan, 1993; Wellman, 1988). Hard work is considered to be pivotal to success in North

American culture and adults communicate this message to children over and over again (Stipek & MacIver, 1989). Thus, it is not surprising that children believe effort is important for memory. It is also not surprising that preschoolers emphasize the amount of their efforts rather than how that effort is specifically applied. After all, they are frequently told that hard work and exerting a lot of effort will be rewarded with success, rather than that effort applied through efficient strategies is more effective than effort alone (O'Sullivan, 1993). For example, in preschool, teachers encourage children to try hard or do their best. Furthermore, teachers generally reward effort rather than performance outcomes (e.g., the result of the efforts). The message being conveyed to North American children is that trying your best and working as hard as you can will lead to success and reward. It seems that preschoolers understand these messages and they have established beliefs about effort, reward value, and effort-reward-performance relations consistent with these messages (Danner & Lonky, 1981; O'Sullivan, 1993, 1994; Schwarz, Schrager, & Lyons, 1983). Because adults tend to place little emphasis on how effort can best be deployed to maximize performance,

it is not unreasonable that amount of effort figures significantly in preschoolers' beliefs about how to facilitate recall. What this means, however, is that when translated into strategic behaviour, preschoolers would know how to work harder but not necessarily how to work better to increase their recall.

In summary, preschoolers have established beliefs about the impact of strategic effort on recall performance. Conclusions inferred from their strategy behaviour during recall tasks suggest that they believe effort can increase recall, and that effort is a useful tool to ensure remembering (O'Sullivan, 1993; Pressley et al., 1981; Wellman et al., 1981). Findings from studies where preschoolers' beliefs about strategic effort were measured directly converge on the same conclusion, 4-year-olds believe working harder will insure superior recall. This belief turns out to be naive however. This is because when preschoolers try harder to remember they channel their efforts into strategies that do not pay off in terms of superior recall. Thus, the belief that effort is helpful may motivate children to try, but they are unlikely to try effectively until they understand

that how effort is deployed is just as important as how much (O'Sullivan, 1993, 1994).

The Present Study

Two specific questions were addressed. First, what do preschoolers believe about the individual and combined effects of effort and anticipated reward value on recall? Second, do these beliefs accurately represent the actual relations between these variables? Two experiments were conducted to address these questions. In Experiment 1 preschoolers' beliefs about the influence of high and low memory effort and high and low anticipated reward on recall were examined. The prediction was that preschoolers would believe that recall increases with increasing effort and reward value, and that increases in reward value would elicit increased effort leading to higher recall. This prediction is consistent with findings from previous studies on preschoolers' beliefs about the effects of effort and reward value on memory (O'Sullivan, 1993, 1994).

In Experiment 2 the validity of these beliefs was examined, the question being would preschoolers work harder and remember more if promised a high versus low

value prize? Consistent with findings from previous studies (e.g., Baker-Ward et al., 1984; Lange et al., 1989; O'Sullivan, 1993, 1994) the prediction was that preschoolers would exert more effort (as evidenced by time spent in study and use of strategic memory behaviours) when promised a high value reward, but whether these differential strategic efforts would lead to superior recall was considered doubtful, as significant strategy-recall relations in preschoolers are not usually obtained for preschoolers.

EXPERIMENT 1

In this experiment, preschoolers' beliefs about the influence of high versus low memory effort and high versus low anticipated reward value on recall were examined. It was predicted that the preschoolers would believe that recall increases with increasing effort and reward value, and that reward value influences the amount of effort exerted on a recall task (i.e., a high value reward elicits high effort and a low value reward elicits low effort).

Method

Subjects. Subjects were 20 preschool children (9 male, 11 female) aged 4 years 0 months to 4 years 9 months (mean age = 4 years, 5 months; S.D. = 3.04 months). All subjects attended a part-time preschool program located in St. John's, Newfoundland. The children were from middle income backgrounds and their participation was secured by written parental consent.

Materials. Four black-and-yellow line drawings (20 x 16 cm each) were used. Each depicted a child sitting behind a table on which there were ten toys displayed in a semi-circular array. The toys were: a watch, horse, cup, sunglasses, book, camera, doll, scissors, airplane, and a ball. Two of the drawings were designed to represent high versus low memory effort, with effort being manipulated through the facial expression of the child in the drawing (see Appendix A). High effort was portrayed by a facial expression with tightly knitted eyebrows, a sharply downturned mouth and beads of perspiration falling from the head, whereas, low effort was represented by slight knitting of the brows and downturning of the mouth. The two remaining drawings were designed to represent high and low anticipated

reward value. Each of these drawings (see Appendix A) displayed a child without facial features or facial expression. Either a package of crayons or a pencil was drawn in the lower right hand corner, indicating the prize (crayons or a pencil) that the pictured child could win. Previous testing with 28 preschoolers had elicited unanimous agreement that the crayons were a better prize than the pencil (see Appendix B). Two sets of ten toys identical to those shown in the line drawings were also used.

Procedure. The subjects were accompanied individually by a female experimenter to a quiet room in the preschool. Each subject was first familiarized with the memory task depicted in the drawings. With both the subject and experimenter sitting together on the floor, the experimenter demonstrated what she described as a memory game frequently played at children's parties. She placed ten toys in a semi-circle in front of the subject and explained that she would soon take them away, and that the subject should try to remember what they were. Then, she withdrew the toys and asked the subjects what toys they could remember. When the subjects had finished recall they proceeded to three trials, a memory effort

trial, an anticipated reward value trial, and an effort-reward combination trial. The order of presentation of the first two trials was counterbalanced across subjects, but the effort-reward combination trial was always administered last.

1. Memory Effort Trial. Subjects were shown the two drawings representing memory effort and told that the children (described as the same age and sex as the individual subject) in the pictures were playing the memory game the subject had played minutes before (see Appendix C). The experimenter, while referring to the facial expression of the children in the drawings, described one as trying a whole lot and the other as trying a little to remember the toys. Then as a manipulation check, subjects were asked to identify which child was trying a lot and a little. All subjects correctly identified the appropriate drawings. Next, the experimenter placed two sets of ten toys, identical to those pictured in the drawings, around each drawing. She asked the subjects to select the toys that the child who was trying a lot would remember and the toys the child who was trying a little would remember (counter-balanced). When subjects had made their selections the

experimenter restated their predictions and asked for confirmation. Then the drawings and the toys were removed.

2. Anticipated Reward Value Trial. Children's estimates of recall for the different reward values were obtained using the same procedure. Subjects were shown the two drawings depicting reward value and told that the children in the drawings were playing the memory game (see Appendix C). This time they were informed that one child could win a box of crayons for remembering a lot of the toys. The subjects were also told that the child in that drawing believed the crayons to be a great prize and really wanted to win them. The child in the other drawing could win a pencil for remembering a lot of the toys. However, subjects were told that this child considered pencils to be just an OK prize because he/she had many pencils already, and consequently did not really care if he/she won the pencil or not. As a manipulation check the subject was asked to identify the child who would win the great prize and the child who would win the OK prize. All subjects made the correct identification. A set of toys identical to those in the drawings, was

then laid out for each drawing and subjects' recall estimates obtained as before.

3. Effort-Reward Combination Trial. Finally, the experimenter laid out the reward value cards, described them again and pointed out that the children in those drawings had no facial features (see Appendix C). Subjects were told that they should give each child a face. The effort cards were then presented and described and the subjects were asked to put the right card/face (i.e., trying a little or a lot) on the child playing for the great prize and the child playing for the OK prize (counterbalanced). When the subjects made their placements, the experimenter restated their choices, laid a set of toys around each pair of two pictures and asked children to estimate recall.

Results and Discussion

Two questions were addressed in the analyses. First, the number of children who made the "correct" judgements about effort and anticipated reward value, and effort and anticipated reward combinations, was determined. Second, the effects of manipulating effort, anticipated reward value, and effort-reward combinations,

on the number of toys subjects predicted would be recalled was examined. Because preliminary analyses indicated no significant effects for trial order (i.e., whether the effort or reward value trial was administered first), subsequent analyses were collapsed across this variable.

The majority of subjects, 16 (out of 20) judged that high effort would lead to superior recall than low effort, $\chi^2(1) = 7.2$, $p < .01$. Of the remaining four subjects, three predicted that recall in the low effort condition would be higher than in the high effort condition, whereas the fourth subject estimated equal recall in both the high and low effort conditions. The majority of subjects, 17, also judged that an anticipated reward of high value would lead to superior recall relative to an anticipated reward of low value, $\chi^2(1) = 9.8$, $p < .01$. The other three subjects estimated equal recall in the high and low reward value conditions.

Eighteen of the subjects judged that a high value reward would elicit high effort and a low value reward would elicit low effort, $\chi^2(1) = 12.8$, $p < .001$. Of the 18 subjects who made these "correct" effort reward value pairings, 17 then judged that the high effort-high value

pair would produce higher recall than the low effort-low value combination, $\chi^2(1) = 14.22$, $p < .001$. The eighteenth subject estimated equal recall in the high effort-high reward and low effort-low reward conditions. As predicted then, most subjects believed that recall would increase with increased effort or reward value and that high reward value would elicit high effort and result in higher recall than low effort combined with low reward value.

Next, the effects of the task variables (i.e., effort, reward value, both) and their magnitude on the number of items subjects predicted would be recalled was analyzed with a 2(magnitude: high v low) x 3(task variable: effort v reward value v both) repeated measures analysis of variance. Data from the two subjects who "incorrectly" paired high effort with low anticipated reward value and low effort with high anticipated reward value, were excluded from this analysis. A significant effect emerged for magnitude, indicating that the preschoolers predicted significantly greater recall in conditions of high magnitude (mean = 7.56), in comparison to low magnitude (mean = 3.85), $F(1,17) = 274.93$, $p < .001$. No significant effects emerged for task

variable and the task variable x magnitude interaction was not statistically significant.

The prediction that preschoolers would believe that recall increases with increasing effort and reward value, and that reward value effects the amount of strategic effort exerted on a recall task, was supported by these results. Overall, the results indicated that most of the preschoolers believed that (1) high effort would produce significantly more recall than low effort; (2) children promised a high value reward would recall more items than children promised a low value reward; (3) a high value reward would elicit greater effort than a low-value reward; and (4) the combination of high value and high effort would result in significantly greater recall than the low value-low effort combination. These findings indicate that 4-year-olds have beliefs about the effects of effort, anticipated reward value, and their combination on recall, and also have established beliefs about the impact of reward value on effort expenditure during a recall task.

An interesting outcome from these findings pertains to preschoolers' recall predictions for the effort-reward value combinations. They predicted equivalent recall for

both the individual (effort or reward) and paired (effort-reward combination) variables. The reasoning behind these predictions is not clear. However, it appears that these preschoolers did not add the effects of effort and reward value together when predicting recall in the combined condition. Wellman et al. (1981) indicated that young children's recall predictions seem to be founded on effort considerations, suggesting that the preschoolers in this experiment may have believed that rewards work through effort to influence recall. O'Sullivan (1993) has suggested that predictions involving reward value alone or in combination with effort may be driven by the belief that the influence of reward value on recall is indirect and mediated through effort. Clearly, these issues demand further study.

EXPERIMENT 2

How valid are preschoolers' beliefs about the effects of effort, anticipated reward value, and their combination, on recall? Because the beliefs demonstrated in Experiment 1 probably reflect childrens' real life experiences with effort-reward-performance relations (Stipek & MacIver, 1989), it was expected that subjects

who anticipated a high value reward would exert more effort during study than those promised a low value reward. That is, subjects who anticipated a high value reward were expected to study longer and demonstrate different levels of strategic activity (e.g., label the to-be-remembered stimuli more) than those promised a low value reward. Whether these differences in study effort would translate into recall differences was doubtful. This is because in most previous studies variations in preschoolers' study behaviour was not associated with reliable differences in recall (e.g., Baker-Ward et al., 1984, O'Sullivan, 1993).

Method

Subjects. Subjects were 32 preschool children (11 male, 21 female) aged 3 years 5 months to 5 years 6 months (mean age = 4 years, 2 months; S.D. = 6.25 months). All subjects attended either full-time or part-time programs conducted by six preschool centres located in St. John's, Newfoundland. Subjects were from middle income backgrounds and their participation was secured with written parental consent. Each child was randomly

assigned to one of two reward conditions: high or low anticipated reward value.

Materials. The stimuli were 15 uniform-sized (approximately three inches square), categorically different toys. The toys used were: a watch, a pack of cards, a waterpistol, a screwdriver, a doll, a horse, a mirror, a balloon, a ball, a camera, scissors, airplane, cup, sunglasses, and a book. A box of crayons representing a high value reward and a pencil representing a low value reward were also used.

Procedure. All of the subjects were individually tested in a familiar room in their preschool centre by a female experimenter. The subject was seated at a small table next to the experimenter. First, subjects were told that they would be shown a group of toys and would have to remember them (see Appendix D). Subjects were instructed to do anything they liked to remember the toys. Then, each child was shown either the crayons or the pencil. Subjects shown the crayons were told "if you do really well, I will give you this package of crayons. Everyone just loves the crayons, they think they're just great". Subjects shown the pencil were told "if you do really well, I will give you this pencil for a prize".

(Of course, on completion of their participation, all children were given both prizes.)

Next, the experimenter put away the prize and subjects were given three study-distracter-test trials. The 15 toys were positioned in a semi-circle before the child, and the experimenter named each toy as it was placed. Subjects were reminded to do anything they wished to remember the toy, and they were instructed to tell the experimenter when they were ready for the recall test. The study trial proceeded until the child indicated that he/she was ready for the recall test or until four minutes, 15 seconds had elapsed, whichever came first. To eliminate short-term memory effects a 20 second distracter task followed in which the subject drew X's and O's on a sheet of paper. The recall trial proceeded until no new items were recalled within a 10 second interval. At the end of the third test trial a manipulation check was used. Subjects were asked to recall the reward they had been promised for remembering the toys. All subjects recalled their prize. A video camera recorded each subject's entire performance.

Results and Discussion

Recall Performance. The first row of Table 1 contains the means for recall by reward condition and trial. The number of toys recalled was analyzed with a 2(reward: high v low) x 3(trial: 1 v 2 v 3) analysis of variance, in which reward was a between subjects variable and trial a repeated measure. Reward had a significant effect, $F(1, 30) = 7.71$, $p < .01$, such that subjects recalled more toys when promised a high (mean = 7.15) relative to a low value reward (mean = 5.79). No significant effect was obtained for trial, and the reward x trial interaction was not significant.

Study Time. The second row of Table 1 contains the means for study time in each reward condition on each of the three trials. A 2(reward: high vs. low) x 3(trial: 1 vs. 2 vs. 3) analysis of variance was used to analyze study time. Here, reward was a between subjects variable and trial a repeated measure. No significant effects emerged. Although visual inspection of these means suggests that study time increased across trials in the low value reward condition, and decreased across trials in the high value reward condition, there was considerable individual variation in study time for both

TABLE 1

Means for Recall, Study Time, and Proportion of Observation Blocks in which Each Coded Study Behavior Occurred, by Reward Condition and Trial

	Reward					
	Low Value			High Value		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
Recall	5.63	6.19	5.56	7.00	6.88	7.56
Study Time (seconds)	99.81	75.81	123.63	107.13	104.50	95.30
Visual Examination	.88	.89	.96	.91	.92	.91
Object Manipulation	.37	.41	.56	.35	.42	.57
Naming	.22	.28	.22	.35	.39	.28
Semantic Play	.10	.18	.17	.12	.12	.22
Off-task Behavior	.19	.17	.10	.18	.13	.14
Unfilled Time	.07	.02	.01	.01	.01	.04
Verbal Elaboration	.03	.02	.00	.01	.01	.04

N = 16 in each condition

reward conditions (low value range = 3 - 254 seconds; high value range = 22 - 252 seconds), contributing to the insignificant statistical findings.

Study Behaviour Measurement. For each subject, each of the three study trials was divided into five second segments. For each five second segment, seven behaviours were scored as either present or absent. The seven study behaviours examined were: visual examination, object manipulation, semantic play, naming, verbal elaboration, unfilled time, and off-task behaviour (Baker-Ward et al, 1984; Lange et al, 1989; O'Sullivan, 1993). They were defined as follows. Visual examination occurred when the child visually scanned the array of toys or focused on particular items. Object manipulation occurred when the child touched, lifted, moved, or grouped the objects. Semantic play occurred when the child manipulated the toys in a manner that engaged their basic properties (eg. trotting the horse; drinking out of the teacup). Naming occurred when the child verbalized the names of any toy. Verbal elaboration included any talk about the toys which went beyond simply naming (eg., "I have a camera at home"). Off-task behaviour occurred when the child attended to an identifiable stimulus not central to the

task (e.g., a child was off-task when out of his/her seat or making faces at the examiner). Unfilled time occurred when the child was neither in contact with the toys nor distracted by off-task stimuli.

Two observers independently coded the study behaviours for 12 randomly selected subjects. The mean interrater agreement was 94.4% (range = 84% - 100%) across behaviours. Cases of disagreement were resolved by discussion between the two raters. Next, the number of five second blocks in which each of the seven behaviours occurred was calculated separately for each trial and subject. Finally, these figures were converted to proportions.

Study Behaviour Analyses. The last seven rows of Table 1 show the mean proportion of observation blocks in which each behaviour occurred by reward condition and trial. Following tradition in this area of research and based on the recommendations in Huberty and Morris (1989) these data were analyzed using seven separate 2(reward: high v low) x 3(trial: 1 v 2 v 3) analyses of variance - one for each study behaviour. Here, reward is a between subjects variable and trial a repeated measure. No significant effects emerged from the analyses of visual

examination, naming, semantic play, verbal elaboration, off-task behaviour, or unfilled time. Trial had a significant effect on object manipulation, $F(2,60) = 6.78$, $p < .01$. Post-hoc analysis with Tukey's HSD Test (Ferguson, 1976) indicated that object manipulation increased significantly from Trial 1 (mean = .3595) to Trial 2 (mean = .4183) to Trial 3 (mean = .5660).

Correlations were computed between recall and each of the seven study behaviours, separately for each trial and reward condition (see Table 2). Few significant relationships between recall and study behaviour were found. Exceptions were the significant correlation coefficients obtained between recall and naming on trial one, and recall and off-task behaviour on both trials two, and three in the high reward value condition. This means, of course, that recall increased as naming the toys increased and as off-task behaviour decreased in that condition. The only significant correlation in the low reward condition occurred between recall and verbal elaboration on trial two, meaning that recall increased as verbal comments about the toys increased on that trial.

TABLE 2

Correlations between Recall and Each of the Coded Study Behaviours by Reward Condition and Trial

	Reward					
	Low Value			High Value		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
Visual Examination	.06	.27	.15	.17	.35	.25
Object Manipulation	-.14	-.20	-.19	-.08	.27	.25
Naming	.19	.45	-.02	.49*	.37	.24
Semantic Play	-.09	-.26	-.13	-.33	.04	.01
Off-task Behavior	-.24	-.29	-.37	-.06	-.51*	-.51*
Unfilled Time	.24	.02	.33	.16	-.15	-.24
Verbal Elaboration	-.16	.49*	-.05	.07	-.17	-.07

N = 16 in each condition

* $p < .05$.

Correlations were computed between all seven coded study behaviours in order to reveal any relationships among these behaviours. The correlation values between study behaviours on trial three are shown in Table 3, for the high value condition, and in Table 4 for the low value reward condition. Seven significant correlations emerged in the high value condition, whereas, only three were obtained in the low value condition. In both conditions, visual examination was inversely related to off-task behaviour, naming was inversely related to semantic play, and object manipulation positively related to semantic play. In the high value condition, positive relationships were found between visual examination and object manipulation, and between off-task behaviour and unfilled time, as well as, negative relationships between object manipulation and off-task behaviour, and semantic play and off-task behaviour. No other significant relationships emerged, suggesting that the preschoolers often used one or another of these behaviours rather than combining one or more at a time (Lange et al., 1989).

The hypothesis in this experiment was that preschoolers who anticipated a high value reward would exert more effort (as evidenced by time spent in study

TABLE 3

Correlations between Each of the Coded Study Behaviours on Trial Three in the High Value Condition

Study Behaviour	V.E.	O.M.	N	S.P.	O.T.B.	U.T.	VR.E.
Visual Examination Mean = .9078	-	.70**	-.22	.43	-.84**	-.17	.25
Object Manipulation Mean = .5743	-	-	-.46	.69**	-.75**	-.46	.32
Naming Mean = .2797	-	-	-	-.62**	-.08	-.16	-.29
Semantic Play Mean = .2192	-	-	-	-	-.50*	-.29	-.14
Off-task Behavior Mean = .1412	-	-	-	-	-	.51*	.29
Unfilled Time Mean = .0433	-	-	-	-	-	-	-.13
Verbal Elaboration Mean = .0363	-	-	-	-	-	-	-

N = 16 in each condition
* $p < .05$.
** $p < .01$.

TABLE 4

Correlations between Each of the Coded Study Behaviours on Trial Three in the Low Value Condition

Study Behaviour	V.E.	O.M.	N	S.P.	O.T.B.	U.T.	VR.E.
Visual Examination Mean = .9550	-	-.03	.22	.04	-.79**	.15	.03
Object Manipulation Mean = .5578	-	-	-.21	.77**	.03	-.34	.27
Naming Mean = .2189	-	-	-	-.52*	-.29	-.21	-.07
Semantic Play Mean = .1705	-	-	-	-	.01	-.26	.31
Off-task Behavior Mean = .0954	-	-	-	-	-	-.04	-.05
Unfilled Time Mean = .0083	-	-	-	-	-	-	-.10
Verbal Elaboration Mean = .0030	-	-	-	-	-	-	-

N = 16 in each condition
* $p < .05$.
** $p < .01$.

and use of strategic memory behaviours) during study than those promised a low value reward, but would not recall more. These hypotheses were not supported. Instead, the results indicated that preschoolers, in fact, recalled more toys when promised a high value reward in comparison with a low value reward, and that neither study time nor study behaviour differed between the two reward value groups. Thus, reward influenced recall but did not significantly effect effort deployment during study.

Why did the subjects in the high value reward group recall significantly more toys than subjects in the low-value reward group when there was no difference in the measured study time and behaviour displayed by these two groups? A number of factors which were not measured in the present experiment may have influenced the superior recall displayed by the high value reward group. It is possible that covert strategies such as internal labelling/rehearsal strategies without accompanying vocalized or overt indicators may have been employed to a greater extent by subjects in the high value (crayons) condition than subjects in the low-value (pencil) condition. However, the use of such covert strategies by preschoolers is unlikely (Wellman, 1988).

It is also possible that coordination of strategies (e.g., looking while touching and naming) rather than individual strategies may have led to superior recall. The greater number of significant correlational relationships found between study behaviours in the high value condition indirectly support the hypothesis that coordination of strategies may have positively influenced recall. Currently, there are no conceptual models to direct the measurement of preschoolers' use of multiple study strategies. The need to develop such models to investigate how the coordination of strategies impacts on recall has been noted by others (Baker-Ward et al., 1984). This situation is further complicated by the finding that children take many alternative approaches to study on memory tasks, and that no particular pattern of behaviours is systematically related to recall (Baker-Ward et al., 1984). This raises a challenge for future research efforts.

Retrieval effort may also have played a role in the higher recall scores obtained by subjects in the high value reward condition. Hudson & Fivush (1983) reported that children's ability to use strategies to guide retrieval deliberately, develops considerably during the

preschool and school years. There is considerable evidence that, across childhood, developments in retrieval are much more pronounced than developments in storage (Howe, Brainerd, & Kingma, 1985). In view of this, it seems likely that differences in retrieval efforts may have influenced the higher recall obtained by subjects in the high value reward condition in this experiment. The preschoolers may have exerted more effort to retrieve the names of the toys they had stored in their memory when anticipating a high value reward relative to a reward of low value. This hypothesis should be pursued in future research.

The findings in this Experiment that reward influenced recall but not study effort can be contrasted with O'Sullivan's (1993) findings that reward influenced study effort, but not recall. First, consider the finding that reward affected recall here but not in O'Sullivan (1993). Methodological differences between these two experiments may account for the differences in findings. For example, in this Experiment subjects were only shown the prize they could win. That is, subjects in the high value reward condition were only shown a package of crayons. Subjects in the low-value condition

were only shown a pencil. Subjects in O'Sullivan's (1993) study, on the other hand, were shown both rewards, regardless of reward-value group assignment. That is, they were shown both the pencil and the box of crayons and told which of the two prizes they were playing for. Perhaps displaying both rewards created some misunderstanding for the subjects in O'Sullivan's (1993) study. For example, the subjects in the low reward condition might have believed that they could win the better prize if they did really well on the recall task. Consequently, they may have exerted extra effort at retrieval which contributed to recall equivalent to that in the high reward value condition.

Now consider the finding that reward did not effect study effort in this study but did in O'Sullivan (1993). O'Sullivan (1993) reminded subjects after each trial about the prize they could win. The preschoolers in the present experiment were not given any reminder during the three trials. O'Sullivan's (1993) procedure may have influenced motivation at the start of each trial and resulted in higher study effort in the high reward condition. In the present experiment, when subjects were not reminded they did not display different study effort.

Again, this supports the hypothesis that recall differences between the high and low reward conditions in the present experiment were due to retrieval effort. Interestingly, as pointed out earlier, O'Sullivan's (1993) high reward subjects did not recall more despite their use of different study effort. Thus, their strategies were faulty or ineffective, and as a result their strategic effort was not reflected in their subsequent recall scores (Miller, 1990; O'Sullivan, 1993; Wellman, 1988).

An interesting "non-finding" in this experiment was that recall did not differ significantly across trials. This is unusual because subjects usually demonstrate learning gains over three trials. The experimental methodology may have contributed to this effect. Subjects in this experiment were not informed in advance that they would have three chances to recall the toys. Therefore, they may have considered each trial to be their only or final chance to win their prize. O'Sullivan (1993) using a similar task told subjects they would have three trials and obtained significant increases in recall across trials. The effects of

telling/not telling subjects the number of recall trials they will have should be investigated in future studies.

Finally, the finding that reward value influenced recall is consistent with previous research in which reward value positively affected recall in young school-age children (Danner & Lonky, 1981). In that study, as here, the mechanisms responsible for this effect is not clear and should be pursued in future research. The role of retrieval processes in mediating the effects of reward on recall should receive empirical attention.

GENERAL DISCUSSION

The present study was designed to investigate preschoolers' beliefs about the influence of effort and reward on recall, and to examine the validity of those beliefs. Findings from Experiment 1 clearly demonstrate that preschoolers believe that (1) increased effort leads to increased recall; (2) increased reward leads to increased recall; (3) high reward value elicits high effort and low reward value low effort; and (4) the combination of high effort and high reward value leads to superior recall relative to the low effort-reward combination. The validity of those beliefs was assessed

in Experiment 2. The belief that recall performance increases when expecting a high-value reward in comparison with a reward of low value was validated in Experiment 2. Subjects promised the crayons recalled significantly more toys than subjects promised a pencil. However, the belief that preschoolers would exert more effort (as evidenced by differences in study and study time) when promised a high value reward than when promised a low value reward was not validated. No statistical differences in study time or behaviour in high and low reward conditions were obtained. Overall, preschoolers' beliefs about the effects of reward on recall were valid, but beliefs about the effects of reward on effort were naive.

These findings are important for a number of reasons. First they illustrate that preschoolers can demonstrate valid beliefs when asked about variables important in their lives - in this case relations between reward value and recall. The preschoolers were able to accurately judge the effect of reward value on recall, most likely because they were asked about a variable that is important in their everyday experience. Young children are promised rewards as an incentive to stay on

task or to behave well (e.g., promising a cookie as a reward for doing as you've been told to do) (Stipek & MacIver, 1989). Furthermore, they are able to adapt their behaviour in response to variation in reward value, indicating the powerful influence and relative importance of preschoolers' beliefs about reward value (Danner & Lonky, 1981; O'Sullivan, 1993; Schwarz et al., 1983).

Second, the findings illustrate that preschoolers' also have naive beliefs. These include the beliefs that children will work harder for a good prize and that hard work will result in superior recall. (Of course, it is possible that this belief is valid, and that increased retrieval effort (not measured here) leads to superior recall.) The finding that subjects believed reward would effect effort when it did not, is contrary to the hypotheses advanced in this study. It had been predicted that increased reward value would be associated with increased effort, but that these increased efforts would be deployed into faulty utilization deficient strategies. How can the current findings be explained and what are the implications for strategic development in preschoolers?

Although speculative it seems likely that the age of the subjects (in this relative to similar studies (O'Sullivan, 1993, 1994; Baker-Ward et al., 1984; Lange et al., 1989)) is very important. The subjects in Experiment 2 were an average of four months younger than those in O'Sullivan's (1993) study on reward, effort, and recall. It may be that young 4-year-olds approach these tasks automatically and do not try to manipulate their strategic effort deliberately, whereas older 4-year-olds are beginning to try out their strategic routines. Furthermore, consistent with Miller's suggestions (1990), when children first begin to manipulate strategies deliberately, their strategic efforts may actually interfere with recall. What this means is that the older 4-year-olds in O'Sullivan (1993, 1994) may have neutralized the enhancing effects of high reward and high interest on their recall because of their attempts to vary effort. It follows that the young 4-year-olds in this study, who did not manipulate their strategic effort in response to reward value experienced the automatic positive influence of reward on their recall performance (Danner & Lonky, 1981). Clearly, research concentrated on developments between the ages of three and five is

needed to elucidate on preschoolers' strategic effort development, including their beliefs about effort.

How do preschoolers develop their beliefs about effort? Social mechanisms very likely contribute. As mentioned in the introduction, beliefs about the value of effort may well be a by-product of the socialization process. Children are encouraged to try harder by their parents, well-meaning individuals, television programs, story books, and even nursery rhymes (e.g., "if at first you don't succeed, try, try again"). Parents and preschool teachers control and direct many of the learning experiences to which children are exposed, and adults also impart knowledge and advice during these learning experiences. Preschoolers in North America are very likely influenced by the continuous emphasis on amount of effort by the adults in their lives. Usually little advice about <u>how to try</u> is passed along, so the focus is on quantity rather than quality of effort. Preschoolers' beliefs about memory, therefore, may be based in large measure on their personal experiences, especially what they have been told by the individuals with whom they have contact.

These practises may have important implications for children's strategic and metacognitive development. For example, in Germany where teachers stress the importance of how effort is deployed into strategic behaviour, children display sophisticated strategic memory behaviour at an earlier age than American children (Kurtz, Schneider, Carr, Borkowski, & Rellinger, 1990). Here in North America, teachers tend to stress the importance of amount rather than type of effort (strategic). Since North American preschoolers appear to develop naive beliefs based on what they are told by adults and the media, more appropriate messages could potentially produce more sophisticated strategy use by North American children at the same age as their German peers.

In conclusion, the results of this study clearly indicate that at 4-years-of-age, prior to the start of school, children have well developed beliefs concerning some of the variables that affect memory. Some of those beliefs are valid and some naive, and they have important implications for children's memory behaviour and performance. As these beliefs likely develop from a

social base, the role of social and cultural variables in metamemory development should be explored in future research.

REFERENCES

Baker-Ward, L., Ornstein, P.A., & Holden, D.J. (1984). The expression of memorization in early childhood. *Journal of Experimental Child Psychology, 37,* 555-575.

Bisanz, J., Danner, F., & Resnick, L. B. (1979). Changes with age in measures of processing efficiency. *Child Development, 50,* 132-141.

Bjorklund, D.F. (1987). How age changes in knowledge base contribute to the development of children's memory: An interpretive review. *Developmental Review, 7,* 93-130.

Brown, A.L. (1978). Knowing when, where, and how to remember: A problem of metacognition. In R. Glaser (Ed.), *Advances in instructional psychology* (pp. 77-165). New Jersey: Erlbaum.

Danner, F. W., & Lonky, E. (1981). A cognitive-developmental approach to the effects of rewards on intrinsic motivation. *Child Development, 52,* 1043-1052.

Deloache, J. S., Cassidy, D. J., & Brown, A. L. (1985). Precursors of mnemonic strategies in very young children's memory. *Child Development, 56,* 125-137.

Demarie-Dreblow, D., & Miller, P. H. (1988). The development of children's strategies for selective attention: Evidence for a transitional period. *Child Development, 59,* 1504-1513.

Fabricius, W. V., & Cavalier, L. (1989). The role of causal theories about memory in young children's memory strategy choice. *Child Development, 60,* 298-308.

Fabricius, W. V., & Hagen, J. W. (1984). Use of causal attributions about recall performance to assess metamemory and predict strategic memory behaviour in young children. *Developmental Psychology, 20,* 975-987.

Ferguson, G.A. (1976). *Statistical analysis in psychology and education.* McGraw-Hill: New York.

Flavell, J. H. (1971). First discussant's comments: What is memory development the development of? *Human Development, 14,* 272-278.

Hagen, J.W., Jongeward, R.H., & Kail, R.V. (1975). Cognitive perspectives on the development of memory. In J.W. Reese (Ed.), *Advances in child development and behaviour* (vol. 10, pp. 57-101). New York: Academic Press.

Howe, M.L., Brainerd, C.J., & Kingma, J. (1985). Storage-retrieval processes of normal and learning-disabled children: A stages-of-learning analysis of picture-word effects. *Child Development, 56,* 1120-1133.

Howe, M.L. & O'Sullivan, J.T. (1990). The development of strategic memory: Coordinating knowledge, metamemory, and resources. In D. Bjorklund (Ed.), *Children's strategies: Contemporary views of cognitive development* (pp. 129-156). Hillsdale, NJ: Erlbaum.

Huberty, C. J., & Morris, J. D. (1989). Multivariate analysis versus multiple univariate analyses. *Psychological Bulletin, 105,* 302-308.

Hudson, J., & Fivush, R. (1983). Categories and schematic organization and the development of retrieval strategies. *Journal of Experimental Child Psychology, 36,* 32-42.

Isotomina, Z. M. (1975). The development of voluntary memory in preschool-age children. *Soviet Psychology, 13,* 5-64.

Kail, R. (1988). Developmental functions for speeds of cognitive processes. *Journal of Experimental Psychology, 45,* 339-364.

Kintsch, W. (1970). *Learning, memory, and conceptual processes*. New York: Wiley.

Kreutzer, M. A., Leonard, C., & Flavell, J. (1975). An interview study of children's knowledge about memory. *Monographs of the Society for Research in Child Development, 40*(1, Serial No. 159).

Kurtz, B. E., & Borkowski, J. G. (1984). Children's metacognition: Exploring relations among knowledge, process, and motivational variables. *Journal of Experimental Child Psychology, 37*, 335-354.

Kurtz, B., Schneider, W., Carr, M., Borkowski, J. & Rellinger, E. (1990). Strategy instruction and attributional beliefs in West Germany and the United States: Do teachers foster metacognitive development? *Contemporary Educational Psychology, 15*, 268-283.

Lange, G., MacKinnon, C. E., & Nida, R. E. (1989). Knowledge, strategy, and motivational contributions to preschool children's object recall. *Developmental Psychology, 25*, 772-779.

Miller, P. H. (1990). The development of strategies of selective attention. In D. F. Bjorklund (Ed.), *Children's strategies: Contemporary views of cognitive development* (pp. 157-181). Hillsdale, NJ: Erlbaum.

Moely, B. (1977). Organizational factors in the development of memory. In R. V. Kail & J. W. Hagen (Eds.), *Perspectives on the development of memory and cognition* (pp. 203-236). Hillsdale, NJ: Erlbaum.

Naus, M. J., & Ornstein, P. A. (1983). The development of memory strategies: Analysis, questions, and issues. In M. T. H. Chi (Ed.), *Trends in memory development: Vol. 9. Contributions to human development* (pp. 1-30). Basel: Karger.

Newman, L. S. (1990). Intentional and unintentional memory in young children: Remembering vs. playing. *Journal of Experimental Child Psychology, 50*, 243-258.

O'Sullivan, J. T. (1993). Preschoolers' beliefs about effort, incentives, and recall. *Journal of Experimental Child Psychology, 55*, 396-414.

O'Sullivan, J. T. (1994, April). *Preschoolers' beliefs about effort, interest, and recall.* Paper presented at the annual meeting of the Western Psychological Association, Kona, Hawaii.

Perlmutter, M., & Myers, N. A. (1979). Development of recall in 2- to 4- year old children. *Developmental Psychology, 15*, 73-83.

Pressley, M., Borkowski, J. G., & Schneider, W. (1987). Cognitive strategies: Good strategy users coordinate metacognition and knowledge. *Annals of Child Development, 4*, 80-129.

Ratner, H. H. (1980). The role of social context in memory development. *New Directions for Child Development, 10*, 49-67.

Schneider, W., & Brun, H. (1987). The role of context in young children's memory performance: Isotomina revisited. *British Journal of Developmental Psychology, 5*, 333-341.

Schwarz, J. C., Schrager, J. B., & Lyons, A.E. (1983). Delay of gratification by preschoolers: Evidence for the validity of the choice paradigm. *Child Development, 54*, 620-625.

Shiffrin, R. M., & Dumais, S. T. (1981). The development of automatism. In J. R. Anderson (Ed.), *Cognitive skills and their acquisition* (pp. 111-140). Hillsdale, NJ: Erlbaum.

Stipek, D., & MacIver, D. (1989). Developmental change in children's separate assessment of intellectual competence. *Child Development, 60*, 521-538.

Weissberg, J. A., & Paris, S. G. (1986). Young children's remembering in different contexts: A reinterpretation of Isotomina's study. *Child Development, 57*, 1123-1129.

Wellman, H. M. (1977). Preschoolers' understanding of memory-relevant variables. *Child Development, 48*, 1720-1723.

Wellman, H. M. (1988). The early development of memory strategies. In F. Weinert & M. Perlmutter (Eds.). *Memory development: Universal changes and individual differences* (pp. 3-29). Hillsdale, NJ: Erlbaum.

Wellman, H. M., Collins, J., & Glieberman, J. (1981). Understanding the combination of memory variables: Developing conceptions of memory limitations. *Child Development, 52*, 1313-1317.

Wellman, H. M., Ritter, K., & Flavell, J. H. (1975). Deliberate memory behaviour in the delayed reactions of very young children. *Developmental Psychology, 11*, 780-787.

Yussen, S. R. (1974). Determinants of visual attention and recall in observational learning by preschoolers and second graders. *Developmental Psychology, 10*, 93-100.

Yussen, S. R., Kunen, S., & Buss, R. (1975). The distinction between perceiving and memorizing in elementary school children. *Child Development, 45*, 547-551.

Yussen, S. R. & Levy, V. M. (1975). Developmental changes in predicting one's own memory span of short-term memory. *Journal of Experimental Child Psychology, 19*, 502-508.

APPENDICES

Appendix A:

Line Drawings Used in Experiment 1

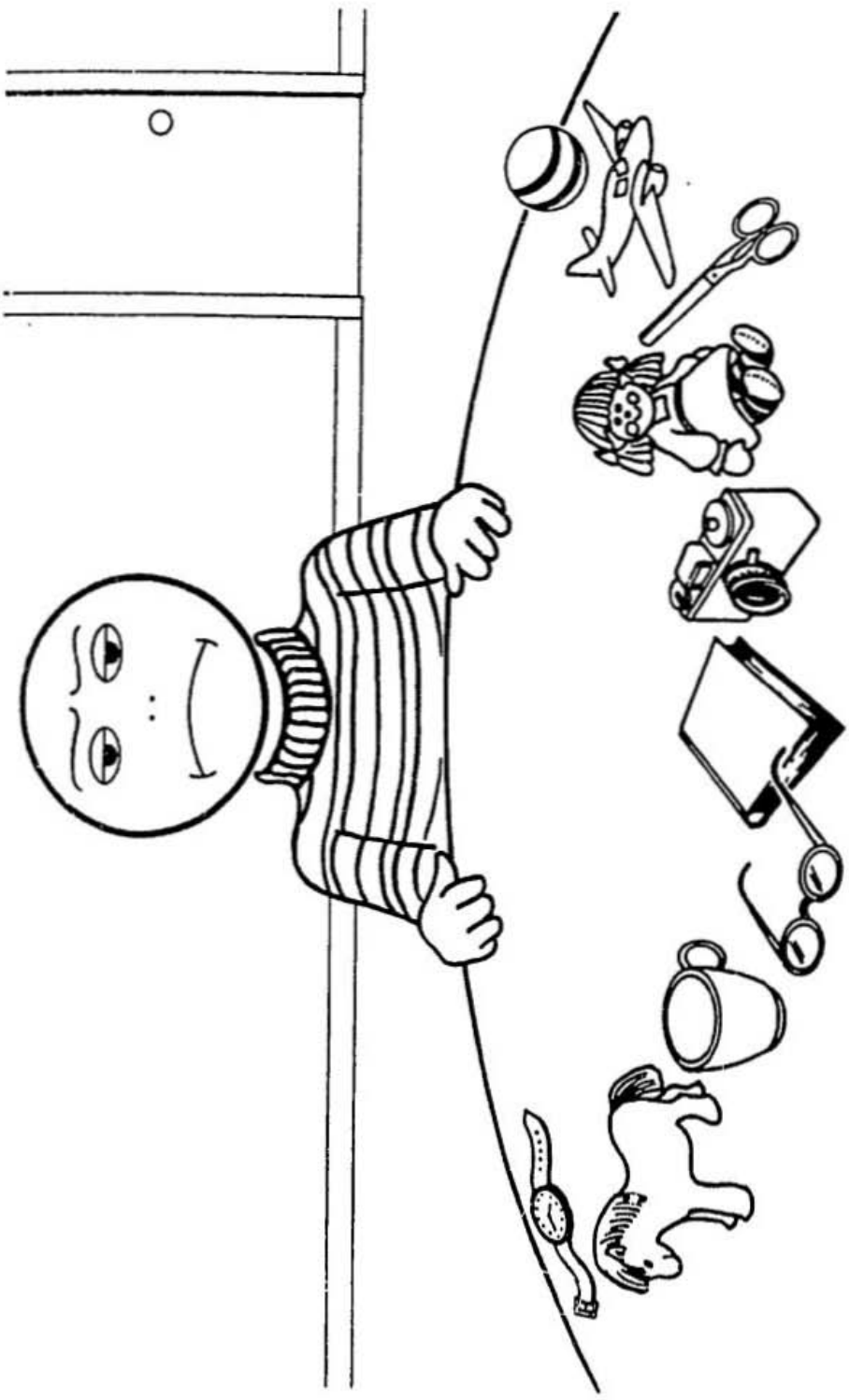


Figure 1. Line drawing depicting low cognitive effort.

Figure 2. Line drawing depicting high cognitive effort.

Figure 3. Line drawing depicting low reward value.

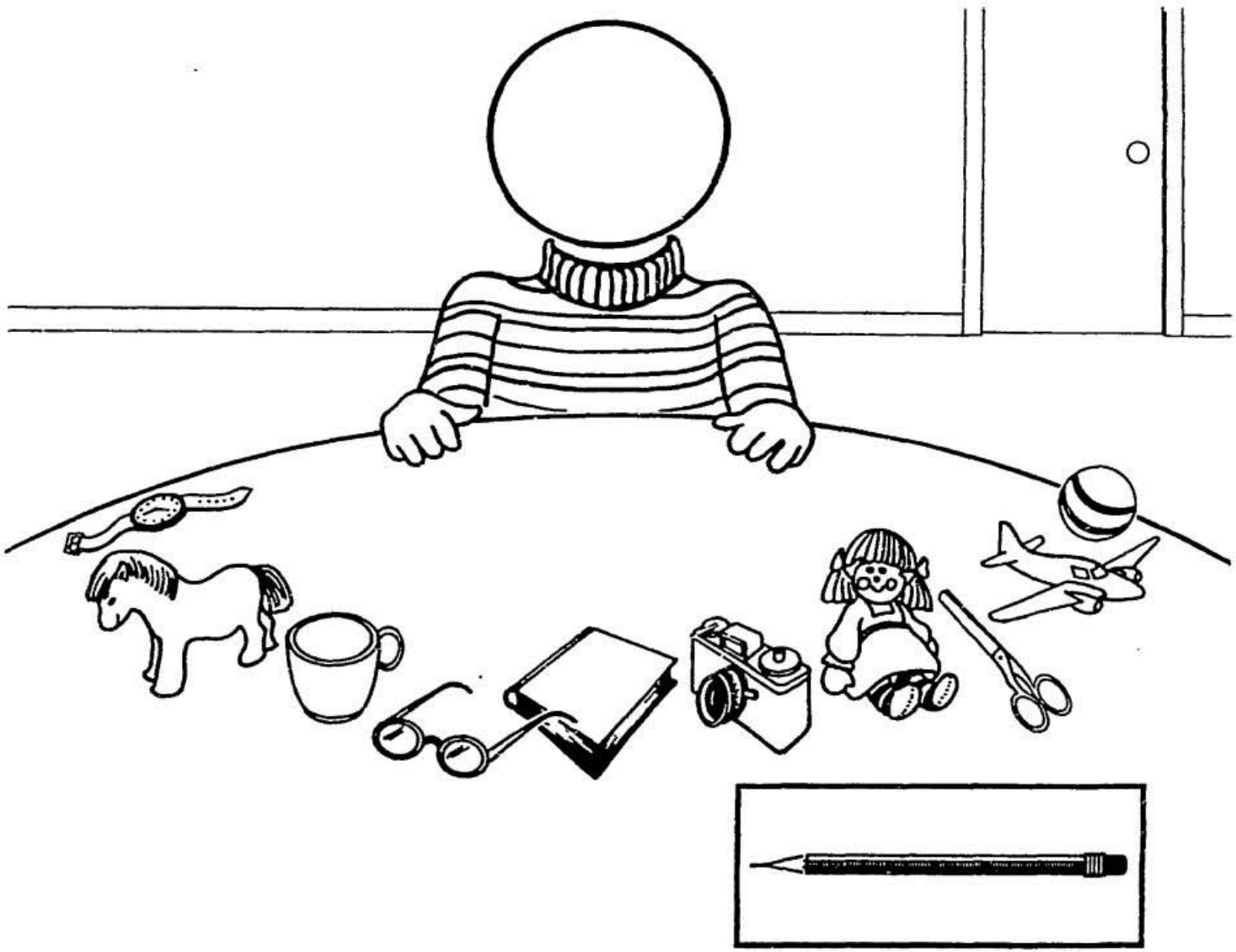
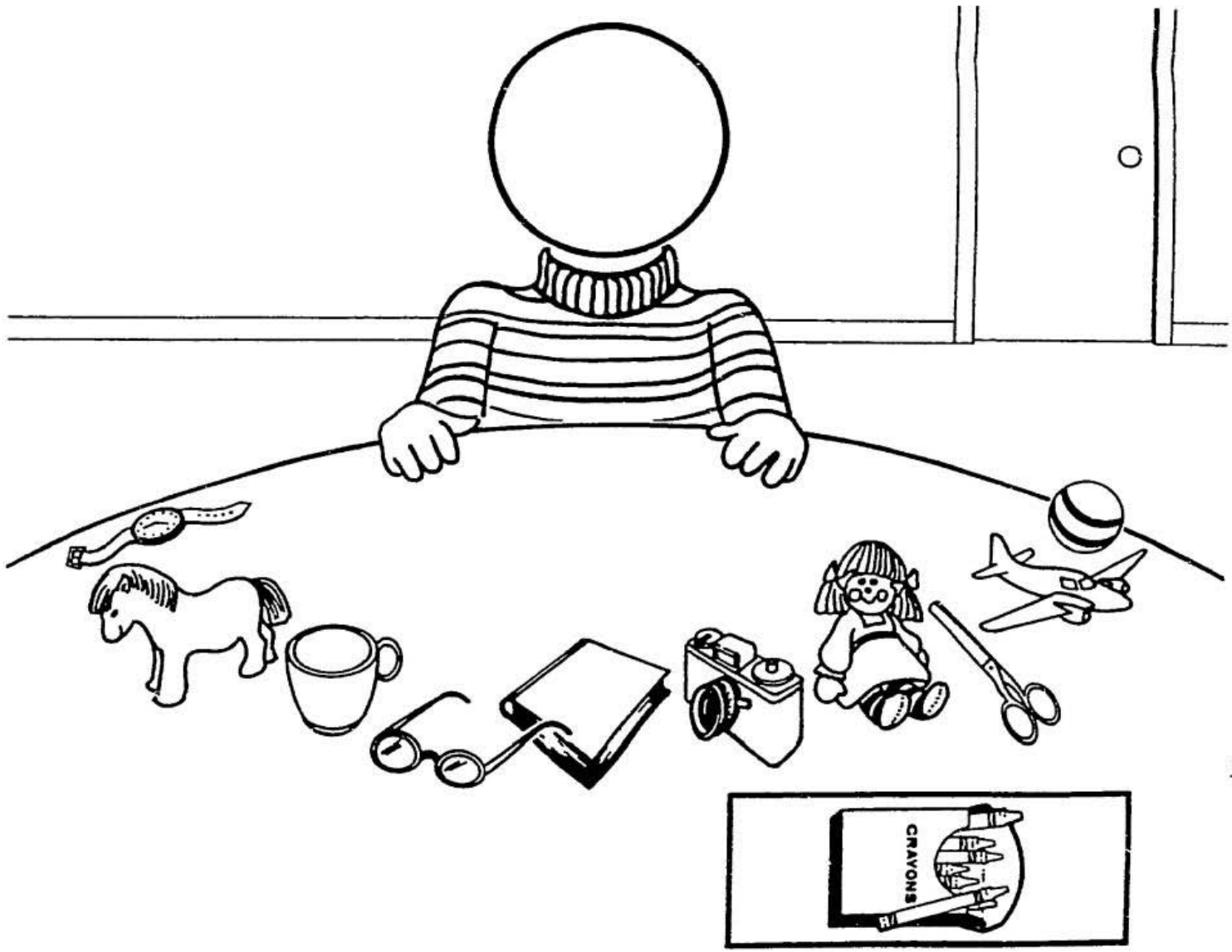


Figure 4. Line drawing depicting high reward value.



Appendix B:

Pilot Study of Preschoolers' Reward Preferences

Purpose

To establish a concrete prize that has a high value relative to a prize that has low value for 4-year-olds.

Method

Subjects. Subjects were 28 preschool children (13 male, 15 female) aged 41 months to 66 months (mean age = 52 months). All subjects attended either full-time or part-time programs in preschool centres located in St. John's, NFLD. Written parental consent was a prerequisite for participation in the study.

Materials. Seven prize pairs including: penny vs dollar coin, pencil vs package of crayons, four sheets of blank paper vs colouring book, plastic harmonica vs windwheel, bag of pretzels vs bag of chips (equal proportioned), two Cabbage Patch stickers vs two Teenage Mutant Ninja Turtle badges, and 25 M&M candy pieces vs 25 mini-marshmallows.

Design and procedure. All subjects were tested individually. Each child was told that their assistance was required to choose prizes for children their own age. Each of the seven prize pairs was then shown to the child in random order and the child was asked which member of the pair would be the best prize.

Results

Preference ratios for reward pairs were as follows: pencil vs package of crayons, 1:27, penny vs dollar coin, 2:26; four sheets blank paper vs colouring book, 4:24; pretzels vs potato chips, 7:21; two stickers vs two badges, 7:21; harmonica vs windwheel, 15:13; M&M's vs marshmallows, 15:13. Since the greatest discrimination between members of a pair was obtained when comparing the pencil vs package of crayons, this pair was selected.

Appendix C:

Script For Experiment 1

Procedure

All children were tested while sitting on the floor of a separate room in their daycare. The following symbols identify the experimenter and subjects: E = experimenter, S = subject.

1. Familiarization with the task:

E: "Do you ever play memory games?".

S: ----

E: "Well let me show you one that I play with some boys and girls your age. Some people play this game at birthday parties".
(Present toys - give instructions).
Instructions: "I have a bag of toys here (show bag) and I play a memory game with them. What I do is lay all of my toys out in front of them like this for a few minutes then I take them all away so that they can't see them and ask them what the toys were. I bet you can do that. Let's try".
(Pick up all toys and put out of sight).

"Now can you tell me what some of the toys were?"

(Allow them a few seconds for recall).

2. Questions About Effort:

E: (Present two effort cards) "Here are two boys/girls the same age as you and they are playing my memory game. Look at their faces (point to faces). This boy/girl (point to face) is trying a whole lot to remember the toys. Look at his/her face (point to face). He/she is trying a whole lot to remember the toys. Now look at the other boy/girl's face (point to face). He/she is only trying a little bit to remember the toys. Show me the boy/girl who is trying a whole lot to remember the toys (child points to picture - correct him/her if wrong). Show me the boy/girl who is trying a little (child points to picture - correct him/her if wrong). (Place out the two sets of toys. One set in a semi-circle around each picture). Show me how many the boy/girl who is trying a whole lot will remember"

(point to picture). Take out the toys you think he/she will be able to remember. Show me how many the boy/girl who is only trying a little bit will remember (point to picture). Take out the toys you think he/she will be able to remember. Okay, so the boy/girl who is trying a whole lot will remember (state predicted number of toys) of the toys and this boy/girl who is only trying a little bit will remember (state predicted number) of them" (Point to appropriate picture. Remove all pictures and toys out of sight).

3. Questions About Value:

E: (Present two value cards) "Here are two other boys/girls. They are playing the memory game too. But they are playing it a little different. They are playing for prizes like you do at birthday parties. See the box of crayons/pencil? He can win the crayons/pencil if he/she does really good at the game and remembers a lot of the toys. This boy/girl thinks the crayons are a really great prize and he/she wants to win them a whole lot. This

boy/girl thinks that the pencil is an okay prize. He/she already has a lot of pencils at home and he/she does not care if he/she wins it or not. Show me which boy/girl is playing for the great prize (child responds - correct if wrong). Show me which boy/girl is playing for the okay prize (child responds - correct if wrong).

(Lay out all of the toys and follow procedure for predictions as with effort. Remove all toys and cards out of sight).

4. Questions About Value x Effort:

E: (Present value cards first).

"Here are two more boys/girls playing my game". (Reiterate the description and questions about the value cards). Do you notice something missing on these boys/girls? That's right, they have no faces do they? Well let's give them some faces. (Present effort cards). This face is trying a whole lot to remember the toys and this face is only trying a little bit. Put the right faces on these (point to the value cards) boys/girls. Which boy/girl is

trying a whole lot to remember (hold up card) and which one is only trying a little bit? (Hold out cards to child - child places cards. Restate the child's pairings and with the superimposed pictures present the toys as before and get predictions as per previous procedure)

Appendix D:

Script For Experiment 2

Procedure

All children were tested while sitting at a small table in a separate room in their daycare centre. The following symbols identify the experimenter and subjects: E = experimenter, S = subject.

1. Familiarization With The Task:

E: "We're going to play a game. You see this box? (show box) It has toys in it, and in a couple of minutes I am going to take all of the toys out of the box and put them on the table. All you have to do (child's name) to play the game is remember the toys. You can do whatever you want to remember the toys, and when you think you can remember them all, you can tell me and I will put all the toys back in the box so you can guess them. O.K.? Do you understand?".

S: ----

E: "If you do really well I will give you a prize" (either of the following depending upon subject's experimental grouping): (a). "I will give you this pencil for a prize if you do

really well. So if you do really well, I will give you this pencil for a prize". (b). "I will give you this package of crayons if you do really well. Everyone just loves the crayons, they think they're just great (said with animation). So if you do really well, I will give you this package of crayons for a prize".

E: "Are you ready?"

S: ----

E: "Here's a (name of toy)".

(Continue until all toys are arranged in semi-circle before the subject).

E: "Don't forget to tell me when you think you can remember the toys."

S: ----

2. Distracter Task and Recall of Toys:

(Remove toys from table)

E: "Now I want you to draw me some X's and O's just like the one's you see on this paper" ... (when 30 seconds have elapsed) "O.K. that's enough ... now tell me all the toys you can remember".

S: ----

(When recall is complete)

E: "That was really good. Let's try it again!".

3. Procedure for Trials Two and Three:

(Prior to each trial the following instructions were given to the child)

E: "So I'll put all the toys on the table, and you can do anything you want to remember the toys. When you think you know them all, you'll tell me - O.K.?".

S: ----

E: "Here's a (name of toy)".

(Repeat sequence).