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SOCIAL MODELS INFLUENCE CHILDREN'S DELAY OF GRATIFICATION STRATEGY USE AND DELAY PERFORMANCE

by

MELISSA L. HRABIC

Under the Direction of Rebecca Williamson, PhD

ABSTRACT

Delay of gratification is the ability to forego an immediate indulgence in lieu of a later, greater reward. Past research has shown that using behavioral strategies may help children to delay gratification longer. The current project tests whether children can learn one such strategy, covering the eyes, through imitation. Four-year-olds saw a model delay gratification using a strategy, using no strategy, or saw no model. They then participated in an accumulation task, where they could earn an incremental sticker reward. Children who saw a strategy showed evidence of imitation by covering their eyes. Unexpectedly, however, this had an adverse influence on their ability to delay gratification. Thus, although children can apply a strategy, its effectiveness may be limited by the type of task used (accumulation) or from an incomplete understanding of the strategy's function. Additional research is needed to investigate whether delay performance can be promoted by a social example.

INDEX WORDS: Delay of gratification, Imitation, Strategy, Modeling, Social influence, Accumulation task

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Melissa Leigh Hrabic
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DEDICATION

I dedicate this work to my family and friends. I am especially grateful to my parents, David and Jeanette Hrabic, for their words of encouragement, and eternal support of my graduate endeavors, even when they're not entirely sure what I do. This work is also dedicated to Nathan, who has been a constant source of support, and love, and the occasional reality check. A special thanks to the friends who have never left, and the friends that I've met along the way.

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1 INTRODUCTION

Delay of gratification is defined as the ability to forego an immediate reward in favor of a later, greater reward. This is necessary and beneficial in many situations, such as in making sound fiscal decisions (e.g., choosing to let money accrue interest in the bank rather than taking it out) or health-related decisions (e.g., choosing to drive by a fast food restaurant to cook a healthy meal at home). The classic paradigm for testing delay of gratification involves presenting the participants, usually young children, with two rewards (e.g., one marshmallow versus one pretzel) and asking them to indicate a preference (Mischel & Ebbesen, 1970). They are then asked to sit and wait for their more preferred reward, with the knowledge that they can end the waiting period at any time and accept the immediate, but less preferred, reward. The researchers measure the amount of time that the children wait before forfeiting the greater reward. Over the last 40 years, variations of this procedure have been adapted to test delay of gratification in children, adults, and non-human primates including chimpanzees, capuchin monkeys, and Tonkean macaques (e.g., Beran & Evans, 2012; Bramlett, Perdue, Evans, & Beran, 2012; Pelé, Micheletta, Uhlrich, Thierry, & Dufour, 2011).

Delay of gratification is a topic of particular interest because longitudinal studies indicate that performance on these tasks early in childhood has long-term implications. Children who were better able to delay gratification as 3-year-olds (Mischel, Ebbesen, & Zeiss, 1972) were rated in childhood at ages 4, 7, and 11 years as being more intelligent, cooperative, and resourceful, while *not* delaying gratification was correlated with irritability and aggressiveness (Funder, Block, & Block, 1983). Moreover, children who had longer delay times as preschoolers were found to be more cognitive and socially competent as adolescents (Funder & Block, 1989; Shoda, Mischel, & Peake, 1990). Finally, 40 years later, those who were *not* able to delay

gratification as preschoolers were found to be significantly less able to resist temptation and had more difficulties suppressing positive emotional responses when it was asked of them (Casey et al., 2011). Therefore, promoting this ability could potentially have important later consequences. The current project addresses the relation of two possible influences, specifically working memory and social learning, on delay of gratification performance with the goal of determining what may be viable means for improving this important ability.

1.1 Components of Delaying Gratification

Mischel, Shoda, and Rodriguez (1989) argued that two distinct components are involved in successfully delaying gratification. The first is deciding that the greater reward is worth waiting for. This can involve evaluating both the rewards and the time needed to wait. If the child does not see any greater appeal of the delayed reward than the immediate reward, then they have no reason to delay gratification. Further, when children are told how long they must wait before receiving the greater reward, they are more likely to choose to delay gratification as delay times decrease (Schwarz, Schrager, & Lyons, 1983).

The second component for delaying gratification successfully is to execute the self-control necessary to carry out the decision to delay. This second component will be the focus of the current project. Metcalfe and Mischel (1999) proposed a two-system framework for understanding the processes that enable, or undermine, self-control. They posit that a “cool” system is one that is cognitively and emotionally neutral, flexible, and strategic. Conversely, a “hot” system is one that is the basis of emotionality, both impulsive and reflexive. The cool system is the basis for self-control while the hot system constantly undermines these controlled efforts. In order to successfully delay gratification, children must first make the decision to delay

and overcome their “hot” emotions with their “cool” cognitions, helping them sustain self-control and wait for the greater, delayed reward.

1.2 Maintaining the Decision to Delay

Several factors are thought to influence whether children’s cool system can override their hot emotions in order to sustain a delay. For one, executive functioning may impact self-control. Several researchers have posited a role for working memory, specifically. Better working memory will allow children to keep in mind the goals of the task and monitor the progress they are making towards that goal (Hofmann, Schmeichel, & Baddley, 2012; Metcalfe & Mischel, 1999). Further, working memory may support self-control by allowing individuals to resist attending to a tempting stimulus, so those with low working memory are more likely to make impulsive decisions than wait for the delayed reward (Hofmann, Gschwender, Friese, Weirs, & Schmitt, 2008; Mitchell, Macrae, & Gilchrist, 2001; Schmeichel, Volokhov, & Demaree, 2008).

There is also evidence that the situation impacts the self-control that children display. For example, preschool-aged children are better able to delay gratification when no rewards are present, with most children waiting a full 15 minutes. Conversely, children are least likely to delay gratification when both the immediate and delayed rewards are present, with the mean length of wait time only about 1 minute (Mischel & Ebbesen, 1970). Preschoolers’ delay time has also been shown to increase when they are distracted from the task itself and from the delayed reward, suggesting that frustration with the presence of the greater, delayed reward may override children’s ability to control themselves (Peake, Hebl, & Mischel, 2002).

There are certain strategies that children may use in order to enhance their capacity for self-control, such as manipulating external factors that allow them to delay gratification longer. Mischel, Ebbesen and Zeiss (1972) found that children’s most effective delay strategy was

behavioral in nature: self-distraction. Young children begin to recognize the effectiveness of self-distraction from a young age, and when asked by an experimenter if there are rules to delay gratification, they answer that rewards ought to be covered rather than exposed, though older children are better able to execute this rule than younger (Mischel & Mischel, 1983). Subsequently, it has been found that children were most able to delay gratification when they were able to remove the influence of the immediate delayed reward in front of them (Mischel et al., 1989; Vaughn, Krakow, Schwartz, Kopp, & Johnson, 1986). Specifically, some children covered their eyes with their hands, plausibly in order to avoid intently watching the reward, thus increasing the time they were able to delay gratification.

Cournoyer and Trudel (1991) categorized children into high, medium, and low self-control groups based on their cumulative delay times. They found several differences in the behavioral strategies employed by these groups; children in the low group looked at their delayed reward more often, and those in the high group were more likely to engage in self-distraction. Children also employed multiple behavioral strategies throughout their delay interval including singing songs to themselves, staring at the ceiling, or talking to the experimenter.

Several cognitive strategies may also help children delay gratification. Specifically, Mischel and Mischel (1983) found that young children understand that it is better to employ task-oriented thoughts than consummatory thoughts (i.e. the marshmallow is sweet and chewy). Sixth graders were also more likely to delay gratification if they had thought about a distraction or an abstract representation (i.e. the marshmallow is puffy like a cloud). Additionally, cognitive transformations were found to aid in children's ability to delay gratification (Mischel & Baker, 1975). In this study, the experimenter suggested to the child one of two cognitive strategies: think about the reward's consummatory aspects (the marshmallow is sweet and sticky) or non-

consummatory aspects (the marshmallow is white and fluffy). They found that consummatory thoughts led to significantly shorter delay times while non-consummatory thoughts about the relevant reward led to longer delay times.

Finally, children are able to employ some self-verbalizations to aid in their ability to delay gratification. In a study conducted by Miller, Weinstein, and Karniol (1978), children were verbally instructed to say a statement that was 1) task-oriented, 2) reward-oriented, 3) irrelevant, or 4) there was no verbalization. They found that third graders were able to delay gratification significantly longer than kindergarteners only in a no-verbalization control group. Task-oriented verbalizations were found to be helpful for both age groups, while reward-oriented verbalizations had a negative effect on third graders' performance, but no effect on kindergarteners.

1.3 Social Influences on Delaying Gratification

There is also reason to think that children's social experiences influence their ability to delay gratification. For one, Mischel (1958) found that there may be cultural differences on decisions to delay gratification; those cultures whose people prefer more immediate rewards have children less likely to choose to delay gratification, while cultures which promote behaviors that end in larger rewards have children who are more likely to choose to delay gratification. Additionally, mothers' parenting style has been associated with children's delay of gratification performance; mothers who exhibited an authoritative parenting style were significantly more likely to have a child who was able to delay gratification than mothers who exhibited a permissive parenting style (Mauro & Harris, 2000).

Limited work has also been conducted examining whether the behaviors of third parties influence children's likelihood to delay gratification. These studies have focused primarily on the first step of successfully delay gratification: the decision. Overall, there is evidence that seeing

someone else make a decision about whether to delay gratification can have an effect on the participant's choice. Stumphauzer (1972) found that adult, inmate participants who observed another inmate (acting as a confederate) delaying gratification were, in turn, more likely to make a delaying decision themselves. That is, participants who first saw a model choose to delay gratification were more likely to decide to delay gratification than those in a control group.

Furthermore, Bandura and Mischel (1965) found that 4th and 5th graders would often switch their delaying decisions after seeing another person's choice; children who had previously shown high-delay behaviors were significantly more likely to choose an immediate reward after watching another person choose an immediate reward. Moreover, children who had shown high preference for immediate rewards were more likely to delay gratification after watching someone delay their reward. These effects were stronger for live models versus symbolic, verbal models. That is, children were more likely to delay gratification after watching an adult choose to delay gratification rather than being told about an absent adult's choice to delay gratification. The effects of seeing the live model's decision was present up to one month later.

Staub (1972) also modeled delay choices to children. He first had all participants partake in a delay of gratification task, and then had a "scientist" approach them, either 1) persuading, 2) modeling, or 3) recommending that the participant should make the choice to delay gratification. He found that modeling delay of gratification increased the delaying behavior of boys, but not girls, and verbal persuasion increased the delaying behavior of girls for a one-week period of time, but only had a short effect on boys. Moreover, Nisan (1976) concluded that boys, but not girls, were more likely to delay gratification as a group, but not individually. Overall, these findings suggest that seeing another person delay gratification leads children to also decide to delay gratification.

1.4 Imitation as a Means of Social Learning

Despite past findings that social models can influence a child's choice to delay gratification, no studies to date have examined whether children can learn specific delay strategies from another person's example, particularly on a task requiring delay maintenance. However, there is reason to believe that children would be able to successfully learn and apply a strategy for delay of gratification through the use of their adept imitation skills.

Past research has shown that children possess the capacity for imitation starting when they are only a few days old and already will reproduce an adult's facial gestures (Meltzoff & Moore, 1983). In fact, by the end of their first year, children are selective in their choices of behaviors to imitate, and are most likely to reproduce the physical outcome of a behavior (Zmyj, Daum, & Aschersleben, 2009), yet by 18 months, children begin to copy unnecessary physical means to solve a task, such as using a hammer to open a box when one's hand could as easily be used (Nielsen, 2006). Interestingly, this faithful imitation persists into adulthood, even when actions are visibly unnecessary, and adults' rates of copying unnecessary actions are even beyond young children's (McGuigan, Makinson, & Whiten, 2011).

However, children do not blindly imitate everything that they see, and they can be selective in their decisions to reproduce a behavior. For example, children can assess intentionality when determining whether to imitate. Children will avoid imitating a behavior that seemed accidental (Carpenter, Akhtar, & Tomasello, 1998), they can determine the end goal of an adult's behaviors (Carpenter, Call, & Tomasello, 2005), and they can successfully imitate a task that was not completed by an adult (Meltzoff, 1995). There is also evidence that children are more likely to copy an adult's behavior as opposed to that of a peer (Wood, Kendal, & Flynn, 2012).

This selectivity in imitation may help children to become adept social learners. Through imitation, children are able to learn from others' examples; preschoolers can even learn abstract concepts from watching others (Williamson, Jaswal, & Meltzoff, 2010). They can also learn game rules from adults, and will object to acts performed by third parties that deviate from the adult's original demonstration (Rakoczy, Hamann, Warneken, & Tomasello, 2010). Therefore, it is possible that children will imitate a strategy that they see an adult use in a delay of gratification task, particularly if they think the action is intentional and useful.

1.5 Delay of Gratification Paradigms

Although the ability to delay of gratification is often considered as one specific trait of a person, there are a variety of paradigms used in its assessment. The first of these, a hypothetical delay choice, presents participants with a series of choices between two rewards, such as twenty dollars today or thirty dollars in a month, but with the knowledge that the participant making the choice will not actually receive either reward (Mischel, 1961). The second is a real choice delay task in which participants again choose between two possible rewards, but with the knowledge that they will receive their preferred reward (e.g., Mischel, 1958; Mischel & Metzner, 1962). The third is another classic delay task, designed by Mischel and Ebbesen (1970), often referred to colloquially as the "marshmallow test." In this task, participants choose their preferred reward from two possible rewards (e.g., a pretzel or a marshmallow). Once they indicate their preference, the experimenter explains to them that they must wait in order to earn that preferred reward. However, they can, at any time, choose to forfeit the delayed reward and immediately eat the less preferred reward. Finally, the accumulation task gives children the opportunity to earn a prize that accumulates at a fixed rate, but stops once the child takes the reward. This

requires the child to refrain from taking already available rewards in order to earn more (e.g., Toner & Smith, 1976; for a review, see Addessi et al., 2013).

Adaptations of these types of tasks have also been employed with non-human primates. Specifically, some past literature has focused on apes and monkeys' delay choice decisions, that is, whether they will choose a smaller, immediately available reward, or a larger, delayed reward. Once the choice is made in these trials, the decision cannot be reversed (e.g., Addessi, Focaroli, & Paglieri, 2011). A second avenue of testing delay of gratification in non-human primates involves measures of delay maintenance, or the ability to successfully execute a decision to delay in face of the tempting, immediately available reward. These studies often utilize an accumulation task, adding an incremental food reward to the earnings over time, so long as they can avoid eating the available reward. This procedure has been used with a variety of non-human primate species (e.g., Beran & Evans, 2012; Pelé, Micheletta, Uhlrich, Thierry, & Dufour, 2011).

Importantly, although these paradigms are often compared to one another, there may be a lack of convergent validity between them, such that each task taps into a different aspect of self-control. To test this possibility, Toner, Holstein, and Hetherington (1977) measured preschoolers' performance on both an accumulation and real choice delay task and found no consistent correlations between these two measures. To date, this is the only study to directly compare different measures of delay of gratification with children within one study. A recent meta-analysis also examined the convergent validity of a multitude of self-control measures and found only moderate convergence overall for delay of gratification tasks, with no superior convergence for any specific delay task (Duckworth & Kern, 2011). These differences also exist for work conducted with non-human primates. Specifically, one study (Addessi et al., 2011)

highlighted capuchin monkey's ability to choose a delayed reward, yet another study (Anderson, Kuroshima, & Fujita, 2010) showed less self-control by this species of monkey in their delay maintenance. Addessi et al. (2013) also tested the same capuchin monkeys on both a delay choice and delay maintenance task and found only limited evidence of a correlation between these two tasks. Taken together, these studies suggest that delay of gratification findings may tap into different aspects of self-control, rather than supporting one overarching argument for self-control as a trait that one possesses (or not). Instead, it is likely that they represent different forms of strategic responding based upon specific contexts.

1.6 The Present Study

The primary goal of the current study is to investigate whether children can learn to employ a behavioral strategy for delaying gratification from observing the acts of another person (covering the eyes). 4-year-olds were selected in order to be comparable with past studies of early childhood delay of gratification (e.g., Mischel & Ebbesen, 1972; Toner et al., 1977), and because pilot testing found variability in their delay times. Children saw an adult demonstrate a strategy (covering the eyes) that has been shown to promote children's delaying gratification. The amount of time this group delayed gratification was then compared to a group of children that saw an adult delay gratification without using a strategy and to a baseline group in which children saw no adult. In addition to measuring the time children delayed, other measures included where children focused their looking throughout the delay period and the spontaneous behavioral strategies that children used while delaying in order to determine if seeing the adult's demonstration led children to take up the demonstrated strategy or increased their use of other strategies. Finally, we measured children's level of working memory and self-assessment to

investigate any differences in how these cognitive functions related to children's ability to learn to delay gratification.

It was hypothesized that children who saw a model delay gratification while using a strategy would, in turn, imitate the demonstrated strategy and employ it during their own delay periods. It was also expected that these same children would be able to delay gratification for the longest periods. Children in this group were also predicted to be the most likely to spontaneously produce other, generalized strategies while delaying.

If children can learn a delay strategy from an adult's behavior, it is possible that some children will benefit from this strategy use more than others. Specifically, children with low working memory may show gains in their delay performance beyond their peers with higher working memory. This gain in performance may be a result of the nature of the strategy; that is, covering the eyes directly minimizes the ability to attend to the reward. Because children with low working memory may struggle with resisting the temptation of the reward because they lack the working memory capacity needed to also maintain why waiting is good, and to remember what they will get if they do indeed wait, this strategy may enhance their delay performance by removing the temptation in front of them and instead allowing them to focus on their delay maintenance. Thus, in this study we will also assess children's working memory, with the secondary goal of determining whether the use of a demonstrated strategy may benefit some children more than others. Thus, children with higher levels of working memory were hypothesized to delay gratification for longer than those with lower levels of working memory.

2 METHODS

2.1 Participants

Forty-eight typically developing 4-year-olds (*M* = 50.9 months, *SD* = 3.2; 26 males) were recruited from Georgia State University's Infant and Child Subject Database for this study. This database includes families living in the metropolitan Atlanta area. In this sample, 67% self-identified as White, 13% as Black/African American, 10% as Asian, and 6% as mixed race (1 family did not report ethnicity). In addition, 81% self-identified as non-Hispanic/Latino, and 8% self-identified as Hispanic/Latino (5 families did not specify). Children's primary caregivers identified as 32% having earned an advanced degree (e.g., M.A., M.D., or Ph.D.), 45% completed a college degree, 15% completed some college work, and 2% completed high school (6% did not report highest level of education). Finally, parents identified their partner's highest level of education and 36% had advanced degrees, 43% completed a college degree, and 11% completed some college work (11% did not report partner's highest level of education).

2.2 Materials

An opaque box (approximately 18 x 14 x 8 cm) initially contained the reward of stickers (approximately 3 cm x 3 cm), and there was a small, plastic, translucent bowl (10 x 11.5 x 5 cm) in which stickers were placed. The experimenter also utilized a small, silent timer during the delay period. Finally, there was a large board (approximately 72 x 51 cm) with 6 colored squares (each approximately 22.5 x 24 cm) used for the working memory measure.

2.3 Procedure

The delay task used here was based on that used by Gonsiorowski et al. (2013). In the present experiment, all children participated with two experimenters. The primary experimenter

directed the procedure, and the second experimenter assisted with strategy demonstrations. Children were randomly assigned to one of three groups: baseline, no strategy, or strategy.

2.4 Instructional Period

Identical instructions were given across groups. The primary experimenter began by showing the children the box of stickers, saying “Look, I’ve got stickers in here.” Then, she put the bowl on the table, explaining that she would put stickers into the bowl one at a time and that the child would get to take home any stickers in the bowl at the end. However, if the child touched the bowl or stickers, the game would be over and the child would not get any more stickers. As a reminder, the experimenter said, “Try not to touch the stickers.”

2.5 Demonstration Period

This period included the experimental manipulation. In the *strategy group*, the demonstration phase afforded children the opportunity to see an adult use a strategy that previously has been shown to help children delay gratification. The primary experimenter told the child that it was the second experimenter’s turn to play the game. She moved the bowl in front of the second experimenter and placed one sticker in the bowl every ten seconds. The second experimenter demonstrated the strategy by covering his eyes with his hands as soon as his turn began. After every third sticker, the primary experimenter asked, “Do you want to stop, or do you want to keep going?” The second experimenter always chose to continue. He earned six stickers before the first experimenter ended the game. He did not uncover his eyes until he was told that the game was over.

The *no strategy group* gave children the opportunity to see an adult delay gratification, without providing an example of a strategy to help them delay. Here, the procedure was the same

as in the strategy group except that the second experimenter looked neutrally at the table (instead of covering his eyes).

Finally, the *baseline group* served as a measure of children's spontaneous performance on the delay of gratification task. A second experimenter was present throughout the session to control for the number of experimenters in the room during the children's response period. No demonstration was conducted. The procedure moved directly from the instructional period to the response period.

2.6 Response Period

The primary experimenter explained that it was now the child's turn to play the game. She placed the bowl in front of the child and added one sticker to the bowl every 10 seconds. She stopped after every three stickers to ask the child, "Do you want to stop, or do you want to keep going?" All children had the opportunity to earn 30 stickers over a five minute period. Throughout the response period, the experimenters did not stare directly at the child, to avoid influencing them, and instead looked neutrally at the timer or the table.

2.7 Cognitive Understanding Period

Immediately after their delay period ended, children were asked two manipulation check questions designed to investigate their ability to evaluate their own self-performance. The first of these questions was "Are you happy with how many stickers you got?" and the second was "Was it easy to wait for the stickers?" Questions were repeated to children if necessary to elicit a yes/no answer.

Finally, children participated in a task measuring their level of working memory that was adapted from Bull, Espy and Wiebe (2008). This task was originally used with 6-year-olds, but was simplified for the younger age group in this study by accepting answers either verbally or

through pointing. In this task, children saw an experimenter point to a sequence of colored boxes on a board (e.g., red, orange, yellow). Children were then asked to recite the blocks in the opposite order as the experimenter (e.g., yellow, orange, red), either through verbal naming of the colors or pointing. The task began with sequences of two blocks and progressed to more blocks until the child failed consecutively on two trials with the same number of blocks. The number of blocks that a child correctly recited served as their working memory score; children who failed twice with two blocks were given a score of 0. This task is considered to be one of working memory because it requires both the storage of information and cognitive processing (e.g., reversing the sequence of blocks).

2.8 Dependent Measures & Scoring

Five dependent measures were scored by coders masked to the hypothesis of the study and the child's group assignment, with the exception of the looking time score. The primary measure is the *delay score*, which reflects how long children were able to delay gratification. The average number of stickers earned by the children across groups was 11.8, or 110 seconds. However, children's *delay scores* were measured in the length of time that they were able to delay gratification, where the time began when the experimenter started the timer and ended when 1) the child touched the bowl, 2) the child verbally asked to stop playing the game, or 3) the 30^{th} sticker was placed in the bowl. Coders used a frame-by-frame view (with 30 frames per second) to determine the number of frames for which children delayed gratification, and then divided by 30 in order to get the length of the delay in seconds.

Three measures were used to assess children's use of delaying strategies. The *imitation score* represented whether the children employed the strategy used by the experimenter, specifically whether they covered their eyes with their hands. This was scored dichotomously on

a categorical scale of 0/1. Scores of 0 represented children not intentionally covering their eyes at any time during the procedure. In order for eye-covering to be considered intentional, children must have covered their eyes for a consecutive 30 frames, or 1 second. Scores of 1 represented children who ever covered their eyes.

Additionally, children's looking time was determined through frame-by-frame coding completed by the author. Children's eye gaze was first recorded for each frame into one of five categories of where they could look (e.g., immediate reward, social category including experimenters and caregiver; see Appendix A). Then, percentages of looking time were calculated for each category by taking the number of frames within each category and dividing by the length of time that the focus of their gaze was visible throughout the delay period. Percentage of time was used to account for different delay lengths between children and to allow for exclusion of time that could not be coded (e.g., if a child's back was turned towards the camera and looking could not be coded). Children's *looking time score* is the percentage of time that their gaze was focused on each of the categories, and all looking time category scores combined summed to 100% of the child's delay period in which their gaze was discernible. Data from four children (1 from the baseline group, 2 from the no strategy group, and 1 from the strategy group) were unavailable.

Children's use of other, non-demonstrated strategies that may have helped them to delay gratification (the *other acts* score) was then measured. The scoring scheme targeted strategies that have been identified in previous studies of delay of gratification (Cournoyer & Trudel, 1991; Vaughn et al., 1986), including pointing to or talking about the reward. This coding scheme focused exclusively on behavioral strategies and verbalizations. It is possible children may also have employed cognitive strategies; however, it is impossible to score many of these covert

strategies (past work has typically told children directly what to think about during the delay interval). A complete list of strategies coded is presented in Appendix B.

To calculate a child's *other acts* score, coders counted each time a particular strategy was used. Importantly, covering the eyes with the hands was *not* counted in this coding scheme since it did not represent a spontaneous behavior for those children in the strategy group. The number of acts the children used was then divided by the number of seconds that they delayed. This helped to account for differences in the amount of time children had to act depending on how long they delayed gratification.

Another measure was children's *working memory score.* Here, children had the opportunity to repeat up to 6 colors backwards. Due to limited variability in higher scores, children received a score of 0, 2, or 3+ based on their performance. Children who earned a score of 0 did not correctly answer any of the working memory trials, as they were never able to repeat any color combination backwards. This is possibly because of their lack of comprehension of the task. Children who could correctly recite two colors backwards earned a score of 2. Finally, children who correctly recited three or more colors backwards earned a maximum score of 3. Data for 10 children's working memory scores are unavailable.

Last, children's *understanding of performance* was assessed through the use of the two manipulation check questions. Both of these questions were scored dichotomously on a 0/1 scale. Scores of 0 indicated that the child answered "no" to the question, and scores of 1 indicated that the child answered "yes" to the question. Upon calculating these scores, however, there was little variability in children's answers (only 10% of questions were ever answered "no"), and, consequently, no further analyses were conducted on these scores.

2.9 Reliability

A randomly chosen 25% of the videos were scored by a second coder who was blind as to the hypothesis of the study and the child's group assignment to assess inter-rater reliability on each of the dependent measures. There was perfect agreement for delay score, ICC(1,2) = 1.0, imitation score, $\kappa = 1.0$, $p < .01$, working memory score, ICC(1,2) = 1.0 and understanding of performance, $\kappa = 1.0$, $p < .001$, and substantial agreement for looking time, ICC(1,2) = .98, and other acts score, ICC(1,2) = .89.

3 RESULTS

A preliminary analysis revealed no gender differences on delay score, imitation score, other acts score, or working memory score, and thus further analyses collapsed across gender.

I first tested for a difference in imitation score between those children who saw the model demonstrate the strategy (strategy group) and those children who saw no demonstrated strategy (no strategy and baseline groups) using a Fisher's exact test (see Table 3.1). This showed evidence of imitation; children in the strategy group were significantly more likely to cover their eyes with their hands than were children in the control groups who saw no strategy demonstrated, $p < .001$.

Table 3.1. The number of children covering their eyes with their hands as a function of group.

Group	Number of Children who Cover their Eyes	Number of Children who do not Cover their Eyes
Strategy	9*	7
No Strategy	0	16
Baseline	1	15

Note. p < .001; N = 48

Next, a one-way analysis of variance (ANOVA) was conducted on the delay score, with experimental group (baseline, no strategy, or strategy) as the independent variable. This test was conducted to examine whether the manipulation influenced delay performance. This revealed a significant difference between the groups on the length of time that children were able to delay gratification, $F(2, 42) = 4.23$, $p < .05$, $\eta_p^2 = .17$. Unexpectedly, the results of *post hoc* Bonferroni tests revealed that children in the baseline group waited significantly longer than children in the strategy group (see Figure 3.1).

On average, children in the baseline group delayed for 177.56 seconds, children in the no strategy group delayed for 124.76 seconds, and children in the strategy group delayed for 71.72 seconds. A *post hoc* independent samples t-test revealed no difference in delay time between children in the strategy group who covered their eyes and those who did not; thus, the detriment in performance was not driven only by the use of a strategy, $t(14) = -.06$, $p = .96$, $d = .03$.

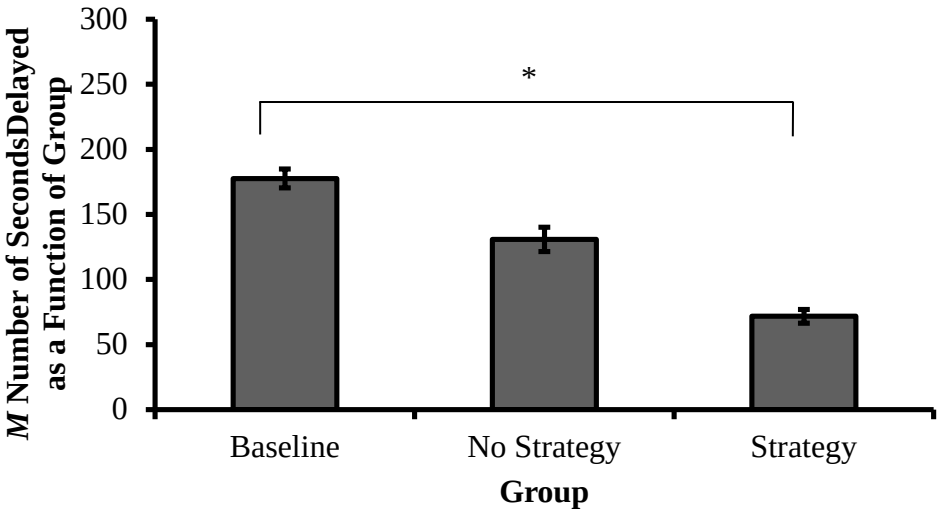

Figure 3.1. Mean number of seconds delayed as a function of group.

In an attempt to better understand how the experimental manipulation impacted children's delay performance, one-way ANOVAs on each of the five looking time categories (e.g., immediate reward, social category) were conducted to determine if there were differences

across the groups of where children focused their gaze while delaying (see Figure 3.2). For this analysis, the Bonferroni correction was used to adjust for multiple comparisons, and the alpha level was set at .01. These tests showed three significant differences in how children deployed their looking behavior as a function of experimental group. Not unexpectedly given the imitation of the model's strategy, there was a significant difference in the amount of time spent with no visual access, $F(2, 42) = 18.03$, $p < .001$, $\eta_p^2 = .47$. Children in the strategy group were significantly more likely than those in the baseline or no strategy groups to spend time with no visual access, (Bonferroni's *post hoc* test, both *p*s < .001).

There were also significant differences between groups for the amount of time the children focused on the immediate reward (their stickers) or the delayed reward (the box containing the stickers), $F(2, 42) = 5.65$, $p < .01$, $\eta_p^2 = .22$; $F(2, 42) = 14.19$, $p < .001$, $\eta_p^2 = .41$, respectively. Children in the strategy group were significantly less likely to look at the immediate reward throughout the delay period than children in the baseline group or the no strategy group, both *p*s < .05. Furthermore, children in the baseline group were significantly more likely to look at the delayed reward than were children in either the strategy group, $p < .001$, or the no strategy group, $p < .01$. However, there was no difference in the amount of time spent looking at the delayed reward between the no strategy and strategy groups, $p = .11$.

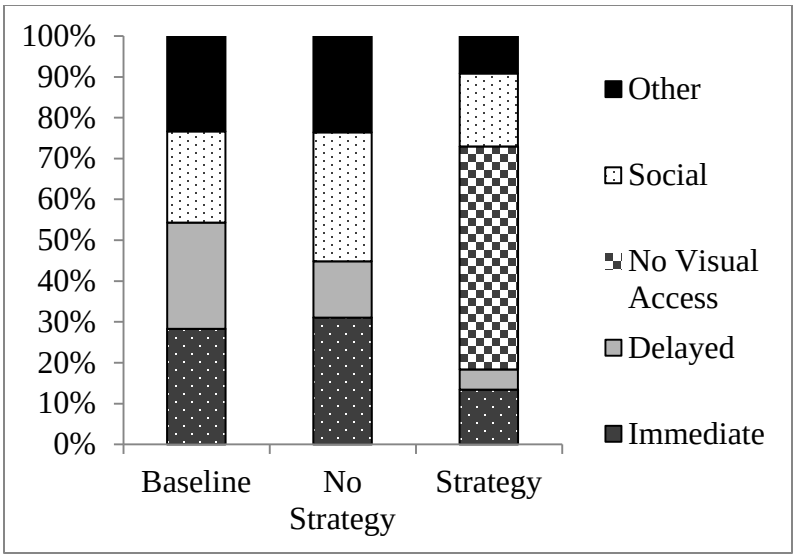

Figure 3.2. Mean percentage of time spent looking at each category as a function of group.

An ANOVA was conducted to test for an effect of the experimental manipulation on children's use of other strategies. This analysis of the other strategies score revealed no difference between groups, (Baseline M = .13, SD = .19, No Strategy M = .52, SD = .97, Strategy M = .16, SD = .32), $F(2, 42) = 1.4$, $p = .26$, $\eta_p^2 = .08$. Thus, seeing a model delay gratification using the eyes-covering strategy did not lead children to employ other related strategies.

Of final interest was the question of whether children with higher levels of working memory were better able to delay gratification. To assess this, a one-way ANOVA was conducted on the delay score, with working memory score (0, 2, or 3+) as the independent variable. This revealed no significant difference between the working memory groups on the length of time that children delayed gratification, $F(2, 36) = .05$, $p = .95$, $\eta_p^2 = .05$, (Score 0 n = 20, M = 136.1s, SD = 121, Score 2 n = 12, M = 113.1s, SD = 96, Score 3+ n = 9, M = 126.9s, SD = 107.6). Thus, these findings suggest that children's ability to delay gratification is independent of their working memory capacity.

4 DISCUSSION

The goal of the current study was to examine whether there were cognitive and social influences on children's delay of gratification performance. The findings indicate that one basic cognitive process, working memory, was unrelated to how long children delayed gratification. However, a social example was found to influence children's delay of gratification performance. Children imitated the eye-covering strategy displayed by the adult. Unexpectedly, despite covering their eyes, children in the strategy group performed significantly *worse* than children in the baseline group in the amount of time that they were able to delay. Children in the no strategy control group showed intermediate performance that was not significantly different from either group. Watching a model perform a strategy while delaying gratification had an unforeseen detrimental effect on children's own delay performance.

4.1 Understanding Strategy Intention

The current finding is in conflict with past research that indicates that covering the eyes is an effective strategy for delaying gratification (Mischel et al., 1989). One possible explanation for this finding is that the eye covering strategy may only be helpful for delaying gratification if it is spontaneously produced by the child, rather than if they are imitating without the complete understanding of why that action is beneficial. It is possible that children who do not understand the strategy's intended effectiveness are actually distracted by the strategy, or see producing the strategy as the goal of the procedure. Past research indicates that children may faithfully imitate the strategy because they think it is necessary, without knowing why (Williamson & Markman, 2006). They then may believe that they have successfully completed the task, and end their delay trial. One piece of support for the proposal that children did not understand the function of the demonstrated strategy in the current task is that there was no difference in their use of other

strategies between the groups. If children successfully understood the purposefulness of the strategy, then they might have extended upon this specific strategy to use other, related delaying strategies, to distract themselves from the reward, such as pointing to the reward, or talking to a caregiver or the experimenter.

Additionally, the demonstrated strategy may not be helpful to children's ability to delay gratification if they do not possess an adequate theory of mind. This may be because theory of mind has been linked to inhibitory control, an essential component in delaying or because successful delay performance requires a representation of both the intended goals and any impediments to that goal, which may require an understanding of higher order mental states (Carlson & Moses, 2001). Indeed, to understand the strategy's effectiveness, it may be necessary for children to understand the intentions of another person, such as "She is covering her eyes because she doesn't want to look at the stickers!" Without this ability, children may imitate the strategy as a means of trying to solve the task correctly, but not benefit from its potential effectiveness. Support for this comes from Carlson, Moses, and Claxton (2004) who argued that an absence in theory of mind may reflect a child's difficulty in comprehending another person's intentional plan, such as using an effective strategy to aid in delay of gratification.

4.2 Strategy/Task Pairing

A second possible reason that viewing a model covering the eyes hinders delay performance involves the type of delay task used. The current study measured children's ability to delay gratification using an accumulation task, in which children receive incremental rewards throughout the delay period (in this study, 1 sticker every 10 seconds). This differs from the Mischel et al. (1989) study, in which these researchers used a classic delay of gratification task, where children were offered a reward, and then had to wait for the duration of the delay period to

earn said reward. It is plausible that children may benefit from covering their eyes in this classic paradigm because by keeping the reward out of sight they minimize its temptation. Conversely, children may actually benefit from watching the reward in an accumulation task. Doing so may allow them to 1) ensure that they are still getting a reward throughout the duration of their delay and 2) get the potentially rewarding experience of watching their reward accumulate.

The looking time data support the proposal that watching the delayed reward may be beneficial in the accumulation task. Children in the strategy group, who on average delayed for the shortest time, were significantly less likely to look at the immediate reward than children in either the baseline or no strategy groups. Further, children in the baseline group were most likely to monitor the delayed reward and also to delay for the longest period. Children in the no strategy group, who showed intermediate performance, were more likely than children in the strategy group to look at the immediate reward, but less likely than those in the baseline group to look at the delayed reward. Thus, seeing a model that minimizes the amount of time spent watching the reward accumulate led children to avoid watching the reward themselves, and they also delayed for shorter times. Conversely, children who saw no model, and thus had no cues on where to direct their gaze, actually showed better delay performance.

4.3 Future Directions

The current study indicates that a social example can influence children's delay of gratification performance, albeit in the opposite direction from what was predicted. This finding does suggest that imitation may be a plausible means for promoting children's performance. If children were given the example of a model covering their eyes with their hands in a classic delay of gratification task, they may outperform other children who saw no demonstration. Further, they may show improved performance on an accumulation task if they were shown a

different (effective) strategy for this task, such as focusing their gaze on the delayed reward intently. Alternately, older children, who may better understand the intended function of the strategy, may also benefit from the adult's example. Thus, future research is needed to determine how to effectively utilize a social example to promote children's delay performance.

The imitation manipulation used in the current study alone likely does not provide enough experience with training for delay of gratification to enhance children's overall self-control, and the related long-term consequences. However, it does act as a first step towards a line of research examining how best to aid children's ability to delay gratification. It was found here that children can spontaneously imitate a strategy that can be used while delaying gratification, although this strategy may not be one that is useful in everyday encounters with delay of gratification situations. A future intervention could give children a strategy that aided in delaying gratification in one scenario, and then ask them to generate other strategies that would also be effective. For example, covering the eyes with the hands may not always be an effective strategy, but it may be helpful to divert attention away from the temptation. Finding multiple effective delay strategies to use may influence how children approach a delay situation in their everyday lives, and may provide them more opportunities for long-term self-control benefits. Teaching these strategies for later opportunities for self-control may be what is necessary to improve children's self-control overall, and enhance later related developments, such as academic and social successes.

However, it is also necessary to target only children who would conceivably benefit from such a training regimen. Specifically, although this study found no evidence for individuals with higher levels of working memory capacity waiting longer than those with lower levels of working memory capacity, past research (e.g., Schmeichel, Volokhov, & Demaree, 2008) has

found a clear link between working memory and self-control. Thus, children with higher working memory capacities may not reap any benefits from delay of gratification training, because they are already performing at optimal levels. The focus, then, should be on those children with lower working memory levels, who may, on their own, struggle with maintaining a choice to delay gratification. By providing them with effective strategies to more ably delay gratification, they may reach performance levels of their higher working memory capacity peers.

In summary, the current study extends previous literature by providing evidence that children can learn a model's demonstrated strategy for delaying gratification, even when no mention of the strategy was made. It has also shown that children's performance on a delay task can be socially influenced, but leaves open the question of the mechanisms of such influence. Finally, it calls into question in what situations a particular strategy is helpful to children, and leaves open avenues of research to determine how best to improve the ability to delay gratification in preschoolers.

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APPENDICES

Appendix A: Children's Eye Gaze Categories

1. Immediate reward (this includes stickers in the bowl in front of the child, or when the sticker is in the experimenter's hand moving towards the bowl)
2. Delayed reward (this includes the box containing stickers)
3. No visual access (this includes when children cover their eyes with their hands, or close their eyes)
4. Social (this includes when the child is looking at experimenter 1, experimenter 2, or their caregiver)
5. Other (this includes instances where children are focused on something other than the categories above, such as looking at the wall next to them, or into their laps, or when children's eyes were moving from one place to another, without focusing on anything)

Appendix B: Behavioral Strategies Coding Scheme

Category	Description
Reward-directed	Point to reward
Social	Touch caregiver/experimenter
Task Vocal	Talk about reward, task, waiting, time
General Vocal	Talk about things other than reward, "chatting" to someone in the room
Gross Motor	Stand, turn in chair
Fine Motor	Drum fingers on table, put hands in lap, rest head on hands/arms