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Review of the Literature on Delay of Gratification Behavior as it Relates to Pre-Academic Social Skills and to Academic Success

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REVIEW OF THE LITERATURE ON DELAY OF GRATIFICATION BEHAVIOR AS IT
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REVIEW OF THE LITERATURE ON DELAY OF GRATIFICATION BEHAVIOR AS
IT RELATES TO PRE-ACADEMIC SOCIAL SKILLS AND TO ACADEMIC
SUCCESS

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TITLE: REVIEW OF THE LITERATURE ON DELAY OF GRATIFICATION BEHAVIOR AS IT RELATES TO PRE-ACADEMIC SOCIAL SKILLS AND TO ACADEMIC SUCCESS

MAJOR PROFESSOR: Dr. Jonathan C. Baker

This review of the literature on self-control and delay of gratification behavior spans educational research, cognitive theory, and behavioral experiments as a deeper exploration of the delay of gratification paradigm in the larger context of society's goal of improving the social and academic performance of its members. The body of literature ultimately suggests five things: first, that children's academic success is in some ways predicated on pre-academic skills such as social orientation; second, that these pre-academic skills are themselves predicated on self-control; third, that the cognitive and developmental theories of self-control are correlated with delay of gratification behavior; and fourth and finally, that delay of gratification behavior can be improved through environmental changes and behavior training. Future research directions, in light of the myriad threads of research discussed, are presented.

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A handful of experiments in the field of behavior science are considered to have cultural and historical impact to the degree that they might be considered popular knowledge. The delay of gratification experiment, colloquially referred to as the "marshmallow test" is one such experiment. Mischel and colleagues developed the marshmallow test to evaluate delay of gratification behavior in the early 70's (Mischel, & Ebbesen, 1970). The fundamental framework of this experimental design is this: the experimenter brings a child into the test space and teaches him that two reward options are available: one marshmallow (or similar reward, such as cookie or pretzel) to eat immediately, or two marshmallows (or similarly more desirable reward) to eat only after the experimenter returns after a length of time. The length of time the child waits for access to the preferred reward, the delay of gratification behavior, is measured and compared to other variables and outcomes. The ability of the child to delay gratification is considered a satisfactory measure of a child's self-control, and self-control in turn, has been proven to be a crucial factor determining social integration and school success.

This review of the literature on self-control and delay of gratification behavior spans educational research, cognitive theory, and behavioral experiments. The body of literature ultimately suggests five things: first, that children's academic success is in some ways predicated on pre-academic skills such as social orientation; second, that these pre-academic skills are themselves predicated on self-control; third, that the cognitive and developmental theories of self-control are correlated with delay of gratification behavior; and fourth and finally, that delay of gratification behavior can be improved through both environmental changes and behavior training.

Social Aspects of School Readiness

In 1989, President Bush Sr. set a national goal for education. "By the year 2000, all children in America will start school ready to learn" (Lewitt, & Baker, 1995, p. 128). Lewitt and Baker (1995) suggest that while this is an admirable goal, it is not an effective mandate for policy change, for it is neither precise nor measurable (p. 128). That is, there has been considerable disagreement about what "ready to learn" even means, much less which systematic changes may bring this goal about. Lewitt and Baker (1995) report that the National Education Goals Panel, an independent federal agency established by the U.S. Department of Education in 1994, set specific objectives in an effort to achieve the national goal: provide subsidized preschool programs, improve parent commitment to education, and disseminate health and nutrition recommendations for young children (p. 136). Benchmarks, or indicators of progress toward each objective and ultimately toward the goal that children begin school ready to learn, have been based on available data on a federal level.

The government mandate that American children "start school ready to learn" may be a combination of two distinct concepts: readiness to learn, and readiness for school (Carlton, & Winsler, 1999). Readiness to learn is conceptually an issue of developmental progress, while readiness for school is about successful integration into a typical school environment. Children must conform to both developmental and educational standards set by the school in order to be successful in kindergarten. Carlton and Winsler (1999) argue that this has led to an increased emphasis on the maturational approach to school entry (the maturational theory which predominates education practice is that children must be at a certain biological developmental stage to benefit from education), and takes the pressure off of elementary schools to ensure their

programs satisfy the individual needs of new students and instead encourages schools to place

the onus of preparedness on the children entering kindergarten (p.338).

Preschool programs such as Head Start have been established in communities around the

nation-in an attempt to bolster the school-readiness of young children, particularly in

disadvantaged groups. The existence and continued success of such programs suggest that, in

direct opposition to the maturational view of school readiness, the skills necessary to

successfully enter kindergarten can be taught and such skills have a proactive effect on school

achievement (Currie, 2001). From a cost-analysis perspective, preschool programs can save the

government and disadvantaged communities a great deal of money if programs such as Head

Start meet "even a quarter of the long-term gains of model programs" (Currie, 2001, p. 214).

Currie (2001) effectively argues that preschool programs provide preventative measures that can

reduce common problems during kindergarten and beyond.

Children who begin kindergarten without pre-academic and basic academic skills such as

communication abilities, curiosity, self-discipline, or the fundamentals of reading and writing are

in danger of failing in their early education (Ramey, & Ramey, 2004). Ramey and Ramey

(2004) report that proactive intervention such as a high quality preschool program has been

shown to be more effective than remedial education in stemming the tide of negative outcomes

resulting from initial failures. Ramey and Ramey (2004) evaluated the effects of their proactive

Abecedarian preschool program for preschool aged children from low-income homes with

uneducated mothers. The Abecedarian program, which provided an individualized teaching pace

for cognitive, fine motor, social, and language skills, had a proactive effect on these high-risk

children when compared to a control group. The effects were examined through a randomized,

controlled trial: 111 high risk children were assigned to either the control group (which received

healthcare and social services, as well as adequate nutritional programs) or the treatment group (which received the same basic care as the control, as well as the Abecedarian preschool program). Children who participated in the Abecedarian program showed significantly improved cognitive and academic progress during the pre-school years versus the control group (the effect size, or difference between z scores of the treatment and control groups, between 18 months and 4.5 years averaged 1.08 and ranged from .73 to 1.45).   The results of their small-scale study optimistically prove that preschool programs can improve academic outcomes for disadvantaged children.

What specific factors of compensatory preschool programs are effective? While the requirements to enter kindergarten generally emphasize academic skills in literacy, language, and mathematics (Neuman & Roskos, 2005), national surveys suggest that parents and teachers believe that the key to school adjustment lies in pre-academic factors such as health, communication skills, and curiosity (West, 1993). Lin, Lawrence, and Gorrell (2003) have reported that teachers, especially the most experienced ones, emphasized the value of social aspects of learning when evaluating children's preparedness. Cooperation and attentiveness, self-control and problem-solving topped the skills considered important. The federally funded Head Start program Some research indicates that compensatory early education (programs such Head Start) correlate with students' kindergarten adjustment and later academic success.

The effects of compensatory education may be mediated by the quality of the individual's peer and teacher relationships and his level of classroom participation (Fantuzzo, Bulotsky-Shearer, Fusco, & McWayne, 2005). Future research would further explore the effective components of early childhood education, but the study by Coolahan, Fantuzzo, Mendez, and McDermott (2000) suggests that social skills and pro-academic behaviors are highly correlated

and that increasing social skills might be a key factor in compensatory education's success. The study compared teacher questionnaires about peer play behavior and academic involvement in high risk preschool students. Peer play interaction was positively correlated with positive learning behaviors (R=.68) while play disruption and play disconnection were negatively correlated (R=-.76 and R=-.70, respectively).

The relation between social orientation and early school adjustment were evaluated in a series of studies by Ladd and colleagues. Specific social dynamics were correlated with teacher evaluations of academic performance and adjustment: peer relationships, (Ladd & Price, 1987; Ladd, Kochenderfer, & Coleman; 1997) and teacher-student relationships (Birch & Ladd, 1997; Birch & Ladd, 1998).

Ladd and Price (1987) evaluated the correlation between peer relationships and school adjustment during the transition from preschool to kindergarten. The researchers observed peer interactions to rate overall social orientation, assigning each subject both a positive (proportion of classmates with whom >51% of observed interactions were prosocial in nature: i.e., cooperative play or social conversation) and negative score (proportion of classmates with whom >51% of interactions were agonistic: i.e, aggression or noncooperation). They found that prosocial orientation toward peers was stable over time and predicted teacher ratings of successful school adjustment outcomes at the end of kindergarten. Antisocial orientation showed even greater stability over time than prosocial orientation, and predicted teacher ratings of maladjustment at the end of kindergarten.

Birch and Ladd (1998) examined the relationship between social orientation and student-teacher relationships in kindergarten and first grade. Teacher questionnaires about students' social orientation were scored for three outcomes: prosocial orientation (tendency to move

"toward" others through positive interaction), antisocial orientation (tendency to move "against" others through aggressive or distractible behavior), and asocial orientation (tendency to move "away" from other with fearful behavior or avoiding interaction). Various dimensions of teacher-student relationships were evaluated via a separate questionnaire. Results showed that the quality of teacher-student relationships and ratings of social orientation were concurrently related (i.e., significant correlations were found between each social orientation type and each dimension of the teacher-student relationship in kindergarten), and that the ratings of relationships and orientation from kindergarten predicted features of the the teacher-student relationship in first grade.

In a study of the qualitative features of the teacher-child relationship and its effect on early school adjustment, Birch and Ladd (1997) proposed three discrete dimensions of the teacher-child relationship in kindergarten: closeness, which encompasses warmth and communication between teacher and child; dependency, which is indicative of over-reliance on the teacher; and conflict, which describes the level of discordance in the child-teacher interactions. They found that the closeness of the teacher-child relationship positively correlated with school adjustment measures. Dependency and conflict correlated negatively with adjustment, as hypothesized.

Ladd, Kochenderfer, and Coleman (1997) evaluated multiple aspects of peer relationships and their specific contributions to overall school adjustment outcomes. The effects of peer acceptance, friendship (number of mutual friends and best friendships), and peer victimization were examined for their unique and combined effects on school adjustment during the course of the kindergarten year. School adjustment outcomes were measured through three criteria: school affect (via a loneliness rating scale), school liking and avoidance (via the School Liking and

School Avoidance Questionnaire), and school performance (via standardized academic tests and teacher ratings). Results showed that each of the specific peer relationships were only moderately related: one type of peer interaction did not necessarily correlate with the others. However, the relationship measures together accounted for a significant portion of the variance in each criterion of school adjustment, suggesting that various aspects of peer relationships uniquely contribute to overall school adjustment.

Taken together, Ladd's publications confirm that a strong relation between social orientation (an individual's mode of interaction with others which leads to positive or negative relational outcomes) and adjustment to the school environment. These findings suggest a research direction toward understanding the complex interactions between specific factors of social relationships and early school adjustment.

Raver and Zigler (1997) discuss the relative importance of social competence in regards to early school adjustment, as well as the difficulties of using social competence as a measure of success of compensatory preschool programs. Namely, that "evaluators may be hesitant to utilize social development outcomes in their research, on the grounds that the construct of social competence is sufficiently nebulous" (p. 364). If we cannot quantify social competence as we can academic competence, can we justify its use as a measurement of preschool viability? But as the authors ultimately affirm, social competence is definable, predictable, as well as predictive of future outcomes such as school adjustment and academic performance.

Specific Social Skills Related to Academic Success

Social competence, one of the linchpins of successful preschool programming, has been proven to be positively correlated with school adjustment. But what specific social skills best predict future success? Ladd and company (Ladd & Price, 1987; Ladd, Kochenderfer, &

Coleman; 1997; Birch & Ladd, 1997; Birch & Ladd, 1998) previously concluded that social orientation has a lasting impact on school adjustment, but it had not yet been determined what particular skills children required to succeed among their peers or in academics.   This section describes research efforts that have ultimately concluded that self control skills (i.e., executive function, effortful control, or learning-related social skills), such as concentration, patience, and emotional control are crucial in the development of relationships with peers and teachers and ultimately to one's ability to learn.

Ladd, Herald, and Kochel (2006) summarized the importance of social skills in a kindergarten classroom as they evaluated social orientation's effect on relationships classwide. They found that, in general, prosocial orientation promotes healthy relationships, and that supportive relationships with peers and teachers in kindergarten promote positive attitudes and high levels of school achievement which persists through grade school. They concluded that specific social skills that might influence or comprise overall social orientation might be found to uniquely influence academic success.

McClelland and Morrison (2003) explored this research avenue as they examined the emergence of specific social skills and their correlation to students' performance during the year. The term "learning-related social skills" (LRSS) was defined as specific skills that were indicative of academic success, such as following directions and staying on task.   The authors assert that while previous research terminology may differ, "executive function," "self regulation," "mastery skills," and "social competence" all reflect skills related to independence, responsibility, self-regulation, and cooperation and are therefore inseparably connected as dimensions of LRSS (McClelland & Morrison, 2003, p. 208). Teacher questionnaires about student performance and standardized measures of LRSS were compared. The results confirmed

that the specific skills of mastery behaviors, assertion, self-control, and cooperation were significant indicators of the larger construct of LRSS. The ratings of these behaviors were stable over time.

The development of specific programs designed to increase LRSS in young students across the country suggests that early education is beginning to acknowledge the existence of social prerequisites of academic success. Webster-Stratton and Reid (2004) aimed to increase social and emotional competence with their Incredible Years curriculum. The curriculum is comprised of 64 15- to 20-minute lesson plans teaching techniques to improve specific skills such as understanding rules, concentrating on work, sharing, and communicating and coping with strong emotions. Teachers were trained to incorporate the lessons into daily activities to provide naturalistic opportunities to practice new skills. The program had been adapted to large scale use in preschool classrooms from a treatment program for children with externalizing behavior problems and their parents. Further research was published in later years that show that the Incredible Years curriculum was well-received as an evidence-based program, showing an increase of social skills in students who were taught the curriculum as well as high satisfaction ratings from teachers (Webster-Stratton, Reid, & Stoolmiller, 2008).

In a longitudinal study of kindergarteners through 2nd grade, McClelland, Morrison, and Holmes (2000) examined the relation between LRSS and school performance. The study specifically targeted work-related skills such as following directions, staying on task. The results show that work-related skills predicted reading and math skills, and that poor work-related skills correlated with a number of known risk factors such as low IQ, medical and physical problems, and behavioral difficulties. The authors suggest the need to emphasize the work-related skills such as independence, self-regulation, and cooperativeness especially with young at-risk

children. Further research on LRSS shows that the construct which includes self-regulatory

behaviors (such as planning, organizing, and self control) and social competence skills (such as

listening, sharing, and following directions) uniquely predict students' math and reading skills at

the end of 6th grade (McClelland, Acock, & Morrison, 2006).

In fact, in one study, self regulatory behavior was better at predicting academic

performance than even IQ. In an observational study across one school year, Duckworth and

Seligman (2005) evaluated the correlation between self-discipline and academic performance in

8th graders. Evaluations included questionnaires, teacher reports, delay discounting tasks, delay

of gratification tasks, IQ tests, grades, attendance, and standardized test scores. They found that

self-discipline accounted for more than twice the variance in measures of achievement than IQ, a

factor commonly attributed as the primary factor of academic performance.

Related to the terms "self-control" and "self-regulatory behavior" is the concept *effortful

control*. Effortful control is defined as "the efficiency of executive attention--including the

ability to inhibit a dominant response and/or activate a subdominant response, to plan, and to

detect errors" (Rothbart & Bates, 2006, p. 129). Valiente, Lemer-Chalfant, Swanson, & Reiser

(2008) evaluated the effect of effortful control, as well as school relationships (both peer and

teacher) and class participation, on academic competence. School relationships and class

participation were included because previous research indicates that these variables are

associated with academic competence, and the goal of the study was to examine the unique and

overlapping impact of effortful control on academic competence. In a sample of 7-12 year old

students, academic competence was assessed via school records of grades and absences and the

remaining constructs were examined through questionnaires: teacher-, parent-, and self-report.

Analysis of the multireporter questionnaires showed reliable scores across reporters for each

construct, so the average scores across reporters were used for further examination. Analysis

shows significant correlations between all four variables, as well as mediation effects of social

relationships and classroom participation on effortful control. Partial mediation of effortful

control on academic performance suggests that effortful control may have both direct and

indirect effects on academic competence, i.e., effortful control uniquely predicts some variance

in academic competence, but it may also influence social relationships and classroom

participation, which in turn effects academic competence.

Valiente, Lemery-Chalfant, and Swanson (2010) examined the effect of effortful control

and emotionality on academic achievement in a short-term longitudinal study of kindergarteners.

Using teacher and parent reports to measure emotionality and effortful control as well as

standardized academic tests to measure achievement, the authors found that at low levels of

powerful emotion (anger and sadness), students who ranked high in measures of effortful control

performed the best. At high levels of emotion, all students performed similarly. These results

suggest that the positive effect that effortful control has on academic performance may be

-mediated by emotionality.

Eisenberg, Valiente, and Eggum (2010) argue that review of existing self-regulation and

academic performance literature shows that the effect of effortful control on school performance

is likely mediated by its effect on prosocial skills. School adjustment is not only related to one's

ability to learn, but also to some extent dependent on social competence. Effortful control

appears to be a critical component in the development of emotional regulation and social

competence, which in turn influences academic success.

Liew (2011) elucidates the overlapping concepts central to the behavioral study of

effortful control and the cognitive study of executive function. Broadly defined, self-control is

the place where those concepts meet: self-regulation, or self-control, encompasses both the behavioral and the cognitive processes which "allow individuals to maintain optimal levels of emotional, motivational, and cognitive arousal for adaptation" (p.2). Adaptation, in this case, means successful adjustment to the school environment with respect to both social and academic requirements. Liew's (2011) position is that research in the cognitive field and the behavioral field must be viewed as complementary rather than opposing, in order for a full understanding of self-regulation and its impact on social-emotional competence to emerge.

Executive function is a construct composed of cognitive processes including "the maintenance of information in working memory, the inhibition of prepotent responding, and the appropriate shifting and sustaining of attention for the purpose of goal-directed action" (Blair, Zelazo, & Greenberg, 2005, p. 561). A neurobiological defense of executive function abilities gives further credence to behavioral self-control literature by confirming results from another angle. Blair (2002) examined the biological evidence of the developmental stages and their impact on school-readiness. The argument emphasizes the need for children to develop self-regulatory skills, as research suggests that "self-regulatory skills underlie many of the behaviors and attributes which are associated with successful school adjustment" (p. 112). Ultimately, Blair (2002) argues, research should focus on the ontogeny of self-control and the development of programs which promote the emergence of such.

Diamond, Barnett, Thomas, and Munro (2007) designed a procedure to implement a specific curriculum ("Tools of the Mind") intended to increase executive function in preschoolers and compare its effects to a traditional curriculum. Executive function in this context is a construct composed of working memory, inhibitory control, and cognitive flexibility. Using a behavioral skills training procedure to increase self-regulatory private speech, executive

function skills were taught and evaluated across 18 classrooms. These skills increased in all 18 groups compared to traditional classrooms. Students in the executive function training groups also received academic testing, which illuminates the correlation between specific executive function tasks and academic performance.

Delayed Reinforcement and Measures of Self-Control

Self-control, being a prerequisite to social and academic accomplishment, has been studied in a number of disciplines in myriad ways. While the previous section illuminates many ways that self control may be defined, examined, and found crucial to school readiness; this section focuses on the behavioral approach: namely, the evaluation of discrete and observable behaviors that occur as a result of delayed consequences. The theoretical implications of time and mediating behavior are discussed and two research paradigms often used to determine individual tolerance for delay are explored.

Howard Rachlin (1974) discusses the many implications of the term "self-control." The author posits that self-control, which describes both the decision to delay outcomes as well as the covert motivation involved in the maintenance of that choice, is simply a function of time. Simply put, "take the temporal issue away and the issue of self-control goes away as well" (p. 94). Rachlin (1974) argues that when the consequences of behavior are not immediate, psychologists have traditionally translated the temporal effects into events inside the organism and have invented mediating mechanisms. The author argues that in the behavioral paradigm, terms such as "self-control," "ego strength" or "resistance to frustration" are unnecessary because such temporal effects can be applied to the behavior itself (Rachlin, 1974, p. 95). The theory of this delay gratification behavior is characterized by an interval of delay of consequences. The maintenance of that decision requires covert as well as overt techniques

which may come with maturation or a learning history which encourages delay behavior. Thus, self-reinforcement and the covert mediators of delayed reinforcement are necessary to bridge the gap between the delivery of a contingency and the delivery of the reward. Strategies that enhance the salience of delayed consequences and improve commitment "bring behavior initially into conformity with long term consequences" (Rachlin, 1974, p.105). The scientific examination of the self-control phenomenon requires an understanding of how self-control effects adaptive behavior, internal and external factors which affect self-control, as well as the various behavioral and developmental components which help and hinder the capacity to delay reinforcement.

Stromer, McComas, and Rehfeldt (2000) reviewed research on the factors necessary to delay reinforcement. They found that establishing a learning history which favors adaptive self-control behavior is crucial. That is, self-control is established when reinforcement is consistently delivered after successful waiting. The use of signals and the development of rule-governed behavior is also key. Stimuli which reliably predict delayed reinforcement can also be maintained to control behavior through delayed reinforcement.

Mahrer (1956) evaluated the preference for delay in 2nd and 3rd grade boys in the context of varying probability. Mahrer (1956) hypothesized that the subjective value of delayed reinforcement is effected by "expectancy," or, the probability held by an individual that future consequences will occur (p. 102). The level of expectancy that the reward would ultimately be delivered in the testing trial was manipulated by systematically varying the probability that the large, delayed reward was delivered over the course of five training trials. Results show that the preference for a larger, delayed reinforcer increases predictably as the probability of receiving that reward increases. This finding is consistent with previous self-control research: a learning history favoring a delayed positive consequence which fails to be presented causes an increase in

one's preference for immediate reinforcement. Conversely, a learning history wherein delayed consequences are assuredly delivered increases one's choice for larger, delayed rewards over smaller, immediate rewards.

Mischel and Grusac (1967) evaluated the relative effects of delay interval and the probability of receiving a consequence on preference for immediate versus delayed reinforcement, as well as on immediate versus delayed punishment. Fourth and fifth grade children were asked to make real choices between smaller, immediate positive and negative outcomes (reinforcement and punishment) and larger, delayed positive and negative outcomes. For half the subjects, the delay interval was held constant while the probability of receiving the delayed consequence was varied (P=.1, .5, and 1.0). For the other half, the delayed consequence was assured (P=1.0) but the delay interval varied (1 day, 1 week, and 1 month). Results show that generally, as the probability of delayed consequence increased, subjects were more likely to choose delayed reinforcement and immediate punishment. As the probability of delayed consequences decreased, subjects were more likely to choose immediate reinforcement but delayed punishment. By examining the specific effect that the probability of receiving a delayed consequence has on delay behavior, this study suggests that the natural consequences in the individual's learning history may have a significant impact on preference for immediate versus delayed gratification.

In the delay discounting task, a series of hypothetical questions test for the preference for small, immediate rewards versus larger, delayed rewards. The subject is asked to imagine that the amount of time he must wait for the delayed outcome is longer or shorter in each successive question. The indifference point, or the point at which subjects equally prefer immediate or delayed rewards, is presumed to measure impulsivity and self-control (Rachlin, Reineri, & Cross,

1991). Rachlin, Reineri, and Cross (1991) developed this delay discounting test to compare with a similar test which varied the probability of receiving the larger reward rather than the length of delay. Both of these tests were developed based on the discounting function predicted by previous non-human research. In the delay discounting test, the subjects were asked to imagine that they would receive the larger reward after successively longer delays (1 month, 6 months, 1 year, 5 years, 10 years, 25 years, and 50 years). In the probability test, the subjects were asked to imagine that the likelihood of receiving the larger, delayed reward is successively smaller, expressed as a percent chance (P=95%, 90%, 70%, 50%, 30%, 10%, and 5%). Results across subjects showed a similar hyperbolic discounting curve for both delay and probability, or similar discounting of the subjective value of the reward as a function of both time and likelihood of receiving award. This finding further suggests a relation between the subjective value of delayed rewards and the likelihood of receiving those rewards.

In a study by Mischel, Grusac, and Masters (1969), subjects were presented with a hypothetical series of outcomes and asked to rate their level of interest in each. The outcomes were varied on two dimensions: they were either delayed or immediate and either reinforcement or punishment. Subjects' preference for immediate or delayed consequences were evaluated to determine the subjective value of delayed reinforcement and punishment. Mischel et al. (1969) evaluated the responses of both children and adults and found that when the same reward was offered immediately or at various times in the future, the subjective value of the reward decreased as the waiting period increased. This effect occurred in both groups, though more sharply in children. However, when the same procedure was replicated with punishment, adults always preferred immediate consequences, but children showed no preference. This difference

suggests a developmental change in temporal perspectives which may guide behavior regarding delayed outcomes.

The delay of gratification paradigm (the self-imposed delay model, as favored by Mischel) and the delay discounting procedure (which is more often used in impulsivity research) are highly related, but not equivalent. Delay of gratification differs from the delay discounting paradigm in that delay of gratification requires the ability to sustain a choice for delayed outcomes in the face of less attractive, immediate alternatives. Delay discounting tasks evaluate only the initial choice for preferable delayed rewards. While the ability to delay gratification is likely to affect the performance on a delay discounting task, the opposite is less likely to be true. (Reynolds, Schifflbauer, 2005).

In an attempt to understand the utility of the delay of gratification paradigm as a measure of self-control -- as well as its predictive power in future achievement, Shoda, Mischel, and Peak (1990) compared variations of the technique and evaluated their correlation to academic competence in adolescence. The delay of gratification task, often employed by Mischel and his colleagues, examines the ability of individual subjects to delay gratification under such conditions that waiting provides more favorable rewards. In the basic design, the experimenter brings students into a room with minimal distractors and simultaneously presents more- and less-preferred rewards. The experimenter explains that he will be leaving the room for a while, and if the child waits until he returns, he will get the preferred reward. If he calls the experimenter back into the room before the time is up, he will get the non-preferred reward. The variations of this basic task were arranged in a 2X2 fashion: the presence or absence of the reward in the room while the subject waits, and the usage or lack thereof of specific instructions of what to think about while he waits. Findings indicate that when no strategies were suggested and temptation

was high (i.e., in the condition wherein the reward was present and no ideation instructions were provided), individual differences in children's ability to delay correlated with 12 of 14 ratings of competence and self-regulation in adolescence. In the other three conditions combined, only 3 such ratings correlated. The authors hypothesize that the first condition represents the most naturalistic environmental state, where individual's spontaneous self-instructions or covert activities may be indirectly measured. The remaining conditions obscure these covert abilities by providing relatively empowering environments which facilitate delay, regardless of individual proclivities.

Mischel, Shoda, and Peak (1988) found that preschoolers' level of success at a delay of gratification task correlated to parents' positive ratings of personality in adolescence. Children who waited longer at 4 and 5 years of age were rated by their parents a decade later as more academically and socially competent than their peers who waited less successfully.

McClelland et al. (2007) sought to prove the relation between behavior regulation and emergent academic skills in preschoolers. The "Head to Toes" task is implemented by simply instructing a subject to "touch your toes" and "touch your head," and then instructing them to switch the rules for each command. It has been shown in the past to be an effective measure of behavioral regulation by tapping an individuals' ability to pay attention, follow rules, and inhibit their natural response. Using the "Head to Toes" task as a direct measure, the study shows a positive correlation between inhibitory control and emergent math and reading skills in several groups, with results stable throughout the school year. While this task differs from the delay of gratification task, which has most frequently been utilized in the realm of self-control research and the delay discounting task, which is commonly used to measure impulsivity, all measures of

behavioral regulation's correlation with future academic success is crucial to our overall understanding of the subject.

Bembenutty and Karebenick (2004) developed an assessment tool (the Academic Delay of Gratification Scale, or ADOS) to evaluate students' preference for delayed academic outcomes (ie. high marks on a future test versus going to a concert tonight). This tool was implemented alongside a measure of cognitive strategies such as organization and rehearsal of academic tasks, in the hopes of illuminating factors which help and hinder delay of gratification. Results show that high marks on the ADOS correlate with high self-regulation abilities and abundant cognitive strategies to cope with impulse dampening. Specifically, their results suggest that it is likely that facilitative beliefs about the future (future time perspective) increase the likelihood of succeeding at academic tasks.

Performance on a delay of gratification task in preschool may predict inhibitory abilities a decade later. In a longitudinal study, Eigsti et al. (2006) found that scores on the delay of gratification task and scores on a go/no go task ten years later were positively correlated. The research suggests that the two measures are effective indicators of cognitive control and point to the individual development of self-control and its corresponding regions of the brain. Specifically, participants who directed their attention away from rewards as preschoolers had much faster reaction time on the go/no go task in adolescence.

Mischel and Metzner (1962) examined the relation between subjects' age, intelligence, and the interval of successful delay, using a group design. They also examined the effect of "future time perspective" on subjects' ultimate decision whether or not to delay. Future time perspective is defined as an individual's conceptions or beliefs regarding the future, especially in regards to delayed outcomes. Their finding showed several significant differences in preference

for delayed outcomes: preference for delay was positively correlated with age (R=.65, p<.0001) and with intelligence (R=.29, p<.0005). They also showed that future time perspective was slightly, but insignificantly correlated to preference. Their findings suggest that the ability to delay gratification has a strong developmental component, though reasons why were not yet evaluated.

The general findings of two experiments conducted in concert by Mischel and Mischel in 1983 indicate the existence of a developmental progression in the skills and strategies required of successful delay behavior. Preschool children prefer to attend to delayed rewards during the delay period, creating a tempting environment which is difficult to overcome. As the age of subjects increases, there is a shift toward preferring to cover the reward while waiting, which improves wait time through reduction of temptation. Further, their results found that preschool children did not verbalize effective strategies for waiting, but sixth graders generally could.

In a series of experiments, Yates and Mischel (1979) examined the strategies that children employ when delaying gratification. Results indicate that in general, preschoolers prefer to view real rewards rather than symbolic rewards or no rewards while waiting, regardless of the relevance to the contingencies in place. Older children (grades 1-3) tend to choose more effective delay strategies by avoiding the frustrating stimulus of the delayed reward, as well as by implementing mediating activities. This difference may help account for the difficulty that young children have in delaying gratification.

In an effort to illuminate the tendency of children to prefer delayed or immediate rewards, Herzberger and Dweck (1978) examined differential attraction to preferred versus nonpreferred rewards. Using a paired choice preference assessment with four choice situations, they found that for children who chose delayed or immediate rewards inconsistently, there were

less prominent preferences between available reinforcers. This suggests that successful delay

behavior is weaker when the subjective value for the reward is not very high to begin with.

The findings in Walter Mischel's studies (Mischel and Metzner, 1962; Michel & Grusac,

1967; Michel, Grusac, & Masters, 1969; Yates, & Mischel, 1979; Mischel, and Mischel 1983;

Shoda, Mischel, & Peak, 1988; Mischel, Shoda, & Peak, 1990) appear to consistently contradict

the frequently cited Freudian theory of frustration and "time binding." Time binding theory

supposes that delay of gratification is facilitated in the mind of a subject by his "hallucinatory

wish fulfillment," or consummatory ideation. In other words, according to popular Freudian

theory, thinking about a delayed reward is supposed to improve one's ability to wait for it, but

Mischel's research handily disproves this.   Miller and Karniol (1976) suggest that, in fact,

Mischel's and Freud's paradigms are entirely different, and not contradictory. Mishel's delay of

gratification paradigm utilizes a self-imposed delay: a task is presented to a subject in which the

subject is instructed to wait for a preferred reward, but may terminate the waiting period at any

time and receive a non-preferred reward instead. Freud's theory begins with the assumption that

the delay is externally imposed, and that the subject must wait a given length of time regardless

of the desire to terminate waiting.

Miller and Karniol (1976) evaluated the effect of external versus self-imposed delay on

time estimates, as well as the effects of the presence of the reward during delay and the

individuals' ability to tolerate frustration. The authors executed a 2X3X2 group design

experiment with 111 third grade students. Note that time estimates, or the amount of time the

subject believes the wait interval to be, is the necessary dependent variable, as subjects in the

external delay condition wait a standard interval of time. Higher time estimates can be

interpreted as greater frustration. In line with the hypothesis, the results show that the effect of

the reward's presence was different in the two waiting paradigms. When the delay was self-imposed, time estimates were higher when the reward was present than when it was absent. The opposite was true in the externally imposed delay. Furthermore, students with a high frustration tolerance differentiated more between the delay situations than did students with a low tolerance; they found the externally imposed delay to feel longer than the self-imposed.

Karniol and Miller (1976) illuminated the differences in coping mechanisms implemented in self-imposed delay situations and externally imposed delays, while also observing the impact of the presence of the delayed reward on these mechanisms. The results of two experiments show that in general, third grade subjects in self-imposed delay scenarios attend less to reward-relevant stimuli overall and distract themselves more with irrelevant activities when the reward is present, than when it is not. Subjects in externally imposed delay express the opposite pattern. They attend to reward-relevant cues more overall and distract themselves less with concurrent activities when the reward is present, than when it is not.

Research on Improving Delay of Gratification Behavior

Having explored the typical designs used in delay of gratification research and discovering potential environmental factors that lead to delay behavior, behavior researchers may begin to manipulate these designs in the attempt to improve delay tolerance. By gradually increasing the wait interval required to earn a preferred reinforcer, by requiring a distracting behavior to be performed during the wait interval, and by manipulating the visual or mental stimuli that represent the reinforcement being delayed, researchers have, to varying degrees of success, improved waiting behavior in children and further explored factors that may improve delay tolerance in individuals.

Drawing from theory in many academic areas, Ainslie (1975) proposes that strategies which make delayed consequences seem more valuable, or which making waiting less aversive, may help improve self-control. Ainslie's (1975) framework suggests that the individual variance in self-control is likely due to the existence of, or lack of, strategies which strengthen the relationship between initial choice and delayed outcomes. reducing the aversiveness of waiting, generating rules and behavior contracts, and distraction were proposed for future study

Procedures which gradually increase the delay time in a choice between smaller immediate rewards and larger delayed rewards are effective in maintaining preference for delayed rewards in subjects who do not originally prefer delayed outcomes, in humans and non-humans alike (Dixon et al.,1998). In a study using such a time fading procedure, Dixon et al. (1998) systematically increased the self-control behavior in young adults with disabilities. The experiment utilized a progressive duration/fixed duration trial procedure to grant access to large rewards and small rewards, respectively. The study also utilized intervening activities (tasks which are performed during the delay period) to mediate behavior, and to increase the utility of the experiment, by improving appropriate behaviors as well as by increasing delay tolerance. Results indicate that gradually exposing subjects to increasing time delays is an effective means to increase delay tolerance. Further, participants' involvement in intervening activities maintained at high rates. This indicates that a procedure which increases self-control can also increase target behaviors.

Dixon, Rehfeldt, and Randich (2003) implemented a fading schedule and mediating tasks, similar to Dixon et al. (1998), to increase preference for delayed reinforcement in adults with mental retardation. By alternating sessions which utilized a mediating activity with sessions which included no activity during the delay, the authors were able to elucidate the effect of, and

preference for, the mediating tasks. While preferences for sessions with the mediating task were inconsistent across participants, there was a slight preference for sessions with the mediating task in two participants.

In an effort to increase self control in preschoolers, Schweitzer and Sulzer-Azaroff (1988) investigated the effect of a gradual delay increase on "impulsive" children's choice for a smaller, sooner versus a larger, later reward. Five children underwent the fading procedure and one more was evaluated in post assessment as a maturation control. The fading procedure began by providing two choices: a small reward or a large reward, both available immediately. After the choice of the large reward reached stability criterion, the choice was altered so that the large reward was delayed by 5 seconds. This procedure was repeated as the delay increased, until the end of the subjects' school year, or in one subjects' case, until preference for the delayed reward failed to reach stability over 45 trials. Results from this experiment show that preference for delayed reinforcement increased significantly for 4 out of 5 subjects. The 5th subject showed a preference for delayed reinforcement already. A gradual increase of the delay period is an effective method of increasing delay tolerance in preschoolers.

In one of the earliest studies of the delay of gratification paradigm conducted with preschoolers, Mischel and Ebbesen (1970) evaluated a particular motivational process which may hinder or facilitate delay. Does a visual, which attracts attention to a preferred reward, non preferred reward, or to both rewards, hinder or help delay of gratification, relative to no visual? The authors hypothesized that the visible presence of the reward would hinder delay, in accordance with Amsel's frustrative nonreward theory, wherein "the occurrence of non-reward when reward is expected elicits a primary frustration reaction" (Mischel & Ebbesson, 1970, p. 335) and that frustration increases the aversiveness of current conditions, in this case the delay

interval (Amsel, 1958). Results suggested that when preschoolers must face rewards, their successful delay interval is much shorter than when no reward is visually available. Subjects' delay interval is the shortest when both rewards are visible.

Mischel, Ebbesen, and Zeiss (1972) offer evidence to support Amsel's frustrative reward theory, which suggests that "any conditions that enhance the aversiveness of frustration should make it harder to wait" (p. 205). The authors hypothesized that external activities (playing with a toy) and cognitive distraction from the reward (thinking fun thoughts) would help delay gratification in preschool children and examined . Experiment one indicated that when the delayed reward, preferred reward and the immediately available reward were in view, subjects waited significantly longer in the cognitive distraction condition (12.12 min) and in the external activity condition (8.59 min) than in the no distraction control condition (<.5 min).   Subjects also waited significantly longer when they implemented the distractors while waiting for rewards than in two control conditions in which they were instructed to implement the distractors but were not waiting for rewards (<1 min in both cases). Experiment two, expanding on the cognitive distraction variable, compared the effect of fun thoughts, sad thoughts, and thoughts about the reward. Results show that thinking sad thoughts and thinking about the reward produced similarly low wait times (approx. 5 min) compared to thinking happy thoughts (13 min). When the reinforcement was not in view in experiment three, results suggest that thinking about the reward hinders delay. Compared to the "think fun" condition and the no instructions (control) condition, where subjects waited on average 14.48 minutes and 12.86 minutes respectively, subjects in the "think reward" condition waited a drastically reduced length of time at .78 minute, on average. The sum of the results of these experiments shows that both

distracting activities and distracting cognition can be useful in increasing wait times, especially in the tempting presence of the delayed reward.

Patterson and Carter (1979) confirmed the relation between the presence of a delayed reward and a subject's ability to wait for that reward, but also added to the literature by evaluating what occurs when the subject must work for the reward rather than wait passively. The authors manipulated two dimensions of the delay of gratification paradigm with preschool children -- the presence or absence of the reward and the behavior required during the delay (waiting or working). They discovered that the presence of the reward in the work condition increased the amount and speed of the work completed relative to when subjects were working with no reward present. However, when subjects were waiting rather than working, the presence of the reward reduced wait time relative to when the reward was not present, replicating previous findings (Mischel, & Ebbeson, 1970). This phenomenon supports Amsel's frustrative non-reward theory (Amsel, 1958), in that the presence of the reward frustrates the subject. This study suggests further implications of the theory -- that frustration hinders passive waiting but facilitates working during a delay interval.

Schack and Massari (1973) show that, in general, 1st grade subjects who must wait for a preferred reward wait for less time when the reward is present, than when it is absent, similar to preschool children. However, the results of the particular study show that the effect is abated when a temporal aid and specific instructions are implemented in the reward present condition. These results support the hypothesis that "the context of 'obtaining rewards soon' may not be equally available to children of all ages" (p. 168). In other words, the cognitive techniques which support successful delay of gratification are related to future time perspective and may develop as children mature. Reasonable time expectations, distracting ideation, and task-facilitating

instructions increase delay behavior in young children who may otherwise be unable to delay gratification.

If attention to the reward during the delay period decreases successful waiting time, what effect does attention to representations of the delayed rewards have? Mischel and Moore (1973) explored this question and found that, contrary to their hypothesis, attending to symbolic rewards (an image of the promised reward on a slide) improved wait time in preschool children, versus an irrelevant stimulus condition and no stimulus condition. This improvement existed both when the children were waiting and working in the delay period. Cognition and transformation of stimuli are theorized to cause these surprising results. The implications that specific ideation concerning future rewards may alter delay behavior opened a new vein of research endeavors.

In 1974, Mischel and Underwood published their discovery that attention toward a delayed reward can improve wait time in the delay of gratification paradigm, specifically when the experimenters suggested that ideation about the reward would influence the time subjects must wait. In the presence of the relevant item, but not in the presence of an irrelevant item, children who were led to believe that thinking about the object would decrease their wait time, waited much longer than subjects who were instructed to think about the object, but who either were not told it would influence wait time or when the object they were presented with was irrelevant to the contingency.

Mischel and Baker (1975) further investigated the effect of ideation on waiting in a delay of gratification paradigm. Ideation which focused on the consummatory properties of the reward while waiting, decreased average effective wait time (5.60 min) compared to average baseline levels (8.44 min). Ideation which transformed the reward, or focused on other features of the reward, increased average delay time from baseline (13.51 min).

In a study conducted by Moore, Mischel, and Zeiss (1976), preschool children were taught to cognitively transform the physically present stimuli (a reward or a picture representation of a reward) in a delay of gratification task. The subjects were instructed to imagine that the real reward was a picture of the reward in one condition, and to imagine that the picture was a real reward in another. In two more conditions, subjects were asked to see pictures as pictures and rewards as rewards. The final conditions were used as controls, wherein subjects had no stimuli present, but were instructed to "pretend to see" pictures or objects. The longest waits occurred in the "see picture" conditions: 17.75 min, 17.70 min, and 15.61 min. when pictures, rewards, and no objects were present, respectively. In the "see real" conditions, wait times were significantly shorter than their counterparts: 5.95 min, 7.91 min, and 12.24 min, respectively. These findings suggest that cognitive transformation of stimuli can be an effective way for children to learn to delay gratification in the face of temptation.

Behavioral Training Programs to Increase Rule-Governed Delay Tolerance

In the previous section, delay of gratification behavior is shown to be increased through a number of environmental manipulations that increase the salience of the delayed reinforcer. This section describes studies showing training can improve delay of gratification in the absence of environmental changes. The behavioral skills training procedure, using techniques such as modeling, rule-repetition, and practice, have been utilized to improve various aspects of delayed consequence driven behavior. The aspects of cognitive transformation of rewards, tolerance to passing intervals of time, and task-oriented behavior during the wait interval have all been increased using behavioral training programs.

Toner and Smith (1977) point out that delay of gratification is a "two-part phenomenon" (p.123). The first part is the selection of delayed outcomes; the second part is the process which

helps an individual maintain that choice during the delay. In their study, the authors sought the

most effective method to encourage increased delay of gratification through instructions to self-

verbalize during the delay period. In a 2X4 design, Toner and Smith (1977) evaluated the ability

to maintain the decision to delay gratification in both preschoolers and third graders under four

conditions: instructions to engage in either rule verbalization, neutral verbalization, reward

verbalization, or no verbalization (control). The authors hypothesized that instructions to

verbalize would differentially affect the two age groups, namely that the older group of children

would successfully wait regardless of the condition.   The results were surprising. The authors

found that preschoolers outperformed third graders in all conditions except the control, and that

reward verbalization actually decreased successful wait time from baseline in third graders. This

suggests that there are indeed differences in performance between the age groups, and that

instructions about how to self-verbalize almost completely neutralize those differences. The

authors conclude that third graders are likely to spontaneously self-verbalize in the no

verbalization instructions condition, while preschoolers generally lack this spontaneous strategy.

Kanfer and Zich (1974) evaluated the effect of various degrees of external elements

during training on subsequent delay of gratification trials in children aged 4 to 6. Using verbal

presentation of rules during testing was hypothesized as "making the positive outcomes of

nontransgression more salient" (p. 109) by continually prompting about the long-term goals.

Training and testing sessions utilized a simple space with a temptation stimulus (toys which are

briefly glimpsed then placed behind the child) and a distracting stimulus (a "banker's game")

Two independent variables were examined in a 2X2 group design: the presence versus absence

of experimenter during training, and the presence of a recording during trials of either the

experimenter or the subject prompting non-transgression. Two conditions were also included as

a control, in which subjects heard no recording during trials. Results indicate that, in general, less external control during training, leads to better performance during trials. The experimenter present-experimenter's voice condition did not significantly differ from the control conditions, but the remaining three test conditions show significantly better wait time relative to control. The best overall performance came from subjects in the experimenter absent-subject's voice condition, the condition with minimal external elements. These data, in accordance with other research findings, suggest that self-verbalization techniques yield greater results than more externally imposed verbal rules.

Miller, Weinstein, and Karniol (1978) examined the effect of self-verbalization instructions on both kindergarten and third grade children's ability to wait. They compared the relative effects of task-oriented, reward-oriented, irrelevant, and no self-verbalization in both age groups. The results showed that the kindergarteners performed as well as the third graders in all conditions except for the control condition (no verbalization). Additionally, the task-oriented self-verbalization condition ("I am waiting for the [preferred reward]") facilitated delay in both age groups, while the reward-oriented self-verbalization ("The [preferred reward] is yummy") inhibited delay in third graders, but did not decrease performance from baseline levels in kindergarteners. These data seem to confirm the hypothesis that the developmental difference which exists in delay of gratification tasks may derive from spontaneous self-verbalization, which emerges in later childhood years and is not typically present in preschool and kindergarten aged children, as well as the theory that these self-verbalization skills can be taught to younger children.

Self-instruction training is a technique commonly used to increase competence at many self-directed tasks. Michel and Patterson (1976) examined the effectiveness of different self-

instructional packages on preschooler's resistance to temptation (time spent waiting successfully) in the delay of gratification paradigm. Results reveal that the self-instructional plans which were more elaborate during training, garnered better resistance to temptation during testing. Results also show that out of three types of plans (temptation-inhibiting, reward-oriented, and task-facilitating), only task facilitating did not improve wait time.

Meichenbaum and Goodman (1971) attempt to improve the self-control of "impulsive" children using self-instructional techniques. Measures of impulsivity were teacher reports and psychometric instruments which evaluate self-control. These tests were given before and after a series of training sessions, wherein subjects were randomly assigned to either a modelling condition, modelling plus self-instruction, or a control. Analysis of the components of the self-instructional package revealed that the highest gains were made in the modelling plus self-instruction condition, when the procedure began with a model and faded to covert self-verbalization.

Patterson and Mischel (1976) evaluated the relative effects of temptation-inhibiting and task-facilitating ideation on on-task behavior in preschool children. Using a self-instructional training procedure and a temptation against work task, subjects were taught to direct their attention away from temptation while working, to direct attention toward the task at hand, to do each of these techniques simultaneously, or were not taught a technique at all. Results of this study indicate that temptation-inhibiting techniques were effective in increasing on-task behavior relative to the control, and that task-facilitating plans and combination plans were not.

Bornstein and Quevillon (1976) evaluate the impact of a self-instructional training package on on-task behavior. Using modeling and rehearsal, the subject learned to verbalize information relevant to the task at hand. A fading procedure followed to remove the model as

well as overt verbalization by the subject, ultimately with only covert self-instruction remaining. On-task behavior increased immediately and maintained over time for all three subjects.

Hanley, Heal, Tiger, and Ingvarsson (2007) developed a classwide program to teach preschool children key prosocial skills: those that are rated important by educators, or those that are often taught as alternative behaviors to alleviate severe problem behavior in individual children. This program sought to overcome challenges preschoolers commonly face by purposefully introducing to each student a specific challenge and the accompanying proactive solution in a controlled environment. Each of these challenges, and the technique taught to overcome it (called a "preschool life skill"), was introduced one at a time, every few weeks over the course of a school year. Each of these preschool life skills (PLS) was taught using the behavioral skills training approach: using classwide instructions, modeling, and practice.

The PLS are proactive solutions to overcome specific deficiencies a child may face in the classroom (such as a lack of attention from a peer or teacher, or lack of access to materials), and the skills taught were primarily functional communication skills or self-control techniques specific to the situation. Thirteen skills were taught sequentially, arranged in 4 units, beginning with delay tolerance and instruction following as foundation skills (p. 283). Following 15 weeks of the program, data showed that there was a 74% decrease in problem behavior during the targeted challenging situations, and preschool life skills more than quadrupled. Specifically, baseline data showed that delay tolerance behaviors were almost never emitted before the intervention, but improved the most (increased 88%) with fewest problem behaviors occurring in tolerating delay scenarios after intervention.

Researchers have taught rule-verbalization, moderating behaviors, and visualization techniques through the behavioral skills training model (modeling, repeating instructions,

practice) typically in controlled environments. A few behaviorists have also taught self-control skills with behavioral skills training, but in classroom settings. In each study, these training procedures have been effective in increasing delay of gratification behavior in the absence of environmental changes. Training students to successfully wait in naturalistic environments and across conditions is crucial to the viability and utility of self-control as a pre-academic skill.

Summary

These studies have proven that delay of gratification behavior can be improved either through behavior skills training, or by manipulating the environment in favor of delayed reinforcement. Furthermore, studies have shown that delay of gratification behavior is a conveniently observable measure of self-control, while still other studies have proven that self-control predicts future academic performance and social success better than measures like IQ and standardized test performance.   The convergence of these lines of study illuminates future researchers' path.

Future studies should deeply explore the correlations between the delay of gratification paradigm, of the behavioral field, and the theory of self-control as defined by many other research fields. How well does delay of gratification behavior predict academic outcomes? Do delay of gratification behaviors have a lasting effect on academic success, or does the predictive effect decrease over time? Do delay of gratification levels, improved by a modified environment or through behavioral skills training, predict academic success as accurately as naturally occurring levels? Further research should also continue exploring how organisms naturally develop the ability to wait for delayed consequences and apply that knowledge to improving children's delay of gratification behavior and other inhibitory behaviors necessary to be socially and academically successful.

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Major Professor: Dr. Jonathan Baker