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Delay of Gratification

A Review of Fifty Years of Regulation Research

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In 1958, the *Journal of Abnormal and Social Psychology* published a report of experimental research by Walter Mischel. Several aspects of this paper provide clues about what was to come in the next 50 years. It reported focused empirical work using an experimental method to probe seemingly intractable theoretical questions. The research was published in a journal dedicated to abnormal psychology, but the clear message was that delay processes underlying abnormal behavior were on a continuum with typical behavior. The research looked toward cognitive and social psychology for explanation, rather than stimulus–response learning or psychodynamic theory. Major graduate-level textbooks covering social psychology theory quickly recognized the research as important for understanding human socialization (e.g., Jones & Gerard, 1967, pp. 95–99). In the next 50 years Mischel, his students, and his collaborators would contribute more than 200 papers, many of which addressed issues in delay of gratification and resistance to temptation.

Within this time frame, researchers examined delay of gratification across the lifespan, yielding some important longitudinal results. For example, Funder, Block, and Block (1983) found significant positive relations between delay of gratification at age 4 and measurements of both ego control and ego resiliency at ages 3, 4, 7, and 11 years. Examining even more distal behaviors, Mischel and colleagues found that delay of gratification measured early in childhood was linked to long-term achievement, better coping abilities and stress management, and greater social competency in adolescence (Mischel, Shoda, & Peake, 1988; Shoda, Mischel, & Peake, 1990). Consistent with these findings, Rodriguez, Mischel, and Shoda (1989) found that low ability to delay gratification was related to poor regulatory capacities and increased risk for disruptive behavior disorders.

This chapter reviews the empirical literature and theoretical underpinnings of delay of gratification research. Definitions used in the literature are diverse, often

Handbook of Personality and Self-Regulation Edited by Rick H. Hoyle
 ISBN: 978-1-405-17712-2

imprecise, and occasionally tautological. Frequently, operational definitions and procedures are equated with the latent hypothetical construct. We define delay of gratification as a set of motivational and cognitive processes related to choice of a later or more distant goal at the expense of an immediate goal. The traditional definition in the literature replaces the word goal with "reward" or "gratification." The goal-based definition recognizes that goals and rewards are conceptually separate. Our definition acknowledges that goals can remain constant despite changes in rewards, and rewards can remain constant despite goal changes (cf. Mischel, 1984, p. 353). Delay of gratification is a subordinate construct within the larger, superordinate construct of resistance to temptation. There are processes other than delay of gratification that could produce resistance to temptation. In turn, resistance to temptation is part of the larger construct of regulation or self-regulation (Jensen-Campbell & Graziano, 2005; Tobin & Graziano, 2006).

The potential number of studies is large. As shown in Table 3.1, we identified a minimum of 618 articles through a PsycINFO search from 1896 to December 2007 with a keyword of "delay of gratification." To organize these studies, we set exclusionary criteria. We excluded research papers not written in English; not published in a peer-reviewed journal; not using humans; and focused primarily on disordered populations involving mental retardation, ADHD, and obesity. Also excluded were studies focused on gambling, drugs, alcohol, and cigarettes, or addictions. We did not include studies primarily addressing economic theories. A full list of references identified through this review is available from the authors. Priority for discussion in this chapter was given to research using experimental methods, sound methodologies, children and adolescents, and to research testing explicit hypotheses. Despite being removed from the review and tally, several excluded studies are discussed, primarily because they addressed conceptual or methodological issues. The remaining 225 studies were categorized by age group. Tallies are only approximate because some studies involve multiple age groups. A total of 21 papers, one of which reported a meta-analysis, were dedicated to theory alone. The largest number of studies were dedicated to preschoolers ($n = 65$) and college students ($n = 63$), followed by school-age children ($n = 55$), and adults ($n = 22$). Fewer studies used adolescents ($n = 10$), toddlers ($n = 8$), and infants ($n = 2$). For purposes of exposition here, we report outcomes without reference to sex unless a difference was reported. This is justified by the outcome of a meta-analysis of the delay of gratification literature (Silverman, 2003). The 33 published studies examining sex differences in delay of gratification yielded a significant but small difference ($r = .06$) favoring girls and women. There was no evidence that sex interacted with age of participants in influencing delay of gratification.

We sorted each included study into one and only one cell within a 5×5 matrix, displayed in Table 3.2. The first dimension involved five theoretical perspectives or approaches: (a) psychoanalytic and psychodynamic, (b) behavioral: S–R version, (c) achievement motivation, (d) behavioral: social-cognitive version, and (e) hot–cool system. Crossed with the first dimension was a second, involving five key delay of gratification

Table 3.1 Delay of Gratification Articles Published Between 1896 and December 2007

	# of articles remaining
Total	618
Exclusions by PsycINFO limit settings	
Nonhuman participants	566
Non-English	540
Nonpeer-reviewed journals	365
Disordered population	285
Exclusions by authors	
Additional articles with nonhuman participants	281
Additional articles with disordered populations	277
Theory only (inc. 1 meta-analysis)	256
Non-US participants	239
Native American comparisons	230
Addiction research	225

variables: (a) attention, (b) affect, (c) interpersonal demands and others, (d) cognition, and (e) developmental processes and age as a proxy for developmental level. Classification is only approximate because theoretical positions have evolved in the last 50 years, and some studies involve multiple approaches and variables. Furthermore, some studies were published before the cognitive revolution, at a time when the variable of attention was more sharply differentiated from cognition than it was after the revolution (Baars, 1986). Wherever possible, classification is based on the primary focus of the research, as reported by the authors. We discuss the matrix in terms of the most representative studies, within priorities noted previously. The 17 studies published in the last seven years (between 2000 and 2007) received special consideration. Some studies clearly defy classification. For example, Bjorklund and Kipp (1996) note that evolutionary mechanisms may have prepared humans with special capacities for delaying gratification.

Foundation of Delay of Gratification Research in Theory

Psychodynamic Accounts

Discussions of processes related to self-regulation, resistance to temptation, and delay of gratification appear in writing from ancient times (e.g., Aristotle's *akrasia*), through Puritan training guides (e.g., Locke), to modern philosophy (e.g., Sartre). The progenitor for much of the modern scientific research on delay of gratification appears to be Freud's psychodynamic theory (Freud, 1922; Metzner, 1963; Sears, 1975; Singer, 1955).

Table 3.2 Selected Delay of Gratification Articles Categorized by Theory and Focus

	Attention	*Affect*	*Interpersonal demands/others*	*Cognition*	*Developmental level/age*
Psychoanalytic	Singer (1955); Miller & Karniol (1976)				
Behavioral					
Stimulus–Response	Sears, Maccoby, & Levin (1957); Amsel (1992)		Houck & LeCuyer-Maus (2004); LeCuyer & Houck (2006)	Nisan & Koriat (1984)	Garon & Moore (2007)
Stimulus–Stimulus		Mischel et al. (1972)	Putnam et al. (2002)	Mischel & Moore (1973); Mischel & Baker (1975)	Nisan (1974); Yates et al. (1981); Mischel & Mischel (1983)
Achievement Motivation		Mischel (1961); Mischel & Gilligan (1964)			
Cognitive–Behavioral	Mischel & Ebbesen (1970)	Moore et al. (1976); Schwartz & Pollack (1977); Thompson et al. (1997)	Mauro & Harris (2000); Sethi et al. (2000)	Moore et al. (1976); Saltz et al. (1977); Toner & Smith (1977)	Yates & Mischel (1979)
Hot–Cool System				Metcalfe & Mischel (1999); Mischel & Ayduk (2002) Peake et al. (2002)	Hongwanishkul et al. (2005)

In this theory, delay of gratification is part of an ego-centered process linking primary and secondary process thought. Unconscious primary process impulses seeking immediate gratification are held in check by the ego's secondary processes. A fantasy image of the desired object is generated, onto which a cathexis is attached to provide immediate gratification. From a modern social-cognitive perspective, this might be described as self-distraction in the service of adaptation to the reality of the immediate situation.

Behaviorist Accounts (S–R Version)

The stimulus–response (S–R) behaviorists were skeptical of the proposed psychodynamic process, but they did not question the delay of gratification phenomenon itself. Instead they proposed alternative processes based on stimulus–responses relations (Amsel, 1992; Mowrer & Ullman, 1945; Sears, Maccoby, & Levin, 1957). S–R behaviorists had a strong aversion for cognitive variables. In keeping with this aversion, they commonly used nonhuman animals (e.g., rats) for research so that the clutter of the "mental mirage" (Skinner, 1967) did not obscure close observation of S–R processes. Mowrer and Ullman recast the problem of impulse control by adding a quasi-cognitive mediator to their S–R analysis. The mediator was symbolic representation, a process pervasive in humans, and perhaps in nonhuman mammals but to a lesser extent. Symbolic representation allowed the (human?) organism to weigh the merits of the immediate and delayed reward on a common scale. The cognitive camel was now in the S–R behaviorist tent. A different recasting came from the S–R behaviorist Amsel (1992) in his research on frustration. In this theory, temporary frustration builds up when a previously reinforced response is no longer reinforced. The frustration can be classically conditioned to the situation, producing "dispositional learning." This form of learning is implicit and without awareness, a result of repeated exposure to an event. For Amsel, most forms of invigoration, suppression, persistence, and regression are endpoints of dispositional learning. Amsel's theory was cited repeatedly by delay of gratification researchers (e.g., Mischel, Ebbessen, & Zeiss, 1972). It is curious that Amsel made almost no reference to humans, even when he discusses implications and future directions in his 1992 summary book. He makes no discernable effort to integrate his work with theory or research on human learning or frustration, much less delay of gratification. Whatever researchers thought of this theory, however, many recognized that delay of gratification could be frustrating, that frustration could motivate behavior, and that frustration could accumulate over time.

Achievement Motivation and Delay

Researchers came to recognize that explanations for delay of gratification (and most other forms of social behavior) were unlikely to come from psychodynamic

approaches or S–R versions of behaviorism (Bandura & Mischel, 1965; Mischel, 1973; Sears, 1975), but perhaps explanations could be found in other theories specifically devoted to human behavior. One prospect was the need-centered theories of achievement motivation (McClelland, Atkinson, Clark, & Lowell, 1953). In particular, need for achievement (nAch) includes testing the self against standards of excellence, and exhibiting behaviors that allow such testing (e.g., taking moderate risk, but avoiding both high and low risk activities that give no diagnostic information about skills). Mischel (1961) explored the links among nAch, preference for delayed-larger reinforcements, occupational aspirations, and acquiescence in 112 Trinidadian children. The behavioral measure of delayed–immediate preference involved a small candy bar or a much larger one (later). In addition, two verbal questions asked delay-related preferences involving money and a gift. The delay measures summed to give each participant a score ranging from 0 to 3. This is a severely restricted range, biasing toward the null hypothesis. Despite this, the correlation between nAch (as measured by TAT) and the composite delay preference was statistically significant. The correlation was $r = .27$.

Mischel and Gilligan (1964) examined the links among delay preferences, nAch, and willingness to cheat to earn an achievement award. The participants were 6th-grade boys ($N = 49$) attending two public schools in Boston. In this study, delay was measured as a single dimension using a 17-item delay–immediate choice battery. Excluding three children who never cheated, total number of immediate choices correlated with cheating ($r = .31$), and total delayed choices correlated inversely with time before cheating ($r = .38$). There was no evidence, however, that achievement motivation was related to delay choices. Failure to replicate the association found in Trinidad between nAch and delay preferences was attributed to sex of examiner interactions, but may have been due to low statistical power or to differences in procedures for measuring delay preferences. The Boston measure of delay had more items and was probably more reliable than the one from Trinidad. As reasonable and theoretically justifiable as it seems, the association between nAch and delay–immediate preferences appears weak, if they systematically covary at all.

Taken together, these results suggested that the motivation underlying achievement strivings offer little toward the understanding of delay of gratification (and vice versa). What was needed was a new theoretical approach that addressed a set of core questions. What are the processes that link affect to cognition? All of the previous theories observed that for delay of gratification to occur, basic early-appearing affective reactions come under the control of later developing cognitive processes (including attention). Perhaps another version of behaviorism would offer the answers.

Behaviorist Accounts (Social-Cognitive Branch) of Delay of Gratification

Not all behaviorists avoided cognitive explanations, nor did all behaviorists insist that reinforcement was necessary for learning. Within the Tolman-based S–S contiguity version of behaviorism, Bandura (1977) proposed a cognitive social learning theory.

In it complex social behavior could be learned and regulated through observational learning, without direct reinforcement. Cognitive processes like memory and attention were key mediators. Social learning theory provided a secure base for the largest number of delay of gratification studies from 1960 to 2007.

With the wisdom of hindsight, it seems almost intuitively obvious that children could acquire delay of gratification preferences from observing others, and not just their parents. At issue among the various theories were the processes that undergirded observational learning, not that it occurred at all. The key variables were attention, cognitive processes including memory and mental images, affect including frustration, developmental processes related to cognition and memory, and the role of other people in the interpersonal environment.

Within the social learning theory framework outlined previously, the variables of attention and cognition (including memory) attracted the most empirical research. At least in logic, gaining and holding the attention of the observer was foundational for later processes of memory (retention and reproduction; see Musser, Graziano, & Moore, 1987). In the case of delay of gratification, however, attention to the later goal would undermine delay. Support for the proposition that attention to later goals undermine delay of gratification is mixed. On the one hand, Mischel and Ebbessen (1970) found that children ($N = 32$) assigned to one of four conditions delayed most when no reward was present. They delayed less when either the immediate or delayed reward was present. They delayed least when both rewards were present. On the other hand, Patterson and Carter (1979) varied whether 40 children had the delayed reward immediately present (and presumably salient in attention) or absent. They also varied whether children filled the time interval simply waiting or engaging in "work" related to later reward. When their task was merely to wait, they delayed longer when the reward was absent. When they were required to work in the interval, however, children delayed longer when the reward was present. It is possible that the reward present acted as an incentive, providing a justification for effort, at least in the work condition. Furthermore, Fry and Preston (1980) randomly assigned 308 fourth graders to conditions in a complex experiment. Like Patterson and Carter, they found that delay was greatest when task performance ("work") was required and the task was similar to the delayed reward. These outcomes are inconsistent with a direct attention-distraction explanation.

Mischel et al. (1972) moved from attention analysis to an affect–cognition analysis. What seems to be important is the exact activity occurring in the delay interval. In three studies, children were directly tutored on deploying a cognitive activity during a delay interval. When the reward is not immediately present, children are better able to delay by "thinking of something fun," or without specific instructions, relative to children who are instructed to "think about the reward." When the reward is immediately present, however, thinking about something fun is the most effective way to delay, relative to when children are given instructions to think about something sad, given a toy with which to play, given instructions to think about the rewards, or given no instructions.

Peake, Hebl, and Mischel (2002) repeated the Patterson and Carter (1979) study, but added a measure of spontaneous attention to determine whether distraction, particularly through work, was the primary explanation for children's enhanced delay. When preschoolers were assigned to wait alone, they delayed less when the reward was present than when it was absent. Study 2 examined if work engagement was a predictor of preschooler's delay. When children were assigned to a situation with a reward immediately present and also had engaging work, they looked at the reward less and waited longer than when they were simply asked to wait.

Another study examined affective and cognitive aspects of delay, adding a developmental dimension. Yates, Lippett, and Yates (1981) found that preschoolers were better able to delay gratification when they were induced to think about three things that made them happy and were then prompted to think about them during delay tasks. Preschoolers who were instructed to think about three things that made them happy plus instructions to use those thoughts during delay performed significantly better than children in the other two groups. Outcomes suggested that children at this stage of development will perform better when explicitly instructed to engage in distracting thoughts. School-aged children, in contrast, performed equally well in the positive affect induction and positive affect induction plus cognitive instruction condition relative to the control condition, indicating that children slightly further along in development are able to use the affect induction experience to better their performance without any direct instruction.

Nisan and Koriat (1984) conducted a two-study set examining cognitive-developmental theory in relation to delay of gratification. In the first study, they found that kindergarteners were more likely to switch their choice of an immediate smaller reward to a larger delayed reward when they were induced to generate reasons for choosing the larger delay reward choice, but not when they were merely told that other children chose the larger delayed reward. The second study examined the relative effectiveness of objective-rational and subjective-emotional arguments in influencing short-term and long-term (three weeks later) reward decisions. Kindergarteners who employed the objective-rational argument were more effective than those who used the subjective-emotional one, particularly when the argument supported a delayed reward relative to an immediate one.

Going a bit further into the cognitive realm, Saltz, Dixon, and Johnson (1977) examined the role of fantasy in delay of gratification. They found that children who were instructed to think about their favorite story while waiting performed better in delay tasks than did those who were not. Children who were trained in thematic-fantasy or sociodramatic play were also better able to delay than children who were exposed to fantasy discussion and those in the no-training control condition.

Fantasy played an important role in psychodynamic theory. The focus of the psychodynamic interpretation of fantasy was not on the unreal aspect as much as on the symbolic representation aspect. Delay of gratification researchers in the social learning theory tradition explored the role of symbolic rewards as part of the link between cognition and performance. In contrast to previous findings, Mischel and Moore (1973)

found that preschoolers were better able to delay gratification when they were provided with symbolic representations of the rewards (projected images on slides) than when they were exposed to irrelevant images or blank screens. They interpreted these findings to indicate that children's ability to delay gratification is enhanced by abstract representations, but not by concrete ones such as having the items physically present. Even more striking, Moore, Mischel, and Zeiss (1976) found that children who were instructed to transform physically present rewards into pictures cognitively were able to delay gratification as long as children who were merely exposed to images of the rewards. Conversely, when children were instructed to transform pictures of reward items into actual rewards in their minds, their delay of gratification was significantly reduced relative to children who were instructed to do the opposite. These findings suggest that cognitive processes can override children's decreased delay of gratification when in the presence of rewards. Yet another study examined children's preferences for the presence of real or symbolic rewards. That is, Yates and Mischel (1979) found that preschoolers, unlike first through third graders, preferred to view real rewards rather than photographs of them, even though doing so makes it more difficult to delay gratification.

The Hot–Cool System

Metcalfe and Mischel (1999) proposed a model for integrating affective and cognitive processes, with implications for delay of gratification. They propose two representational systems, one "hot" and the other "cool." The hot system provides the basis for emotionality, including fears and passions. It is impulsive and reflexive. It undermines efforts at self-control. The cool system is cognitive, emotionally neutral, contemplative, and strategic. The two systems interact through "hot spots" and "cool nodes." This system was used to explain retrospectively the outcomes of previous research on delay of gratification by Mischel and his colleagues. For example, Prediction 1 in Metcalfe and Mischel states that when the hot system is dominant, salient exposure to the hot stimulus will tend to elicit the relevant (nondelay) response. Thus the authors posit that activation of the hot system (in the absence of cool system activation) accounts for the repeated findings in the delay of gratification literature that children's ability to delay is reduced when the rewards are physically present (e.g., Mischel & Ebbesen, 1970; Patterson & Carter, 1979).

The hot–cool distinction is appealing as part of a preliminary descriptive system. As a theoretical model, however, it requires further development. First, the system is descriptive and denotative, rather than explanatory. No mechanisms of transformation or change are included. Constructs are not assessed easily or separately from each other. For example, Prediction 1 states that salient exposure to a hot stimulus leads to nondelay responses, but the only way we can know that the hot system was dominant is from observing the nondelay response. Similar arguments can be raised about the operation of the cool system, and its ability to distract and draw attention away from a salient goal or reward. Block (2002) raised other criticisms of the hot–cool

system including its lack of differentiation from other systems. Overall, the hot and cool systems bear an uncanny resemblance to Freud's id and ego, respectively.

Delay Discounting

This review did not include papers focused primarily on economic theories. However, one potentially important issue involves quasi-economic changes in the values of rewards over time. The theory most immediately relevant to the present analysis comes from George Ainslie's reductionistic *Breakdown of Will* (2001), which was based on his earlier technical work *Picoeconomics.* (See also Ainslie, 2006.) Ainslie notes that an extensive literature shows that both people and animals differentially value future goals proportional to their delays. Future goals are given less value (discounted), but how? Is this discounting an innate product of mammalian evolution or is it an artifact of cognitive architecture? Ainslie does not think so. He draws on the distinction between exponential and hyperbolic discounting. In exponential discounting, a constant proportion of the utility value is subtracted in relation to a time delay. Drinking a bottle of whiskey could be worth 100 units of happiness ("utiles") today, but only 80 utiles tomorrow, and 60 the day after tomorrow, assuming a 20 unit discount rate. More happiness utiles can be expected to come from drinking the whiskey now than in downing it tomorrow. The problem with this form of discounting is its difficulty in explaining swings and instability in choices, described as "dynamic inconsistency" in economics. For Ainslie hyperbolic discounting is the main alternative. Hyperbolic discounting is maximally different from exponential discounting, not at the extremes of the delay interval, but in the middle. The discounting curve is more sharply bowed. On its face, hyperbolic discounting seems irrational, and makes the hyperbolic discounter vulnerable to exploitation by exponentially discounting peers. The process that helps make the phenomenon explicable is higher-order cognitive self-attributions. Choices that pay off quickly tend to be preferred, at least temporarily, over seemingly more valuable choices that pay off more slowly. However, when people are induced to look at their current choices as diagnostic of future choices, additional incentives come to be recruited to the later, seemingly more valuable, choice. The choice can become more valuable as a precedent than as an event in itself.

Ainslie's theory is relatively new, and further clarifications and development are needed. Because its propositions have not been explored systematically, as of this writing it is difficult to know how well it models processes of resistance or delay.

Toward a Process Theory of Delay of Gratification

None of the available theories of motivation appear to explain delay of gratification in a comprehensive, integrative system. Much of the existing research is denotative,

descriptive, and vague in explicating causal mechanisms or mechanisms of transformation from one state to another. The literature primarily points to certain variables and situations that affect delay. Important core questions are not addressed, much less answered. First, as part of his generalized critique of Aristotelian thought, Lewin (1935, 1951, 1987) and others (e.g., Batson, 1991; Cassirer, 1950; Graziano & Waschull, 1995, pp. 234–236) noted the error in segregating and categorizing psychological activities, particularly into "higher" and "lower" levels. In this spirit, we propose that delay of gratification is necessarily part of a larger system of psychological functioning, including basic acts of categorization and psychological development. That conceptualization implies that fundamental aspects of psychological development, like categorization skills and the perception of time and cause, should participate in major ways in the expression of delay.

What are the essential elements or processes without which delay of gratification could not occur? Let us refer to this as "basic delay." At a bare minimum, two components are needed. One is a device that is responsive to time, in terms of its duration, locating events within a sequence or interval. Second is a device that is responsive to differences in goals and rewards. Responsive here means detection or recognition, not differential valuation. The third device assigns valuation to the goals and rewards. Each of these three basic devices could exhibit developmental patterns and individual differences in their operation. Of course, each device would depend on its own set of specific variables and provide feedback to each other. For example, any event that influenced the perception of time could influence the valuation of goals, but probably not the recognition of differences between two goals. Basic delay does not require that any of the three components be in awareness, be effortful, or even be open to the perception of volition (e.g., Gilbert, Brown, Pinel, & Wilson, 2000; Rosati et al., 2001; Wegner, 2002).

Figure 3.1 presents the basic delay approach schematically in structural terms. In brief, basic delay consists of three distinct components: (a) detection and recognition of event sequencing and the embeddedness of events within time; (b) events (including rewards and goals) are categorized as the same as or different from each other; and (c) some events are preferable to others. The three components are arranged hierarchically. Detection of sequencing and time are foundational. Categorizing of events and goals into different groups could not occur without it, and it may emerge developmentally earlier than the other two components (Baird & Baldwin, 2001; Graziano, Moore, & Collins, 1988). Time sequencing may or may not require repeated exposure to acquire (e.g., Piaget's, 1954, primary circular reactions; Meltzoff & Brooks, 2001; cf., Amsel, 1992, on dispositional learning), but basic delay does not require a stand on the issue. Once events, goals, and rewards are embedded in time and categorized as different from each other, valuation can be associated with them.

Figure 3.2 presents basic delay in terms of processes. Time extends horizontally with time markers placed at various intervals along the time line as T_1, T_2, T_3, . . . T_n. Large vertical arrows are placed along the line reflecting the differential categorization of the events. Category 1 need not occur in close temporal proximity with Category 2, but

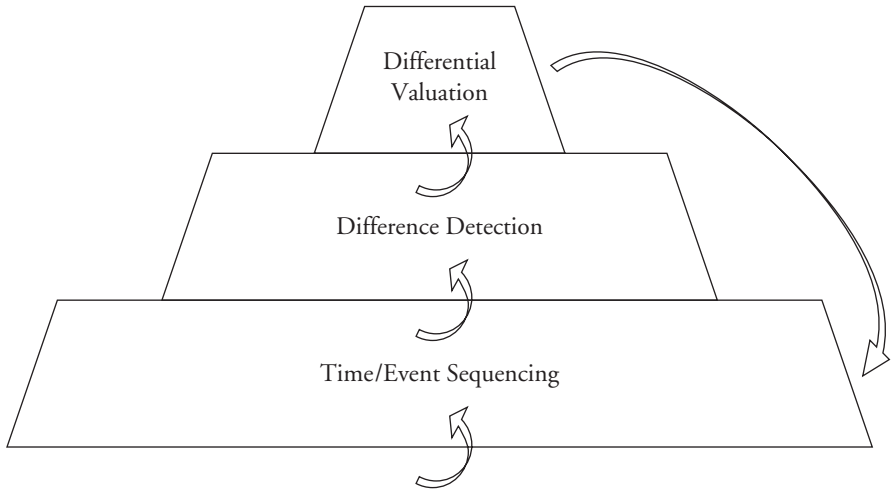

Figure 3.1. Components of basic delay.

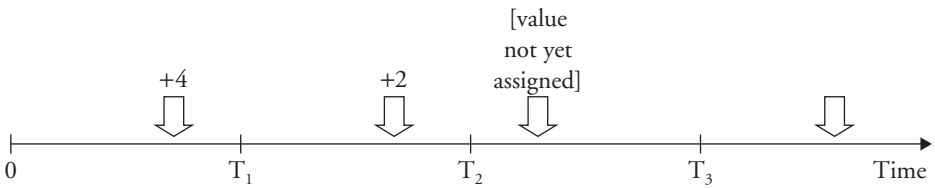

Figure 3.2. Processes underlying basic delay.

if they are not close, repeated exposure to both event categories may require repeated encounters with them to differentiate between them. The plus signs (+) above the large arrows shows the valuation assigned to the events and goals. Some goals and events have not yet received a valuation due to limited exposure, or lack of relevance to ongoing behavior. A dynamic element is added that permits the three components to influence each other. For example, a high evaluation assigned to one goal may induce more extreme categorization at the lower level, sharply differentiating the most preferred goal category from other categories, or reducing the total number of categories. For another example, if the intervals in the passage of time were altered, or if the sequence of events is detected as altered, then categorization of events as similar or different could be affected. This in turn could affect the differential valuation of goals and rewards.

Several studies provide data that are consistent, but not diagnostic, regarding the propositions. Using fMRI, Eisenberger, Lieberman, and Satpute (2005) showed that events categorized as expected or similar activate different areas of the frontal cortex than events categorized as unexpected or different. Apparently, the categorization by itself is not sufficient to activate differential behavior. Neural impulses associated with

the categorization information are sent to an area of the brain that is related to differential behavior. In a somewhat different vein, Witt and colleagues (Witt & Proffitt, 2005; Witt, Proffitt, & Epstein, 2004, 2005) showed that even object perception can be affected by functional considerations. For example, the same object in the environment can be estimated at different distances from the self depending on the object's use to the observer. Beyond the different estimates (categorizations?) of distance perceptually, perceivers show different actions depending on the perceived distance. Tossing a ring over a peg will be based on different patterns of exertion and motor behavior depending on the initial categorization.

If the Eisenberger et al. (2005) and Witt et al. (2004, 2005) analyses apply more generally, then what is needed next is a device that connects categorization and valuation to overt action (i.e., delay choice). That this is a particularly difficult nut to crack is evidenced by the absence of any specific mechanism or device of this sort in previous theory or research. The common assumption is that once a reward or goal is assigned a value (including devalued), action necessarily follows as a consequence. Phrased in such bald terms, the necessity or inevitability of this valuation–behavior link is implausible. This suggests that one other aspect of delay needs attention, namely predictable unpredictability of choices. In economics, the intraindividual variability called "dynamic inconsistency" represents a nuisance rather than an opportunity for theory development. Put simply, is the variability or instability of delay choices a structure, or is it random?

One possible avenue lies in Ainslie's (2001, 2006) discussion of hyperbolic functions of valuation. At this juncture, however, processes of cognitive inference can make important contributions. If the choice of a given reward or goal is interpreted as predictive or diagnostic of an aspect of the self, then the probability of delay is enhanced. The tendency to make performance-related self-attributions is probably a relatively late acquisition developmentally (Eisenberg, Cialdini, McCreath, & Shell, 1987). The persons without this developmental acquisition will behave differently from those who do have it. From a differential perspective, people will also differ in their tendencies to make self-attributions from action choices (e.g., defensiveness, self-favoring biases; Paulhus & John, 1998).

Despite at least 50 years of sustained theory development and research, many important questions about delay of gratification remain unanswered. Many of these are fundamental issues. Among the issues crying out for clarification are these: Is delay of gratification primarily the outcome of a conflict between separate cognitive and emotional systems? This is a nearly universal assumption. Are the choices of a smaller but immediate reward necessarily irrational? The answer seems to be no, but then what are the key variables that make delay less rational? What are the best ways to explain the instability of delay choices ("dynamic inconsistency")? To what extent does the instability of delay choices implicate more general individual differences in personality and motivation? Do personality and individual differences in patterns of delay of gratification implicate systematically different processes of motivation and cognition, or do they merely reflect differences in levels (e.g., Jensen-Campbell & Graziano, 2005)?

Is delay of gratification a reflection of other more foundational developmental cognitive processes like categorization, and the acquisition of the perception of time and causation? It is not difficult to imagine programs of correlational and experimental research to address these questions. In terms of opportunities, the future for delay of gratification research looks promising.

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