Asymmetric Discounting in Intertemporal Choice:

A Query Theory Account

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Abstract

When asked to delay consumption, people are impatient and discount future rewards more than when offered the chance to accelerate consumption. Three experiments provide a process-level account for this asymmetry, with implications for the design of decision environments that promote less impulsivity. In Experiment 1, a thought-listing procedure shows that people ***decompose*** discount valuation into two queries. Considering delayed vs. accelerated receipt of a gift-certificate influences the ***order*** in which memory is queried to support immediate vs. delayed consumption, which affects the number of patient vs. impatient thoughts. Relative frequency and clustering of impatient thoughts predicts discounting and mediates the discounting asymmetry. Experiment 2 implicates query-order causally: Listing reasons for immediate vs. delayed consumption in the orders people use spontaneously in acceleration and delay decisions replicates the discounting asymmetry; reversing this order eliminates it. Experiment 3 supports a memory-interference account of the effect of query order, using an implicit-memory task.

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Our willingness to trade immediate pleasure for later benefits determines whether we adequately save for retirement, imbibe too much alcohol, or reduce our energy consumption to curb climate risks for future generations (Mischel et al., 1969; Kirby & Herrnstein, 1995; Weber 2004, 2006). Choices between alternatives that differ in size and time-to-delivery (e.g., a $50 gift-certificate today or a $100 gift-certificate a year from today) are modeled by the discounted-utility model (Samuelson, 1937) and discount rates are inferred from people's choices. While classical economics assumes exponential (constant per-period) discounting, people discount future outcomes more steeply when they have the opportunity for immediate gratification than when all outcomes occur in the future (hyperbolic discounting, Frederick, Loewenstein, & O'Donoghue, 2002).

A puzzling phenomenon, independent of the assumed discount function, is that the degree of discounting depends on the direction of comparison. People asked to ***delay*** consumption, who expect outcome x_1 at time t_1 and indicate an amount x_2 that would make the delay to later time t_2 acceptable to them, demand a large increase in x, i.e., discount future outcome x_2 greatly. People with the opportunity to ***accelerate*** consumption, who expect to receive outcome x_2 at a later time t_2 and provide the smallest amount x_1 they would accept to move consumption to an earlier time t_1, typically discount far less (Loewenstein, 1988). Understanding the processes that give rise to less impulsive discounting in acceleration decisions may suggest ways to reduce excessive discounting of future consequences in more commonly-encountered delay decisions.

Loss aversion as formalized by Prospect Theory (Kahneman & Tversky, 1979) is used to explain asymmetric discounting (Loewenstein, 1988). People are assumed to encode delay of consumption as a loss and acceleration as a gain; delay thus has greater

disutility than acceleration has utility. Prospect Theory only claims that people choose "as-if" they evaluate outcomes on a two-component value-function with a steeper slope for losses, but is silent on the underlying psychological mechanisms.

Query Theory

A more psychological class of explanations suggests that variants in valuations (acceleration vs. delay; buying vs. selling prices) shift the decision-maker's focus of attention, consistent with differences in implicit goals (Fischer, Carmon, Ariely, & Zauberman, 1999; Weber & Kirsner, 1997). Carmon and Ariely (2000) suggest, for example, that both buyers and sellers in endowment effect studies (Thaler, 1980) focus more on what they may have to give up, which for buyers is the money and for sellers the good.

Johnson, Häubl, and Keinan (2006) developed this notion further in their process account of the endowment effect called Query Theory. Query Theory assumes that preferences, like all knowledge, are subject to the processes and dynamics of memory encoding and retrieval, and explores whether memory and attentional processes can explain observed anomalies in evaluation and choice. If preferences are constructed rather than well-known to the decision-maker (Payne, Bettman, & Johnson, 1993), then factors influencing the accessibility of information about the object or action under evaluation should determine preferences (Kahneman, Ritov, Schkade, 1999).

Query Theory makes four assumptions:

- (H1) Decision makers naturally ***decompose*** valuation questions such as "Should I delay receiving this gift-certificate?" into component queries

(Collins & Michalski, 1989): "Why should I consume now?" and "Why should I wait to get more later?"

- (H2) These (tacitly posed) queries are executed ***serially***, and query-order ***differs*** between valuation conditions, with initial queries assessing the value of the status quo.
- (H3) With less successful retrieval for later queries due to output interference, differences in query-order lead to differences in retrieved information.
- (H4) Resulting differences in the balance-of-support (for or against consumption-delay) lead to differences in discounting.

The hypothesis that output interference is responsible for the effect of query-order on the resulting balance-of-support derives from memory research showing that cued-retrieval of a subset of items from a memorized list can negatively impact the successful retrieval of remaining items (Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995; Roediger, 1973). Retrieval of the initial subset is facilitated by the inhibition of competing items, lowering their accessibility (retrieval-induced forgetting, Anderson et al., 1994, 1995; Perfect et al., 2002). Heightened accessibility of the initially retrieved items also increases their likelihood of intrusion during attempts to retrieve the remaining items (a part-set cuing effect, Peynircioglu & Moro, 1995). Query Theory assumes that decision-makers initially query their memory for a subset of information relevant to the decision, similar to the initial cued-recall of a list-subset in the two memory paradigms; in preference construction, the initial cue depends on specifics of the task and is

generated by the decision-maker and information about the decision has been stored in long-term memory long before the choice situation.

Experiment 1 tests Query Theory's four hypotheses using a thought-listing procedure. Experiment 2 manipulates query order to examine its causal role in the discounting asymmetry. Experiment 3 substitutes thought-listing with an implicit measure of differences in memory accessibility predicted by the memory-interference account.

Experiment 1

Method

One hundred seventy-six volunteers from the Columbia Center for the Decision Sciences (CDS) Virtual-Lab database (42% male; median household-income: $42,000; median age: 38, range: 18 to 75) responded to an email-solicitation and completed an online survey.[1]

Intertemporal-Choice Conditions. Half of the participants were told that they had been selected to receive a $50 Amazon gift-certificate today, but could opt to receive a gift-certificate of larger value in three months (***delay***). The other half were told that they had been selected to receive a $75 Amazon gift-certificate in three months, but could opt instead to receive a gift-certificate of lesser value today (***acceleration***). They knew that, in addition to an $8 participation-fee received by everyone, one participant had been randomly preselected to actually receive an Amazon gift-certificate, either today or in three months, depending on his/her expressed preference in the survey. Amounts were resolved thus that it was in respondents' best interest to express their true preferences between immediate and delayed certificates (Becker, deGroot, & Marschak, 1963). To

ensure that participants fully understood their intertemporal-choice condition and how their answers determined which gift-certificate they might receive, they had to answer two multiple-choice questions correctly before being allowed to continue.

Thought-Listing. Before indicating their intertemporal preference, respondents were prompted "to tell us everything that you are thinking of as you consider this decision." A carefully designed interactive web-form and practice in a different content domain ensured that respondents listed between 1 and 12 thoughts for their decision, with a mean of 3.6.

Choice Titration. Delay respondents were given a series of choices between a $50-certificate now or a gift-certificate three months later that increased from $50 to $100 in $5 increments. Acceleration respondents were given a series of choices between a $75-certificate in three months or a gift-certificate now that decreased from $75 to $25 in $5 decrements. The indifference point was the value midway between the dollar-amounts of the varying gift-certificate at which participants switched from consistently preferring the fixed gift-certificate to consistently preferring the gift-certificate with the varying amount.

Thought-Coding. Near the end of the session, respondents rated each thought they had generated earlier, on three dimensions: (a) Was it about the present, the future, both, or neither? (b) Did it favor getting the gift-certificate now, later, or neither? (c) Was it abstract or concrete?[2]

Results

Twelve respondents were eliminated for implausibly short response-times or non-monotonic preferences in the choice-titration.[3]

Discount Factor. Discounting was quantified as $\delta = (x_1 / x_2)^{(1/(t2-t1))}$, where x_1 is the amount received today ($t_1 = 0$) that is seen as equivalent to x_2 received in 3 months (t_2 = ¼ year) (Read, 2001). The discount factor indicates how much $1 now is worth in a year: δ=1 indicates no discounting and smaller values (δ<1) greater discounting.

Asymmetric Discounting. We replicated prior demonstrations of asymmetric discounting in both direction and magnitude (Figure 1, left panel). Respondents discounted the value of a later gift-certificate more when delaying (δ=.34) than when accelerating its arrival (δ=.57), $F(1,163) = 17.43$, $p<.0001$, $p_{rep}= 1.00$.[4]

Query Decomposition (H1) and Task-Specific Query Order (H2). Consistent with H1, generated thoughts fell into two categories, "impatient thoughts" favoring receipt of the immediate gift-certificate and "patient thoughts" favoring receipt of the later-and-larger gift-certificate. We measured thought-clustering using the Standardized Median Rank Difference, $SMRD = 2(MR_p - MR_i)/n$, where MR_p is the median-rank of patient thoughts, MR_i the median-rank of impatient thoughts, and n the total number of thoughts (Johnson et al., 2006). Randomly-interspersed thoughts produce a SMRD of zero. Figure 1 (right panel) shows that, as predicted by H2, impatient and patient thoughts clustered differently in the two tasks: Impatient thoughts occurred earlier in the delay-task (SMRD = +.22) and later in the acceleration-task (SMRD = -.18), $F(1,161) = 7.71$, $p=.006$, $p_{rep}= 0.97$.

Order-Dependent Balance-of-Support (H3). Figure 1 (middle panel) shows that, as predicted, respondents generated a larger proportion of impatient thoughts in the delay-task (prop=.39) than the acceleration-task (prop=.28), $t(163)=-2.26$, $p=.03$, $p_{rep}=.94$.

Prominence-of-Impatient-Thoughts and Discount Factor. Proportion-of-impatient-thoughts and their clustering (SMRD-score) were related though not redundant (r=.68). A principal-component factor-analysis provided the weighting to combine them into a single prominence-of-impatient-thoughts factor (Eigenvalue=1.64), which predicted respondents' discount factors extremely well (r=.54). For every unit-increase in prominence-of-impatient-thoughts, respondents' discount-factors decreased by .13, $t(162) = -6.94$, $p<.0001$, $p_{rep}=1$.

Mediation of Discounting-Asymmetry by Prominence-of-Impatient-Thoughts (H4). Figure 2 shows regression coefficients and their 95% confidence intervals for the effect of task-condition on discount-factor, with and without the inclusion of the mediator, the prominence-of-impatient-thoughts. Inclusion of impatient-thought-prominence significantly reduced the effect of task-condition on discount-factor from .34 to.26, providing evidence for partial mediation.[5]

Discussion

Addition of the thought-listing task to the typical intertemporal-choice paradigm did not change the typical pattern of results, suggesting that the thought-listing task merely made the typically tacit querying of arguments explicit. As predicted, patient and impatient thoughts were found to cluster. Acceleration vs. delay task assignment affected query order, changing the number and proportion of impatient thoughts which, in turn, predicted discounting. The effect of task on thought generation mediated observed differences in discounting between the two tasks, suggesting that memory-queries and their order might play a causal role in the construction of preference. In Experiment 2 we investigated a causal connection by manipulating query-order.

Experiment 2

Query Theory suggests that the opportunity to delay consumption causes decision makers to first marshal evidence favoring the status-quo (immediate consumption) followed by evidence favoring delayed consumption, and that the opportunity to accelerate consumption does the opposite. The observed asymmetry in discounting, caused by the fact that answers to the first query interfere with answers to the second query, should replicate if we explicitly ask people to generate reasons for immediate and delayed consumption in the order "natural" for their task-condition. If, on the other hand, we prompt them to ask the same two queries in the reversed order ("unnatural" given their task), the asymmetry in the prominence-of-impatient-thoughts and thus in discounting should be reduced or even reversed.

Method

One hundred twelve CDS Virtual-Lab volunteers completed the online study.[6] The two task-conditions and other details were identical to those of Experiment 1, except for the Thought-Listing Task. Experiment 2 separately prompted respondents for reasons to accept the smaller gift-certificate ***now***, or the larger gift-certificate ***later***. The screen prompting reasons for the smaller gift-certificate now explained that this could include both positives about immediate receipt and negatives about delayed receipt. Half of the respondents received the two queries in the order hypothesized to be "natural" for their task. As found in Experiment 1 and consistent with an initial focus on reasons justifying the status-quo, the natural order was ***now/later*** for the delay-condition, and ***later/now*** for the acceleration-condition. The other half received the two queries in the opposite, "unnatural" order.

Results

Figure 3 (left panel) shows that the explicit sequential querying of patient and impatient thoughts in the natural order replicated the asymmetry in discounting observed in Experiment 1 and other studies, with greater discounting under delay (δ=.28) than acceleration (δ=.63), $F(1,50)=13.61$, $p<.001$, $p_{rep}=0.99$. When explicitly querying the two types of thoughts in the opposite, unnatural task order, there was no significant difference in discounting, δ=.41 and δ=.48 under delay and acceleration, respectively, $F(1,58)=1.84$, $p>.10$, $p_{rep}=0.73$.

Figure 3 (right panel) shows that the query-order manipulation also affected the proportion of impatient thoughts participants listed.[7] More impatient thoughts were generated when the query for reasons for the gift-certificate now came first. Consistent with observed discounting, proportion-of-impatient-thoughts differed significantly by task-condition in the natural query-order condition, $t(50)=4.98$, $p<.0001$, $p_{rep}=1.00$, but not in the unnatural query-order condition, $t(58)=0.89$, $p>.37$, $p_{rep}=0.73$.

Discussion

Experiment 2 provides converging support for Query Theory's assumption about the natural order of queries in acceleration- and delay-decisions and suggests that query order is causally involved in discounting and the discounting asymmetry. When reasons for immediate vs. delayed consumption were explicitly and sequentially solicited in the order natural for each respective task, we replicated previous results. When queries were solicited in the opposite order, the asymmetry in discounting was eliminated. It should be noted that the asymmetry in discounting and proportion of impatient thoughts did not ***reverse*** in the unnatural query order condition. Automatic processes operating as the

result of task-assignment (i.e., tacit queries in the natural order) might by counteracting the results of the explicit, unnatural thought-generation instructions.

Experiment 3

It is possible that the thought-listing task of Experiment 1, while ostensibly nondirective and open-ended, could be interpreted by respondents as a demand to justify their decisions. If true, then discount-factor would determine listed thoughts, rather than the other way around, and the observed asymmetry in discounting might be the result of processes that have nothing to do with tacit sequential queries in opposite orders, and with responses to initial queries reducing the accessibility of responses to later queries. Experiment 3 avoids this possible confound by employing an implicit measure of differential accessibility of patient and impatient thoughts as the result of task condition. This implicit measure will not be affected by any perceived need to list thoughts consistent with one's choice. It also provides a better test of differential thought-accessibility as the result of memory inhibition than the thought-listing procedure which leaves open alternative interpretations.[8]

Method

Eighty-nine CDS Virtual-Lab volunteers completed the online study. Experimental details were identical to Experiment 1, with the following difference. After choosing between the immediate-smaller and the delayed-larger gift-certificates, half of the respondents were presented with an aspect-categorization task,[9] an implicit measure of the hypothesized knowledge-activation during preference construction, adapted from a task used by Perfect et al. (2002) to assess accessibility-effects in retrieval-induced-

forgetting. Respondents were presented with 20 short sentences ("aspects") and were asked to identify for each whether it had been generated as a thought during a decision like the one they had just made about a gift-certificate (in which case they were to press the Q-key) or whether it had been generated as a thought in another decision (in which case they were to press the P-key). Respondents were instructed to respond as quickly as possible while still being sure of their answer. We selected ten thoughts commonly listed in Experiments 1 and 2 ("targets"), half arguing for immediate-consumption (e.g., "Can use it to buy something now;" "Waiting is bad") and half for delayed-consumption ("I don't need the money now;" "Good things come to those who wait"). Ten other aspects ("foils") were thoughts generated by respondents in similar experiments in other choice domains (e.g., "The mug is dusty," from an endowment-effect experiment).

If respondents in the delay-condition first query reasons supporting immediate-consumption, and if this inhibits reasons supporting delayed-consumption, then reasons supporting immediate-consumption should be more accessible and therefore faster to verify than reasons supporting delayed-consumption. The opposite should be true in the acceleration-condition. Our key hypothesis is thus an interaction in reaction time (RT) between condition (acceleration vs. delay) and target-item type (supporting later- vs. immediate-consumption).

Results

We replicated for a third time the discount-factor asymmetry, with respondents discounting more under delay (δ=.38) than acceleration (δ=.57), $t(1,88)=3.00$, $p<.005$, $p_{rep}=.98$. This allowed us to examine observed differences in RTs in the aspect-categorization task. Overall categorization accuracy was 96.7% and did not differ

significantly by task or item-type. Figure 4 shows that RTs varied as predicted. While the RTs for categorizing foils did not differ by task, categorizing targets advocating immediate consumption (now) was faster for respondents in the delay-condition. In contrast, categorizing targets advocating delayed consumption (later) was faster for respondents in the acceleration-condition. The contrast comparing RTs for now- vs. later-targets by task was significant, $F(1,508)=4.97$, $p=.027$, $p_{rep}=.94$, and the result was robust to different dependent-measure transformations.

Discussion

Experiment 3 found systematic differences in the accessibility of arguments supporting different choice-options as a function of task-condition and hypothesized natural query order. As predicted by Query Theory's memory interference account, arguments for actions contrary to the task-specific status-quo were less accessible than arguments for the status-quo.

General Discussion

Three experiments examined the possible role of preference-construction in the accelerate-delay discounting asymmetry puzzle of intertemporal choice. Experiment 1 provided support for the assumptions of Query Theory, the central part of the preferences-as-memory framework proposed by Weber and Johnson (2006). Component processes differed in several ways in decisions to accelerate or delay consumption. Thoughts favoring either immediate or delayed consumption showed significant clustering, suggesting that participants may have (tacitly) executed two serial memory queries. Query-order differed by task and was consistent with an initial evaluation of

arguments for the status-quo (assigned decision default). Fewer arguments were generated for the second query in both task-conditions, with a difference in the resulting balance-of-support. The balance-of-thoughts generated by respondents predicted their discounting and also mediated the asymmetry in discounting between the two task-conditions.

Experiment 2 tested the causal role of the order of memory queries by ***manipulating*** query order. Respondents in the delay-condition were explicitly asked to first provide arguments favoring immediate consumption, then arguments favoring delayed consumption, and respondents in the accelerate-condition were asked to do the opposite. This replicated the typically-observed asymmetry in discounting, with greater discounting in the delay condition. However, reversing this natural order of queries for both tasks reduced the asymmetry in discounting to the point of non-significance, thus providing a recipe for the design of decision environments that can reduce the impulsive discounting of future costs or benefits that have been observed in many real-world delay decisions as, for example, pension savings. Changing the discount-factor in the delay-task from .28 (natural-order condition) to .41 (unnatural-order condition) changes the amount of money someone would be willing to accept immediately rather than wait to receive $100,000 in three months from $72,740 to $80,020.

The memory-accessibility RT data from the implicit aspect-categorization task of Experiment 3 provided converging evidence for the serial memory-query and interference hypotheses of Query Theory using a task that eliminates possible task demands of the explicit thought-listing task of Experiment 1. While the aspect-categorization RT data of Experiment 3 are consistent with a memory-inhibition account, additional studies are

needed to examine or rule out other possible mechanisms. Difficulty with task switching (an executive function deficiency), for example, could also explain the interference effects we observe (Salthouse, Atkinson, & Berish, 2003).

As suggested earlier, we think of the preference-construction processes described by Query Theory as a process-model instantiation and explanation of the task-condition effects described mathematically by the loss-aversion feature of Prospect Theory (Kahneman & Tversky 1979). Other process-model instantiations of loss aversion have been suggested, including one that assumes that loss aversion is actually mediated by differences in strength of affective reactions to perceived losses or perceived gains, as its name suggests. This affective interpretation of loss aversion falls short of accounting for the full range of results observed in this paper, in particular the results of Experiment 2. If giving up immediate consumption simply hurts more than acquiring immediate consumption feels good, then it is unclear why changing the order in which respondents explicitly brought to mind arguments for immediate vs. delayed consumption should affect discounting. Loss aversion conceived of as a feeling and asymmetry in affective reaction to choice outcomes as a function of task-condition should not be affected by manipulations of query order.

Another cognitive process theory that has recently been used to explain a large number of behavioral phenomena (including some from intertemporal choice) using a small number of principles related to memory representation is Construal Level Theory (Trope & Liberman, 2003). It has been used, for example, to explain intertemporal preference reversals by assuming that distant actions (attending a conference a year from

now) are represented more abstractly (in terms of more attractive higher-level goals) and immediate actions (the conference trip tomorrow) more concretely (in terms of less attractive lower-level means). Without some auxiliary assumptions, however, Construal Level Theory seems unable to address asymmetries in discounting between acceleration and delay decisions, since both decision tasks involve the comparison of the same two choice options, an immediate and a later one.

Query Theory owes a debt to reason-based choice explanations of systematic inconsistencies in preference (Shafir, Simonson, & Tversky, 1993) which are explained as the result of subtle task differences that may affect the implicit goals of the decision maker (Lichtenstein & Slovic, 1971; Tversky, Sattath, & Slovic, 1988). While Query Theory shares the idea that task-conditions affect reason-generation or consideration and that reasons influence choice, it goes far beyond reason-based choice in multiple ways. It postulates a mechanism of sequential reason-retrieval in task-specific orders, adds a theory of order-specific output interference, and measures and manipulates these hypothesized constructs. From a methodological perspective, the explicit thought-listing procedure (Experiment 1) and/or the implicit measure of memory-accessibility of reasons after decisions in different task-conditions (Experiment 3) introduced in this paper may prove to be useful tools to test reason-based choice hypotheses in other contexts.

Excessive discounting of future costs or benefits often has dysfunctional consequences (O'Donoghue & Rabin, 1999). A process account such as Query Theory, suggests both causes for such excessive discounting and possible remedies. Query Theory posits that one cause of excessive discounting is the imbalance of thoughts favoring immediate consumption. Indeed, in Experiment 1 the number and clustering of

patient vs. impatient thoughts not only predicted discounting asymmetries but also degree of discounting across both task conditions. Experiment 2 demonstrated that a causal process theory of discounting can suggest ways of being more patient. The provision of explicit protocols for reason-generation for different courses of action in a specific order has the potential to moderate the heavy discounting of future outcomes observed when people contemplate delay of gratification, which is frequently regretted later.

The influence of memory processes and memory representations on decision-making has recently received greater attention (McKenzie & Nelson, 2003; Reyna, Lloyd, & Brainerd, 2003). Much of this work has concentrated on inferential processes, such as the computational memory process model MINERVA-DM designed to explain probabilistic inference and judgment (Dougherty, Gettys, & Ogden, 1999; Dougherty et al., 2002; Dougherty & Hunter, 2003), and work on false memories (Reyna & Lloyd, 1997). The preferences-as-memories program extends such modeling to the area of preferential choice where memory-process considerations have been scarce (Weber, Goldstein, Barlas, 1995). Query theory has been successful in explaining and even eliminating the endowment effect (Johnson et al., 2006) and, in this paper, explains the asymmetry in discounting between acceleration and delay decisions. Consistent with mathematical formalizations of the phenomenon by Prospect Theory's loss aversion, the preference-construction account of Query Theory has the advantage of suggesting interventions able to reduce excessive impatience in intertemporal decisions.

Endnotes

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[1]Respondents in all three experiments came from the same population.

[2]Self-codings correlated highly with blind-rater codings (average-r=.88).

[3]Elimination rates of <7% are typical and apply to all experiments.

[4]p_{rep} is the probability of effect-replication (Killeen, 2005)

[5]Model-R^2 increased from 0.27 to 0.43.

[6]Nobody participated in more than one experiment.

[7] Total number of thoughts (patient, impatient, and other) generated did not differ by task condition or query order, ranging from 2 to 8, with a mean of 4.8.

[8] Other mechanisms include different stopping rule for earlier and later queries or task switching difficulties.

[9] The other half completed a task not discussed here.

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Figure 1. Results of Experiment 1 as a function of being in the Delay or Acceleration task-condition. The left panel shows mean discount-factor d, with smaller values indicating greater discounting. The middle panel shows the proportion of impatient thoughts generated during thought-listing. The right panel shows the clustering of impatient thoughts, with positive SMRD-scores indicating impatient thoughts before patient thoughts, and negative SMRD-scores the opposite.

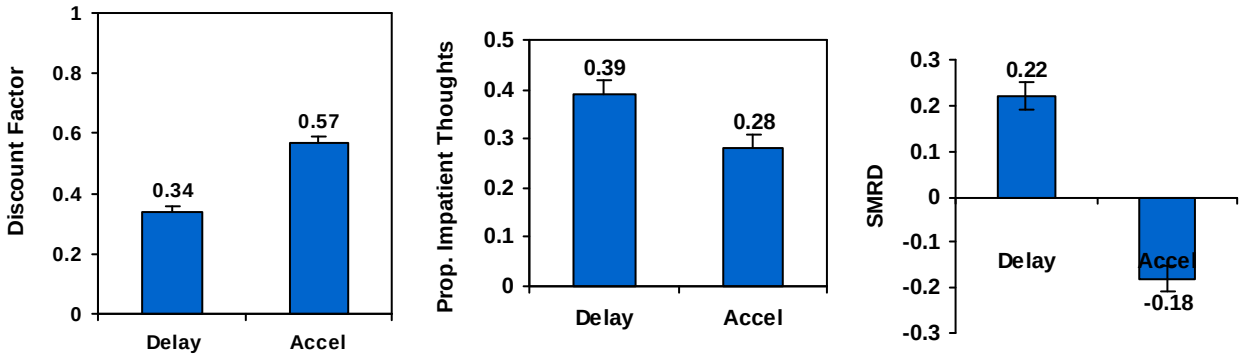

Figure 2. Mediation Analysis for Experiment 1, using the bootstrapping methodology of Bolger and Shrout (2002). Directional arrows denote regression analyses, and regression coefficient and its bootstrapped 95% confidence interval (CI) are shown adjacent to each arrow. CIs not including 0 indicate a significant regression coefficient. Being in the acceleration (vs. delay) task increases discount-factor d significantly by .34. ***After*** the mediator is added to the regression, the effect is reduced to .26. There is significant partial mediation because the reduced regression coefficient (.26) is not inside the 95% CI of the coefficient of the (unmediated) simple regression (.26, .43).

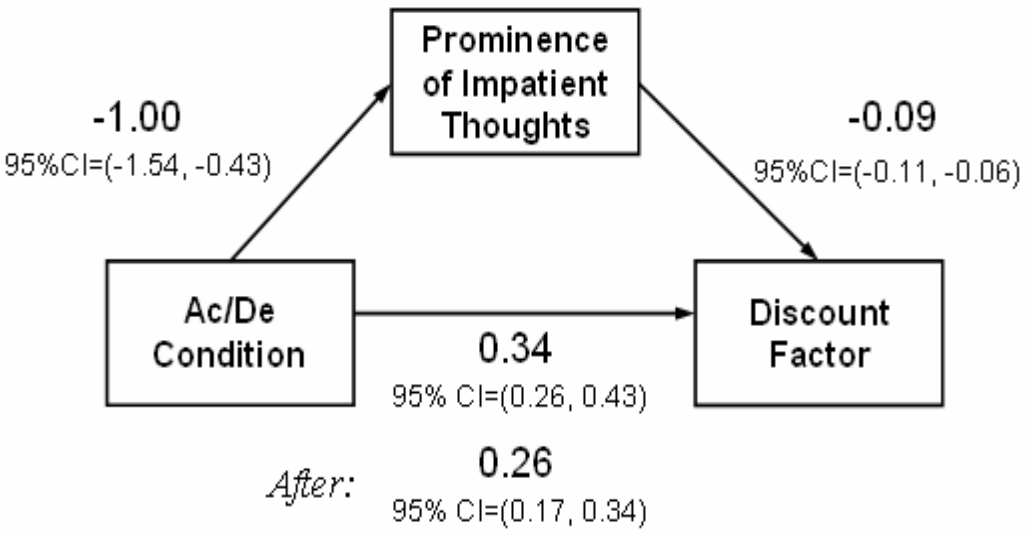

Figure 3. Mean Discount-Factor d (left panel) and Proportion-of-Impatient-Thoughts (right panel) when Delaying or Accelerating Gift-certificate Receipt in Experiment 2, as a function of Manipulated Query Order.

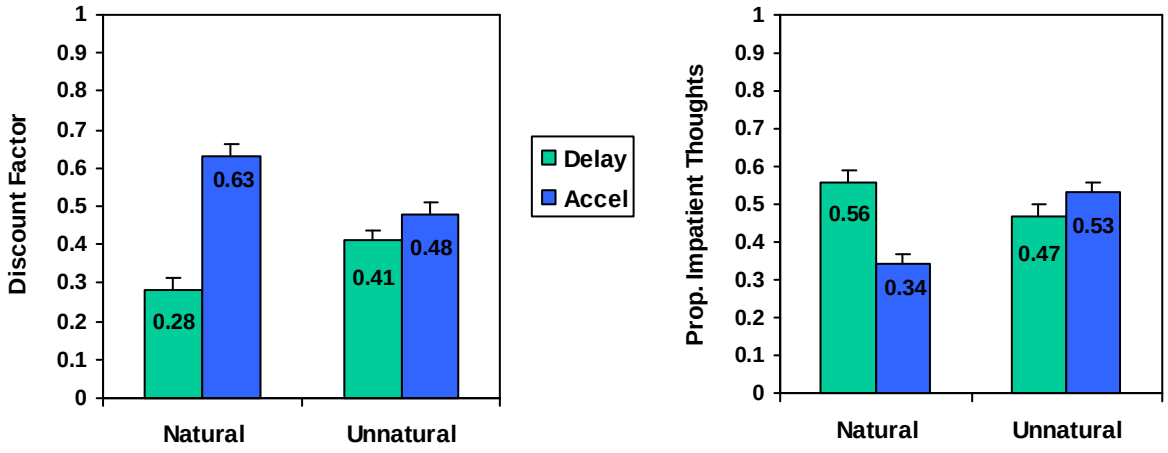

Figure 4: Reaction Time (msec) for Categorization of Different Types of Aspects (Thoughts Favoring Immediate Consumption ("Now"), Delayed Consumption ("Later"), or Neither ("Foils") as a Function of Task Condition in Experiment 3.