

The Paradoxical Effects of Memory Priming on Intertemporal Choice

Benjamin Epstein

Advisor: Michael J. Kahana, Ph.D.

Advisor: Ada Aka

University of Pennsylvania

Abstract

Many decisions involve balancing the desire to consume in the present with the need to save resources for the future. Economists quantify how one compromises these forces with “discounting.” Psychologists have investigated ways to manipulate discounting through various interventions. The present investigation studies the effects of word priming on discounting. In a preliminary study ($N = 185$), participants rated how well words evoke a “Savings” vs. a “Consumption” context. In our main priming study ($N = 84$), we used these words in a free recall task, followed by a choice titration task in which participants indicated their intertemporal preferences. While priming with a Consumption context had no effect on discounting, priming with a Savings context had a significant effect. Surprisingly, a Savings context increased discounting. This finding raises the concern that some interventions aiming to increase positive life outcomes by promoting future-oriented behavior and reducing present-oriented behavior may ultimately backfire.

Keywords: intertemporal choice, implicit memory, priming, delay of gratification, decision making

The Paradoxical Effects of Memory Priming on Intertemporal Choice

The course of every human life has been defined by a universal theme—or burden. Armed with prudence but impaired by compulsion, we are strained by a perpetual tug-of-war: preparing and saving for the future vs. succumbing to the impulses of the present. To study for the LSATs or to watch the finale of *The Bachelorette*, that is the question. This internal conflict, however, has much graver implications than low test scores and reality television addiction. Healthy, future-oriented behaviors, such as regular exercise and consistent saving for retirement, lead to longevity and greater retirement wealth (Reimers et al., 2012; Bernheim et al., 2001). Harmful, present-oriented behaviors, such as unhealthy eating, physical inactivity, drug use, and smoking, continue to be leading causes of preventable death and disease (Johnson et al., 2014). Though it may seem obvious and uncomplicated to achieve these positive outcomes, we too often arrive at the negative ones. 21% of Americans have no retirement savings and 33% of Baby Boomers, the generation approaching retirement, have less than \$25,000 in retirement savings (Northwestern Mutual, 2018). 14% of American adults smoke cigarettes and 80% of American adults and adolescents do not exercise to a sufficient extent (Centers for Disease Control and Prevention, 2020; Piercy et al., 2018). Clearly, it can be far more difficult to endure discomfort or exert energy for a delayed reward than to indulge in instant pleasure or to avoid immediate pain. Philosophers and theorists have posed conflicting solutions to this conundrum for millennia. Thirteenth century Islamic scholar and poet Rumi posits that “he whose intellect overcomes his desire is higher than the angels; he whose desire overcomes his intellect is less than an animal;” ancient Greek sage Epicurus proffers “not what we have but what we enjoy, constitutes our abundance” (Helminski, 2000, p. 19; Epicurus, n.d.). While there may be no consensus on how we ought to behave, one thing remains certain: reconciling these two forces

has grand implications for achieving success, maintaining health, and enjoying the pleasures of everyday life.

As it happens, children who are better at delaying the gratification of a smaller, present reward for the prospect of a larger, future reward tend to score higher on the SAT exam, cope with stress more effectively, build healthier interpersonal relationships, and maintain a lower Body Mass Index in adulthood (Mischel et al., 1988; Shoda et al., 1990; Tangney et al., 2004; Schlam et al., 2012). In fact, self-discipline forecasts academic performance in adolescence more accurately than IQ score (Duckworth & Seligman, 2005). In a comprehensive review, self-efficacy, the ability to control motivation and behavior in pursuit of a personal goal, was found to be the strongest predictor of university GPA, outperforming both high school GPA and ACT score (Richardson et al., 2012). Of the Big Five personality traits, Conscientiousness, characterized by self-discipline and efficaciousness, most strongly predicts college GPA, even after controlling for high school GPA and SAT score (Nofle & Robins, 2007). Self-control has also been linked to impulsive purchasing and present-oriented consumer behavior, especially in intertemporal situations (i.e. situations between different time periods) when the benefits of immediate consumption are enjoyed before the future costs are incurred. (Baumeister, 2002; Hoch & Loewenstein, 1991).

The ability to withhold immediate consumption for larger payoffs in the future surely relates to the positive outcomes of one's life. And while the number of minutes a child can suppress the urge to eat a marshmallow can be an effective measure of one's ability to trade instant pleasure for delayed reward, economists have devised other methods to quantify one's level of self-control in intertemporal choices (Mischel et al., 1972).

Quantifying Intertemporal Choice: Temporal Discounting

How much would you pay today to be given \$100 in three months? How much do you really value being given \$100 in three months? That is to ask, given the choice between \$100 in three months vs. some dollar amount today, what dollar amount would make you indifferent to these two choices? Once this point of indifference has been established, the discounted-utility model can pin down one's ability to delay gratification, a personality trait, to a single number (Samuelson, 1937; Odum, 2011). This number, the Temporal Discount Rate (TDR), is used to compare rewards that payoff at different points in time, rolling back future rewards to their present value. By discounting all future payouts to their value in the same present moment, one's true preferences are revealed.

Exponential Discounting

Samuelson's (1937) model employs exponential discounting, assuming individuals apply constant discounting per period. The exponential discounting model takes the following structure,

$$V = Ae^{(-k \times d)}$$

where A represents the objective value of a future reward, e is a mathematical constant (Euler's number), k represents the TDR, d represents the duration of the delay (i.e. years), and V represents the subjective present value of a future reward. For example, an individual with a TDR of 0.25 ($k = 0.25$) is indifferent to being given \$100 ($A = \100) in 3 months ($d = \frac{3}{12} = 0.25$) and being given \$93.94 today ($V = \93.94). Paying any amount of money less than \$93.94 today to be given \$100 in 3 months would be personally profitable.

Hyperbolic Discounting

While the exponential discounting model effectively illustrates the concept of comparing the payouts of intertemporal choices by rolling back future rewards to their present values, it fails

to capture human impulsivity and a common preference reversal between choices with the same payouts and the same intertemporal delay but that both deliver rewards farther into the future—hyperbolic discounting more accurately accounts for this phenomenon (Ainslie, 1975). The hyperbolic discounting model takes the following structure,

$$V = \frac{A}{(1 + k \times d)}$$

To the individual with a TDR of 0.25, paying any amount of money less than \$94.12 today to be given \$100 in 3 months would be personally profitable.

Despite the lapse of exponential discounting, both models closely reflect real human choices and have both been used extensively in intertemporal choice research (Frederick et al., 2002). Most importantly, the models both demonstrate that an individual with a lesser TDR is more prone to future-oriented savings behavior than an individual with a greater TDR and an individual with a greater TDR is more prone to present-oriented consumption behavior than an individual with a lesser TDR. What's more, researchers have shown that laboratory measured TDRs are strong predictors of individuals' real-life behavior, such as exercise and smoking; it is also associated with obesity, weight-loss in overweight children, smoking relapse, and the response to substance abuse treatment in adolescents (Chabris et al., 2008; Amlung et al., 2016; Best et al., 2012; Sheffer et al., 2014; Stranger et al., 2012). Many future-oriented and present-oriented behaviors relate to an individual's TDR, and some even postulate that the TDR may represent a unique personality trait involving the delay of gratification; this could potentially explain why smokers show more general impatience and risk-tolerance than non-smokers, a clustering of present-oriented behaviors in individuals with high TDRs (Odum, 2011; Khwaja et al., 2006). To support healthy behavior change, it may be important to identify what drives the

differences in TDRs between groups of people and to investigate how high TDRs can be reduced (Koffarnus et al., 2012)

Differences and Manipulations to Temporal Discounting

Recently, there has been contention to Mischel et al.'s (1988) and Shoda et al.'s (1990) claims that childhood ability to delay gratification, which abstracts from one's TDR, predicts life outcomes. Controlling for the characteristics of one's home environment and family background, such as household income and maternal education level, delay of gratification has a milder effect on life outcomes than previously postulated; circumstances of socioeconomic status also confound the results, affecting both the ability to delay gratification and life outcomes (Watts et al., 2018). Research and theory have been put forth to explain the mechanisms by which socioeconomic status may affect one's capacity to delay gratification. Mullainathan and Sharif (2013) propose that the experience of poverty may push individuals towards more present-oriented consumption behavior as the prospect of future, delayed rewards are less certain. Moreover, there is evidence that the uncertain state of being impoverished hinders one's cognitive capacity, which could affect the ability to exercise self-restraint, a top-down executive function necessitating cognitive control (Mani et al., 2013; Heatherton & Wagner, 2011). Socioeconomic status has some degree of influence on the ability to trade immediate pleasure for delayed reward, which, in turn, has some degree of influence on life outcomes. It is important to examine other forces that might also manipulate one's TDR, or the propensity to make future-oriented savings vs. present-oriented consumption choices—these forces could ultimately contribute to the positive or negative outcomes of one's life.

A considerable amount of research has investigated potential interventions to self-regulation and the ability to exert control over one's motivations and behavior (Baumeister et al.,

2006). Muraven et al. (1999) demonstrated that self-control can be improved by self-regulatory exercises, such as monitoring and correcting one's own posture and recording one's own food consumption; physical exercise (i.e. weightlifting and aerobics) has also been shown to improve self-control, curb cigarette smoking and alcohol use, reduce time spent watching television, and increase time spent studying (Oaten & Cheng, 2006). Interventions can also increase individuals' savings rates (Oaten & Cheng, 2007). Commitment devices, self-help peer groups, subsidies for opening a bank accounts, and increasing accessibility to bank accounts can similarly increase savings (Brune et al., 2011; Kast et al., 2012; Cole et al., 2011; Dupas & Robinson, 2013). These interventions have successfully increased beneficial future-oriented behavior and have reduced harmful present-oriented behavior.

In addition to intervention studies, researchers have exhibited relationships between individuals' ability to exert self-control and the qualities and circumstances of their environment. Conditions of socioeconomic status, such as household income and maternal education level, vary with children's capacity to delay gratification (Watts et al., 2018). At the same time, more subtle associations have been established; for instance, the amount of greenery and the number of views of natural landscapes in urban areas predict the academic achievement and the ability to inhibit impulses and delay gratification of at-risk inner-city children (Hodson & Sander, 2017; Taylor et al., 2002). Environmental factors also have an effect on adults, influencing their consumption habits, proclivity towards debt, and ownership of stocks, an investment instrument often used to proactively generate wealth for retirement (Kuhn et al., 2011; Georgarakos et al., 2014; Hong et al., 2004; Brown et al., 2008). Seemingly, external variables are related to the future-oriented vs. present-oriented behavior of individuals of all ages.

Cross-cultural analyses have also demonstrated differences in intertemporal choice decisions between distinct geographic and linguistic groups. In Switzerland, households on the German-speaking side of a language border are considerably more likely to save than similar households on the French-speaking side (Guin, 2016). As it happens, speakers of languages without grammatically distinct future and present tenses (vs. speakers of languages with grammatically distinct future and present tenses) save more money for retirement, smoke less, are less overweight, and behave more pro-environmentally; in fact, econometric analyses have demonstrated that countries where these languages are spoken tend to have stricter climate change policies (Chen, 2013; Mavisakalyan et al., 2018).

While these critical findings do not demonstrate a causal relationship between language and the degree to which households and societies discount, a causal effect in individuals has in fact been established in experimental settings. Framing intertemporal choices decisions between immediate rewards and delayed rewards with varied verb tenses affects the degree to which one discounts (Banerjee & Urminsky, 2020). Sheffer et al. (2016) and Shevorykin et al. (2019) demonstrated that individuals discount the value of a delayed rewards less (vs. more) when asked to write personal sentences using ten future-focused words (vs. ten present-focused or ten non-temporal focused words), revealing how internalizing priming cues can be employed to manipulate intertemporal choices decisions; however, these results may speak more to the force of self-affirmation processes, whereby individuals behave in a manner which validates their current self-concept (Steele, 1988). Israel et al. (2014) attempted to influence temporal discounting by priming individuals with pictorial and textual exposés of old age vs. vacation; while the pictorial exposés affected their temporal discounting, the textual exposés had no such effect. This failure to replicate the textual priming effect decreases the strength and

generalizability of the findings that do in fact show the causal effect of linguistic priming; this is not necessarily surprising, given the general difficulty in replicating priming effects (as discussed in Bower 2012; Pashler & Wagenmakers 2012; Cesario 2014; Molden 2014; Vadillo et al. 2016, as cited in Banerjee & Urminsky, 2020). How language can be used to prime individuals to make future-oriented savings vs. present-oriented consumption decisions is still an unresolved question—an important question as its effect could be both a powerful and easily implementable tool to encourage future-oriented behavior and increase positive life outcomes.

The Present Investigation

In this investigation, we conducted an experiment to examine the causal effects of word priming on individuals' intertemporal choice decisions; specifically, we examined the priming effect of words that evoke a "Savings" context vs. a "Consumption" context. In a preliminary study we asked participants to rate words in order to measure the degree to which they evoke a Savings context vs. Consumption context, to carefully select our stimuli for our main priming study. In the main study, we used the most evocative words to prime participants in a free recall task and measured whether (and how) priming influences their intertemporal choice decisions using a choice titration task. Our central hypothesis was that individuals will demonstrate more (vs. less) future-oriented savings behavior when primed with words that evoke a Savings context (vs. a Neutral context) and will demonstrate more (vs. less) present-oriented consumption behavior when primed with words that evoke a Consumption context (vs. a Neutral context). That is, priming with a Savings context should lower one's TDR while priming with a Consumption context should higher it.

Preliminary Study: Rating Words on a Savings-Consumption Continuum

In our preliminary study, two researchers compiled two sets of words with strong evocations of a Savings context and a Consumption context, respectively. For example, “Insurance” and “Lettuce” were generated for the Savings word set, while “Impulse” and “Cookie” were generated for the Consumption word set. To validate our experimental stimuli, we examined if other individuals perceive these words to have the same evocations that we perceive them to have. To conduct this, we ran an online study and asked English-speaking participants to rate our words on a Savings-Consumption continuum. After the stimuli in our word sets were rated by the participants, we used their ratings to select the most extreme words within each set to be used in our main study, as to prime participants with the most evocative stimuli.

Method

Participants

One hundred eighty-nine participants were recruited on Prolific, an online crowdsourcing task platform. Participants were paid an hourly rate of \$10.00 for their participation in this study. Two participants were removed from the analysis because they did not finish the survey and two participants were removed from the analysis because they failed an attention check. Participants ($N = 185$) were between ages 18 and 59 ($M = 33.2$, $SD = 10.54$). Ninety (48.65%) participants were female. Our experiment was approved by The Institutional Review Board of the University of Pennsylvania and informed consent was granted by all participants.

Measures

Savings-Consumption Rating. We defined a Savings word (i.e. a word that evokes a Savings context) as relating to investing time, effort, energy, or money with the expectation of a rewarding outcome in the future. Similarly, we defined a Consumption word (i.e. a word that

evokes a Consumption context) as relating to the using up of a resource in the present moment to immediately satisfy a desire or achieve pleasure. Participants indicated their perception of the words on a 7-point continuum, a score of “1” representing a pure Savings word and a score of “7” representing a pure Consumption word. For instance, the word “Patience” received a mean rating of 1.25, indicating that participants perceived it to evoke a strong Savings context; the word “Cake” received a mean rating of 6.75, indicating that participants perceived it to evoke a strong Consumption context.

Procedure

We generated a set of 238 nouns that evoke a Savings context and a set of 237 nouns that evoke a Consumption context. Participants were asked to complete a survey on Qualtrics in which they would rate these nouns. After they issued their informed consent, participants were given our definitions of a Savings word and a Consumption word, as defined in the above section. They were then instructed to indicate to what degree they perceive each word to be a Savings word vs. Consumption word by rating it on a 7-point Likert scale. Each participant rated approximately 15 unique words, randomly sampled from a pool of both sets of words (i.e. a total of 475 words). We recruited participants until each word had been rated at least five times. Participants spent approximately two minutes completing this task.

Before we conducted any analysis, we removed the ratings of eleven words from our dataset. Two words were removed because they contained accents (e.g. “Fiancé”) which was incompatible with the Qualtrics interface. Nine words were removed because they contained a space (e.g. “Ice Cream”), which was incompatible with our free recall paradigm in our main study as the rest of our word pool only included individual words. Of the eleven words removed, two were Savings words and nine were Consumption words.

Results

We conducted a within-subjects, one-sample t-test to assess the difference between the perceived evocation of words in the Savings word set and the Consumption word set. As expected, there was a significant difference between the ratings in the two word sets, $t(183) = -20.45$, $p < .001$, $d = -1.77$; see Table 1. This result demonstrates that participants perceived the words in the Savings word set to evoke a stronger (vs. weaker) Savings context than words in the Consumption word set and perceived the words in the Consumption word set to evoke a stronger (vs. weaker) Consumption context than words in the Savings word set. This result validated our two word sets, validating that our perception of the words we generated matched the perception of our participants. We then calculated the mean ratings for each word in both word sets. We selected the 120 Savings words with the lowest mean ratings (i.e. evoking the strongest Savings context) and selected the 120 Consumption words with the highest mean ratings (i.e. evoking the strongest Consumption context) to be used as priming stimuli in our main experiment (see Table 2).

Table 1

Within-Subjects T-Test Comparing the Difference of Savings and Consumption Words' Ratings

	<i>df</i>	Mean diff.	SD	<i>t</i> -statistic
Rating	183	-1.77	1.18	-20.45***

*** $p < .001$.

Note. *df* = Degrees of Freedom. *SD* = Standard Deviation. Ratings range from 1 (pure Savings word) to 7 (pure Consumption word).

Experiment: Free Recall and Choice Titration Task

In our main experiment, we examined the effects of word priming on intertemporal choice decisions by asking participants to complete a free recall task followed by a choice

titration task. Each participant began by completing a free recall task in which they studied and recalled lists of words. Depending on the condition to which they were randomly assigned, the lists of words included Savings and Neutral words, Consumption and Neutral words, or only Neutral words. Neutral words were gathered from an internal pool of neutral words in our laboratory. Upon completing the free recall task, participants were given a choice titration task in which they expressed their preferences on several intertemporal choice decisions, each offering the choice between a lesser monetary reward today and a greater monetary reward in the future. Based on the preferences that the participants expressed, we calculated their TDRs, fitting them to both the exponential and hyperbolic discounting models. We used their TDRs to compare the degree of discounting between the conditions—that is, the influence priming with Savings words vs. Consumption words has on the propensity to make future-oriented decisions vs. present-oriented decisions.

Method

Participants

One hundred thirteen participants were recruited on Amazon Mechanical Turk (MTurk), an online crowdsourcing task platform. Participants were paid an hourly rate of \$10.00 for their participation in this study. Twenty-nine participants were removed from the analysis because they did not finish the experiment. Participants ($N = 84$) were between ages 24 and 70 ($M = 41.13$, $SD = 10.25$). Forty-three (51.19%) participants were female. Our experiment was approved by The Institutional Review Board of the University of Pennsylvania and informed consent was granted by all participants.

Procedures

Free Recall Task. Participants began the experiment with a double-blind random assignment to one of the three conditions: Savings, Consumption, or Neutral. Their condition assignments determined which priming stimuli (i.e. types of words) they would encounter in the free recall task. The task consisted of 10 sequential study-recall trials; in each trial, the participants observed a list of 24 words flash on their computer screens in succession and were then instructed to recall as many words as they could from that list by typing them on their keyboards, within 60 seconds. The words that the participants observed in each list depended on the condition to which they were assigned. Participants in the Savings condition observed 10 lists of 24 words, each containing 12 unique Savings words and 12 unique Neutral words. Participants in the Consumption condition observed 10 lists of 24 words, each containing 12 unique Consumption words and 12 unique Neutral words. Participants in the Neutral condition observed 10 lists of 24 words, each containing 24 unique Neutral words. Across the three conditions, all 24 words were randomly ordered within each list and no words were repeated between the lists.

Choice Titration Task. Upon completing the free recall task, participants were then told that they had been entered into a lottery with the other participants of the study, where one participant would randomly be chosen to win a bonus on top of their initial payment. The bonus that the lottery winner would receive would be one of their preferences from the choice titration task, randomly selected. The participants were instructed to indicate their preferences across 10 intertemporal choice decisions. Each intertemporal choice decision offered the choice between a lesser monetary reward today and a greater monetary reward in the future. Across the 10 intertemporal choice decisions, the monetary rewards offered today were fixed at \$50; the monetary rewards offered in the future ranged from \$55 to \$100, increasing in \$5 increments; the delay periods for the monetary rewards offered in the future were also fixed at three months.

That is, each intertemporal choice decision offered the choice between \$50 today and \$55 - \$100 in three months. The 10 intertemporal choices were displayed vertically on one webpage, sorted by future monetary rewards in ascending order. Participants clicked bubbles to indicate their preferences. Participants spent approximately 15 minutes completing both the free recall task and the choice titration task.

Measures

Temporal Discount Rate. We derived each participants Temporal Discount Rate (TDR) from the indifference point indicated by their preferences on the choice titration task. The indifference point was the midpoint of the two preferences between which a participant switched from consistently preferring the lesser monetary reward today to the larger monetary reward in three months. For example, if one's preferences were the following,

1. \$50 today (instead of \$55 in three months)
2. \$50 today (instead of \$60 in three months)
3. \$50 today (instead of \$65 in three months)
4. \$70 in three months (instead of \$50 today)
5. \$75 in three months (instead of \$50 today)
6. \$80 in three months (instead of \$50 today)
7. \$85 in three months (instead of \$50 today)
8. \$90 in three months (instead of \$50 today)
9. \$95 in three months (instead of \$50 today)
10. \$100 in three months (instead of \$50 today)

the indifference point would be \$67.50, as the direction of their preferences (i.e. today vs. in three months) switched between \$65.00 and \$70.00 and were also consistent before and after

the switch. In other words, this hypothetical individual would be indifferent to \$50.00 today and \$67.50 in three months. After isolating each participants' indifference point, we fit them to the exponential and hyperbolic discounting models, yielding two TDRs for each participant. Continuing the previous example, we would fit the indifference point to the exponential discounting model such that,

$$\$50.00 = \$67.50e^{(-k \times 0.25)}$$

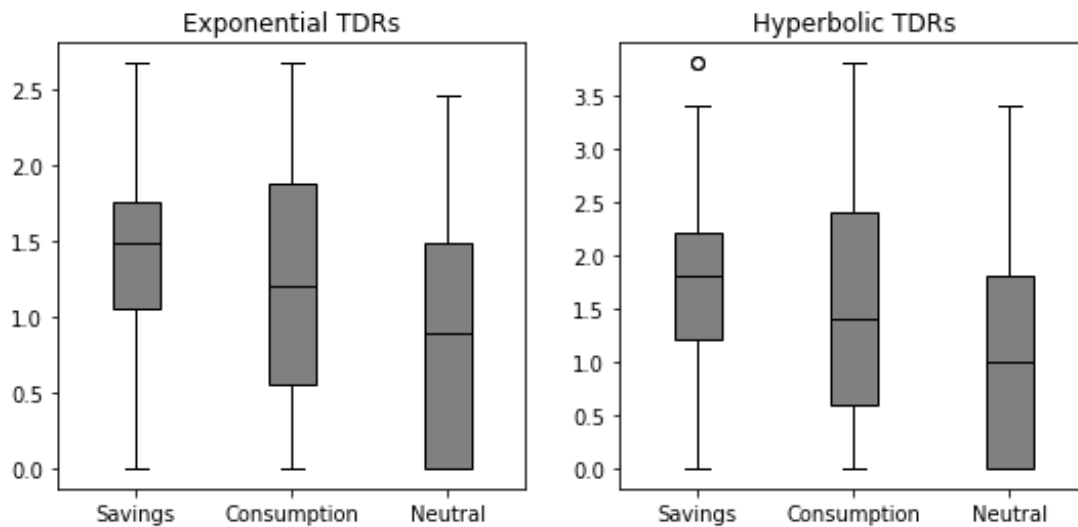
where \$67.50 represents the objective value of the future reward, e is a mathematical constant (Euler's number), k represents the TDR, 0.25 represents the duration of the delay (i.e. 3 months), and \$50.00 represents the subjective present value of the future reward, or the value that makes the individual indifferent to the two choices. Solving for k , this individual's TDR would be 1.20 according to the exponential discounting model. Similarly, their TDR would be 1.40 according to the hyperbolic discounting model.

Nineteen participants' preferences were consistently future-oriented (i.e. all 10 of their preferences were for larger monetary rewards in three months) and could not be fit to either model as their indifference points could not be established. These participants defaulted to an exponential TDR of 0.00 and a hyperbolic TDR of 0.00, as they exhibited no discounting at all. Six participants' preferences were consistently present-oriented (i.e. all 10 of their preferences were for lesser monetary rewards today) and also could not be fit to either model as their indifference points could not be established. Additionally, these preferences theoretically yield an infinite TDR, incompatible with any analysis. Thus, these participants defaulted to the next highest exponential and hyperbolic TDRs, the TDRs associated with nine preferences for lesser monetary rewards today and one preference for a larger monetary reward in three months.

Results

We conducted several two-sample, between-subjects t-tests to assess the difference between the exponential and hyperbolic TDRs of participants in the Savings condition and the Neutral condition, as well as the difference between the exponential and hyperbolic TDRs of participants in the Consumption condition and the Neutral condition. The 27 participants in the Savings condition ($M = 1.43$, $SD = 0.74$; see Figure 1) demonstrated significantly higher exponential TDRs compared to the 25 participants in the Neutral condition ($M = 0.90$, $SD = 0.83$; see Figure 1), $t(24) = 2.40$, $p = .02$; see Table 3. Similarly, the participants in the Savings condition ($M = 1.81$, $SD = 1.05$; see Figure 1) demonstrated significantly higher hyperbolic TDRs compared to the participants in the Neutral condition ($M = 1.12$, $SD = 1.10$; see Figure 1), $t(24) = 2.31$, $p = .025$; see Table 3. Moreover, the 32 participants in the Consumption condition ($M = 1.24$, $SD = 0.95$; see Figure 1) failed to demonstrate significantly higher exponential TDRs compared to the 24 participants in the Neutral condition ($M = 0.90$, $SD = 0.83$; see Figure 1), $t(24) = 1.40$, $p = .17$; see Table 3. Similarly, the participants in the Consumption condition ($M = 1.61$, $SD = 1.36$; see Figure 1) failed to demonstrate significantly higher hyperbolic TDRs compared to the participants in the Neutral condition ($M = 1.12$, $SD = 1.10$; see Figure 1), $t(24) = 1.46$, $p = .15$; see Table 3. The results from the free recall task were not relevant to our original research question, but we are including them in the appendix.

Figure 1

Boxplots Comparing the TDRs between Conditions

Note. *TDR* = Temporal Discount Rate.

Table 3

Two-sample T-Tests Comparing the Difference in Exponential TDRs between Conditions

Exponential Discounting				
	<i>df</i>	M	SD	<i>t</i> -statistic
Savings	24	1.43	0.74	2.40*
Consumption	24	1.24	0.95	1.40
Neutral		0.90	0.83	

Hyperbolic Discounting				
Savings	24	1.81	1.05	2.31*
Consumption	24	1.61	1.36	1.46
Neutral		1.12	1.10	

* $p < .05$.

Note. *df* = Degrees of Freedom. *SD* = Standard Deviation. Two *t*-tests were conducted, comparing both the Savings condition and the Consumption condition to the Neutral condition.

Discussion

In our main study, we examined the influence of word priming on intertemporal choice. We hypothesized that individuals would demonstrate more (vs. less) future-oriented savings behavior when primed with words that evoke a Savings context (vs. a Neutral context) and would demonstrate more (vs. less) present-oriented consumption behavior when primed with words that evoke a Consumption context (vs. a Neutral context). That is, we predicted that priming with Savings words would lower one's TDR while priming with Consumption words would raise it. We were unable to confirm this hypothesis. While individuals who were primed with Consumption words did discount more than those who were primed with Neutral words, the result was insignificant. We were, in fact, able to establish a significant difference in discounting between individuals who were primed with Savings words and those who were primed with Neutral words; however, the direction of this significant difference is in direct contradiction to our original hypothesis. We predicted that individuals primed with Savings words would discount less (vs. more) than individuals primed with Neutral words. In actuality, we found that participants in the Savings condition had significantly higher exponential and hyperbolic TDRs than participants in the Neutral condition. This result also contradicts previous research that demonstrated how priming individuals with future-focused contexts, via linguistic and pictorial cues, decreases the degree to which they discount in intertemporal choice decisions (Banerjee & Urminsky, 2020; Sheffer et al., 2016; Shevorykin et al., 2019; Israel et al., 2014). In an attempt to prime individuals with similarly future-focused contexts, we discovered the opposite effect and aim to uncover possible mechanisms that explain this result.

One possible explanation is that participants in the Savings condition did actually make future-oriented decisions. Even after successfully being primed to engage in more future-oriented

behavior, it is possible that an individual could reasonably prefer an immediate, lesser monetary reward. For example, a participant could have planned to use the reward to pay off debt faster or because they thought that investing the money themselves would yield a higher return than waiting for the larger monetary reward in three months. Future work can investigate this possibility by including an additional question at the end of the study, asking participants to elaborate on what they are planning to do with the money earned from the study and/or lottery.

Another possible explanation is that participants in the Savings condition “choked under pressure,” underperforming in the choice titration task despite there being incentives to perform well (Baumeister, 1984). Savings words could have evoked future-oriented behaviors that are difficult to perform and life outcomes that are difficult to achieve. This manipulation of pressure could have increased their level of self-consciousness; by increasing their conscious attention on their own process of performance, their performance on intertemporal choice decisions could have been decremented. The presence of Savings words, however, do not match any of the pressure variables that Baumeister (1984) identified. These pressure variables, audience presence, implicit competition, and performance-based incentives, were also all equally present across the three conditions and, thus, could not explain the significantly differing TDRs between the Savings condition and the Neutral condition.

Participants in the Savings condition could have also been subject to a type of “stereotype threat,” the tendency to confirm a negative stereotype about one’s group (Steele & Aronson, 1995). While the ethnicities and racial identities of the participants were not captured in this experiment, Aronson et al. (1999) demonstrated that individuals, even for whom no relevant stereotype exists, exhibit performance decrements due to certain situational pressures, such as an invoked comparison to a group with a relevant stereotype of superiority. Savings

words could have been perceived as character traits of an exemplar individual who has superior abilities to delay gratification, makes responsible future-oriented decisions, and achieves positive life outcomes. Savings words could have also been perceived as socioeconomic accomplishments of an exemplar individual, such as “College,” “Paycheck,” and “Promotion.” This could invoke a stereotype threat to social class, which has also been shown to hinder performance (Croizet & Claire, 1998). Through implicit comparison with the exemplar, participants could have internalized feelings of inferiority, ultimately impairing their performance on intertemporal choice decisions by increasing the degree to which they discount future rewards.

Sheffer et al. (2016) and Shevorykin et al. (2019) seemingly did not induce this stereotype threat in their experiments, as they successfully demonstrated that individuals discounted the value of delayed rewards less (vs. more) when primed with future-focused words (vs. present-focused or non-temporal focused words). It is critical to note, however, that participants in these experiments used these words to write personalized sentences, which very well could be seen as self-affirmations. The self-affirmation process can, in effect, update one’s self-concept. This can lead to behavior adaptation, as one attempts to mitigate dissonance and maintain congruence between their self-concept and their actions (Steele, 1988; Aronson et al., 1999; Festinger, 1957). An important distinction between Sheffer et al. (2016) and Shevorykin et al. (2019)’s experiments and our experiment could be internalization vs. externalization. Their paradigm could have invoked positive self-affirmations and engendered future-oriented self-concepts, which could have led to more future-oriented behavior; our paradigm could have invoked an asymmetrical locus of comparison and aroused feeling of inferiority, which could have led to more present-oriented behavior.

Limitations and Future Directions

There are several limitations to our study that are worth noting. One considerable limitation is that we did not empirically test for the perception of Neutral words. While we did test for the perception of Savings words and Consumption words and used the most evocative of these words in our free recall task, our results may have been stronger had we made sure that the Neutral words were perceived as evoking a Neutral context, with respect to future and present orientations. As all three conditions, however, made some use of the Neutral words, and the Neutral condition did not make any use of the empirically tested and most evocative Savings and Consumption words, it is unlikely that this limitation had significant impact on our results. Future researchers, though, may want to also compare Savings, Consumption, and Neutral words across dimensions, such as valence, in addition to evocations of a Savings vs. Consumption context. Controlling for other evocations of these words would allow researchers to better isolate the effects of priming with a future-oriented context vs. a present-oriented context.

Another limitation of our study is the dropout rate. Only 84 of 113 (74.3%) participants completed both the free recall task and the choice titration task. While the number of participants in each condition were approximate equal (*Savings* = 27, *Consumption* = 32, *Neutral* = 25), it is possible that certain words associated with a condition in the free recall task contributed to participants dropping out of the experiment, a potential violation of randomization as participants of a condition could be categorically different than participants of the other conditions. However, of the 29 participants who did not complete the study, the numbers of participants in each condition were approximately equal (*Savings* = 10, *Consumption* = 11, *Neutral* = 8), implying that dropping out of the study was not disproportionately induced by any one condition. By testing and controlling for other evocations of the priming stimuli used in the free recall task,

future researchers may be able to mitigate against any differential dropout between the conditions.

Finally, more research should be conducted on the potential negative outcomes of positively intended interventions. Our result contradicted both our initial hypothesis as well as the results of previous research, which had demonstrated that priming with a future-focused context decreases discount. Future research should investigate how interventions that focus on internalization (e.g. positive self-affirmation) may lead to different outcomes than interventions that focus on externalization (e.g. asymmetrical comparisons), as well as other mechanisms behind paradoxical interventions.

Conclusion

The current investigation provides a new paradigm by which to study manipulations of intertemporal choice; through priming with stimuli in a free-recall task and subsequently capturing their intertemporal preferences in a choice titration task, we successfully manipulated individuals' Temporal Discount Rates. Previous research has shown that having individuals reflect on a future-focused context decreases the degree to which they discount future rewards. Our study, however, demonstrates that simply priming individuals with words that evoke such a future-focused context actually increases the degree to which they discount, contrary to the previous research and our original hypothesis. We do not yet understand the mechanisms behind this paradoxical result, and have turned to research on pressure, self-consciousness, comparison, and performance for direction. Though we do not yet understand it, the implication of our results should raise concern. Our investigation suggests that some interventions that intend to help individuals achieve better life outcomes, by increasing positive future-oriented behavior and decreasing negative present-oriented behavior, may be self-defeating.

References

- Ainslie, G. (1975). Specious reward: Behavioral theory of impulsiveness and impulse control. *Psychological Bulletin*, 82(4), 463. <https://dx.doi.org/10.1037/h0076860>
- Amlung, M., Petker, T., Jackson, J., Balodis, I., & MacKillop, J. (2016). Steep discounting of delayed monetary and food rewards in obesity: a meta-analysis. *Psychological Medicine*, 46(11), 2423-2434. <https://dx.doi.org/10.1017/S0033291716000866>
- Aronson, J., Cohen, G., & Nail, P. R. (1999). Self-affirmation theory: An update and appraisal. In E. Harmon-Jones, J. Mills (Eds.), *Cognitive dissonance theory: Revival with revisions and controversies* (pp. 127-147). American Psychological Association.
- Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When white men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology*, 35(1), 29-46. <https://dx.doi.org/10.1006/jesp.1998.1371>
- Banerjee A. & Urminky O. (2020): What You Are Getting and What You Will Be Getting: Testing Whether Verb Tense Affects Intertemporal Choices. Working Paper. <https://dx.doi.org/10.2139/ssrn.3698127>
- Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research*, 28(4), 670-676. <https://dx.doi.org/10.1086/338209>
- Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-regulation and personality: How interventions increase regulatory success, and how depletion moderates the effects of traits on behavior. *Journal of Personality*, 74(6), 1773-1802. <https://dx.doi.org/10.1111/j.1467-6494.2006.00428.x>

- Bernheim, B. D., Skinner, J., & Weinberg, S. (2001). What accounts for the variation in retirement wealth among US households? *American Economic Review*, 91(4), 832-857. <https://dx.doi.org/10.1257/aer.91.4.832>
- Best, J. R., Theim, K. R., Gredysa, D. M., Stein, R. I., Welch, R. R., Saelens, B. E., Perri, M. G., Schechtman, K. B., Epstein, L. H., & Wilfley, D. E. (2012). Behavioral economic predictors of overweight children's weight loss. *Journal of Consulting and Clinical Psychology*, 80(6), 1086–1096. <https://dx.doi.org/10.1037/a0029827>
- Brown, J. R., Ivković, Z., Smith, P. A., & Weisbenner, S. (2008). Neighbors matter: Causal community effects and stock market participation. *The Journal of Finance*, 63(3), 1509-1531. <https://dx.doi.org/10.1111/j.1540-6261.2008.01364.x>
- Brune, L., Giné, X., Goldberg, J., & Yang, D. (2011). Commitments to save: A field experiment in rural Malawi. The World Bank.
- Centers for Disease Control and Prevention. (2020). *Current Cigarette Smoking Among Adults in the United States*. U.S. Department of Health and Human Services. Retrieved from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm#:~:text=In%202019%2C%20nearly%2014%20of,with%20a%20smoking%2Drelated%20disease.
- Cole, S., Sampson, T., & Zia, B. (2011). Prices or knowledge? What drives demand for financial services in emerging markets? *The Journal of Finance*, 66(6), 1933-1967. <https://dx.doi.org/10.1111/j.1540-6261.2011.01696.x>
- Chabris, C. F., Laibson, D., Morris, C. L., Schuldt, J. P., & Taubinsky, D. (2008). Individual laboratory-measured discount rates predict field behavior. *Journal of Risk and Uncertainty*, 37(2), 237-269. <https://dx.doi.org/10.1007/s11166-008-9053-x>

- Chen, M. K. (2013). The effect of language on economic behavior: Evidence from savings rates, health behaviors, and retirement assets. *American Economic Review*, 103(2), 690-731.
<https://dx.doi.org/10.1257/aer.103.2.690>
- Croizet, J. C., & Claire, T. (1998). Extending the concept of stereotype threat to social class: The intellectual underperformance of students from low socioeconomic backgrounds. *Personality and Social Psychology Bulletin*, 24(6), 588-594.
<https://dx.doi.org/10.1177/0146167298246003>
- Duckworth, A. L., & Seligman, M. E. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, 16(12), 939-944.
<https://dx.doi.org/10.1111/j.1467-9280.2005.01641.x>
- Dupas, P., & Robinson, J. (2013). Savings constraints and microenterprise development: Evidence from a field experiment in Kenya. *American Economic Journal: Applied Economics*, 5(1), 163-92. <https://dx.doi.org/10.1257/app.5.1.163>
- Festinger, L. (1957). *A theory of cognitive dissonance*. Row, Peterson.
- Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, 40(2), 351-401.
<https://dx.doi.org/10.1257/002205102320161311>
- Heatherton, T. F., & Wagner, D. D. (2011). Cognitive neuroscience of self-regulation failure. *Trends in Cognitive Sciences*, 15(3), 132-139.
<https://dx.doi.org/10.1016/j.tics.2010.12.005>
- Helminski, K.E. (2000). *The Rumi Collection: An Anthology of Translations of Meviana Jalaluddin Rumi*. Threshold Books.

- Hoch, S. J., & Loewenstein, G. F. (1991). Time-inconsistent preferences and consumer self-control. *Journal of Consumer Research*, 17(4), 492-507.
<https://dx.doi.org/10.1086/208573>
- Hodson, C. B., & Sander, H. A. (2017). Green urban landscapes and school-level academic performance. *Landscape and Urban Planning*, 160, 16-27.
<https://dx.doi.org/10.1016/j.landurbplan.2016.11.011>
- Hong, H., Kubik, J. D., & Stein, J. C. (2004). Social interaction and stock-market participation. *The Journal of Finance*, 59(1), 137-163. <https://dx.doi.org/10.1111/j.1540-6261.2004.00629.x>
- Georgarakos, D., Haliassos, M., & Pasini, G. (2014). Household debt and social interactions. *The Review of Financial Studies*, 27(5), 1404-1433. <https://dx.doi.org/10.1093/rfs/hhu014>
- Guin, B. (2016). Culture and household saving. Available at SSRN: :
<http://ssrn.com/abstract=2698872>
- Johnson, N. B., Hayes, L. D., Brown, K., Hoo, E. C., & Ethier, K. A. (2014). *CDC National Health Report: leading causes of morbidity and mortality and associated behavioral risk and protective factors—United States, 2005–2013*. Retrieved from
<https://www.cdc.gov/mmwr/preview/mmwrhtml/su6304a2.htm>
- Kast, F., Meier, S., & Pomeranz, D. (2012). Under-savers anonymous: Evidence on self-help groups and peer pressure as a savings commitment device. Working Paper, National Bureau of Economic Research. <https://dx.doi.org/10.3386/w18417>
- Koffarnus, M. N., Jarmolowicz, D. P., Mueller, E. T., & Bickel, W. K. (2013). Changing delay discounting in the light of the competing neurobehavioral decision systems theory: A

- review. *Journal of the Experimental Analysis of Behavior*, 99(1), 32-57.
<https://dx.doi.org/10.1002/jeab.2>
- Kuhn, P., Kooreman, P., Soetevent, A., & Kapteyn, A. (2011). The effects of lottery prizes on winners and their neighbors: Evidence from the Dutch postcode lottery. *American Economic Review*, 101(5), 2226-47. <https://dx.doi.org/10.1257/aer.101.5.2226>
- Khwaja, A., Sloan, F., & Salm, M. (2006). Evidence on preferences and subjective beliefs of risk takers: The case of smokers. *International Journal of Industrial Organization*, 24(4), 667-682. <https://dx.doi.org/10.1016/j.ijindorg.2005.10.001>
- Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013). Poverty impedes cognitive function. *Science*, 341(6149), 976-980. <https://dx.doi.org/10.1126/science.1238041>
- Mavisakalyan, A., Tarverdi, Y., & Weber, C. (2018). Talking in the present, caring for the future: Language and environment. *Journal of Comparative Economics*, 46(4), 1370-1387. <https://dx.doi.org/10.1016/j.jce.2018.01.003>
- Mischel, W., Ebbesen, E. B., & Raskoff Zeiss, A. (1972). Cognitive and attentional mechanisms in delay of gratification. *Journal of Personality and Social Psychology*, 21(2), 204-218. <https://dx.doi.org/10.1037/h0032198>
- Mischel, W., Shoda, Y., & Peake, P. K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology*, 54(4), 687-696. <https://dx.doi.org/10.1037/0022-3514.54.4.687>
- Mullainathan, S., & Shafir, E. (2013). *Scarcity: Why having too little means so much*. Macmillan.
- Muraven, M., Baumeister, R. F., & Tice, D. M. (1999). Longitudinal improvement of self-regulation through practice: Building self-control strength through repeated exercise. *The*

- Journal of Social Psychology*, 139(4), 446-457.
<https://dx.doi.org/10.1080/00224549909598404>
- Nofhle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: Big five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology*, 93(1), 116–130. <https://dx.doi.org/10.1037/0022-3514.93.1.116>
- Northwestern Mutual (2018). *1 In 3 Americans have less than \$5,000 in retirement savings*.
<https://news.northwesternmutual.com/planning-and-progress-2018>.
- Oaten, M., & Cheng, K. (2006). Longitudinal gains in self-regulation from regular physical exercise. *British journal of Health Psychology*, 11(4), 717-733.
<https://dx.doi.org/10.1348/135910706X96481>
- Oaten, M., & Cheng, K. (2007). Improvements in self-control from financial monitoring. *Journal of Economic Psychology*, 28(4), 487-501. <https://dx.doi.org/10.1016/j.joep.2006.11.003>
- Odum, A. L. (2011). Delay discounting: I'm a k, you're a k. *Journal of the Experimental Analysis of Behavior*, 96(3), 427-439. <https://dx.doi.org/10.1901/jeab.2011.96-423>
- Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., George, S. M., & Olson, R. D. (2018). The physical activity guidelines for Americans. *JAMA*, 320(19), 2020-2028. <https://dx.doi.org/10.1001/jama.2018.14854>
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138(2), 353. <https://dx.doi.org/10.1037/a0026838>
- Samuelson, P. A. (1937). A note on measurement of utility. *The Review of Economic Studies*, 4(2), 155-161. <https://dx.doi.org/10.2307/2967612>

- Schlam, T. R., Wilson, N. L., Shoda, Y., Mischel, W., & Ayduk, O. (2013). Preschoolers' delay of gratification predicts their body mass 30 years later. *The Journal of Pediatrics*, 162(1), 90-93. <https://dx.doi.org/10.1016/j.jpeds.2012.06.049>
- Sheffer, C. E., Christensen, D. R., Landes, R., Carter, L. P., Jackson, L., & Bickel, W. K. (2014). Delay discounting rates: a strong prognostic indicator of smoking relapse. *Addictive Behaviors*, 39(11), 1682-1689. <https://dx.doi.org/10.1016/j.addbeh.2014.04.019>
- Sheffer, C. E., Mackillop, J., Fernandez, A., Christensen, D., Bickel, W. K., Johnson, M. W., ... & Mathew, M. (2016). Initial examination of priming tasks to decrease delay discounting. *Behavioural Processes*, 128, 144-152. <https://dx.doi.org/10.1016/j.beproc.2016.05.002>
- Shevorykin, A., Pittman, J. C., Bickel, W. K., O'Connor, R. J., Malhotra, R., Prashad, N., & Sheffer, C. E. (2019). Primed for health: Future thinking priming decreases delay discounting. *Health Behavior and Policy Review*, 6(4), 363-377. <https://dx.doi.org/10.14485/HBPR.6.4.5>
- Shoda, Y., Mischel, W., & Peake, P. K. (1990). Predicting adolescent cognitive and self-regulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental Psychology*, 26(6), 978. <https://dx.doi.org/10.1037/0012-1649.26.6.978>
- Stanger, C., Ryan, S. R., Fu, H., Landes, R. D., Jones, B. A., Bickel, W. K., & Budney, A. J. (2012). Delay discounting predicts adolescent substance abuse treatment outcome. *Experimental and Clinical Psychopharmacology*, 20(3), 205. <https://dx.doi.org/10.1037/a0026543>

- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, 69(5), 797.
<https://dx.doi.org/10.1037/0022-3514.69.5.797>
- Steele, C.M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 21, pp. 261-302). Academic Press.
- Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72(2), 271-324. <https://dx.doi.org/10.1111/j.0022-3506.2004.00263.x>
- Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2002). Views of nature and self-discipline: Evidence from inner city children. *Journal of Environmental Psychology*, 22(1-2), 49-63.
<https://dx.doi.org/10.1006/jevp.2001.0241>
- Watts, T. W., Duncan, G. J., & Quan, H. (2018). Revisiting the marshmallow test: A conceptual replication investigating links between early delay of gratification and later outcomes. *Psychological Science*, 29(7), 1159-1177.
<https://dx.doi.org/10.1177/0956797618761661>

Appendix

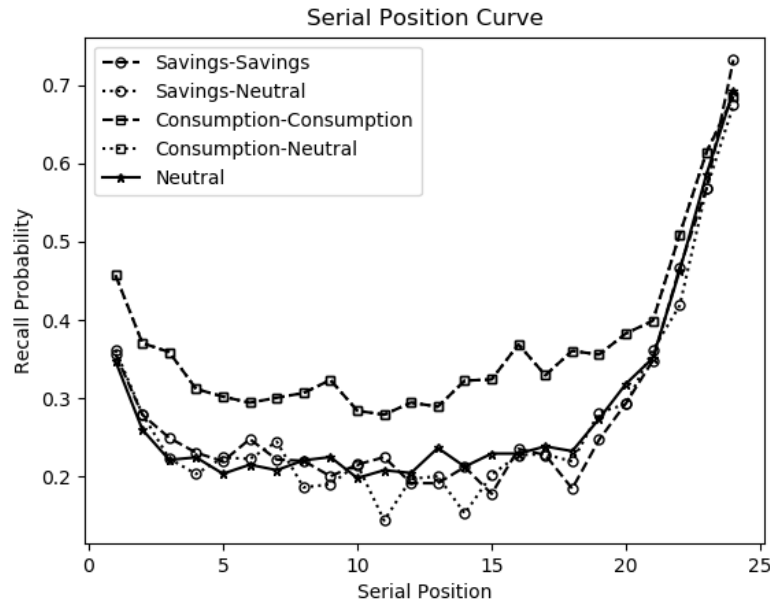
Table 2

Savings Words and Consumption Words used as Experimental Stimuli

Savings	Consumption
Almond, Apple, Arrest, Arugula, Asparagus, Avocado, Banana, Bankruptcy, Berry, Blueberry, Book, Broccoli, Calcium, Cancer, Carrot, Cashew, Cauliflower, Celery, Certificate, Checkup, Children, Cholesterol, Cleanser, College, Communication, Consequence, Consideration, Danger, Death, Debt, Dentist, Deportation, Desk, Diabetes, Diet, Disease, Disinfectant, Disserve, Egg, Eggplant, Emergency, Encyclopedia, Engagement, Exam, Expulsion, Failure, Fiber, Firm, Focus, Fraudulence, Fruit, Grape, Grapefruit, Gym, Habit, Harm, Hospital, Humiliation, Hygiene, Illness, Incarceration, Injury, Inspection, Instability, Jail, Kale, Knowledge, Kombucha, Lean, Lentil, Lettuce, Marriage, Medicine, Mineral, Moisturizer, Mortgage, Network, Oat, Paycheck, Pea, Penitentiary, Pennilessness, Poverty, PowerPoint, Pride, Promotion, Protein, Quinoa, Quiz, Reading, Repayment, Restriction, Running, Salad, Salmon, Sanitizer, Service, Sickness, Soap, Spinach, Spouse, Squash, Supervision, Surgery, Swimming, Tea, Textbook, Therapy, Tomato, Training, Unemployment, Vegetable, Victimhood, Vitamin, Walnut, Water, Watercress, Watermelon, Yoga, Yogurt	Adultery, Aggression, Anger, Appetite, Binge, Bonbon, Bragging, Bread, Brothel, Butter, Buzzfeed, Cake, Candy, Caramel, Carelessness, Casino, Cheeseburger, Cheeto, Chocolate, Clickbait, Coca-Cola, Cookie, Couch, Cracker, Craving, Cupcake, Custard, Decadence, Desire, Dessert, Discotheque, Dorito, Doughnut, Drunk-driving, Entertainment, Erotica, Excess, Extremism, Facebook, Fanta, Feast, Flavor, Fornication, Fortnite, Fraud, Frito, Frosting, Fudge, Fun, Gambling, Glut, Gobstopper, Gossip, Gratification, Greed, Gumdrops, Hedonism, Hit, Hulu, Hunger, Icing, Immoderation, Impulse, Indulgence, Instagram, Itch, Lavishness, Libido, Liquorice, Lottery, Lust, Marshmallow, Masturbation, Mouthful, Movie, Muffin, Netflix, Nintendo, Notification, Oreos, Pancake, Pasta, Pepsi, Piercing, Pizza, PlayStation, Pleasure, Poker, Popcorn, Pornography, Pretzel, Procrastination, Prostitution, Pudding, Punch, Rage, Roulette, Salsa, Salt, Sex, Snack, Soda, Spending, Sugar, Sundae, Sweetener, Tabloid, Taste, Television, Temptation, Theft, TikTok, Tinder, Tiramisu, Treat, Twitter, Unfaithfulness, Urge, XBOX, YouTube

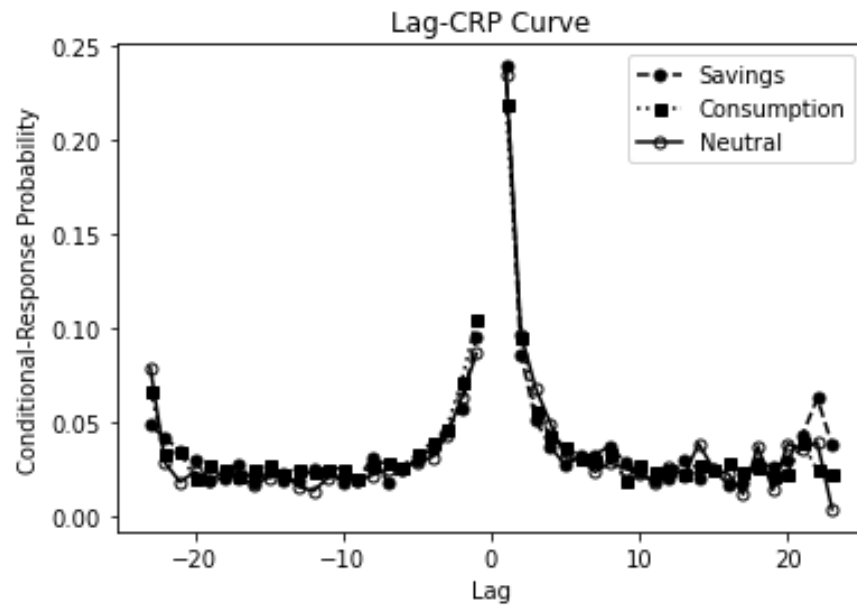
Note. These experimental stimuli are the 120 most evocative words from the Savings and Consumption categories, respectively, that were rated in our preliminary test by 185 participants. Participants were instructed to indicate to what degree they perceive each word to be a Savings vs. Consumption word by rating it on the 7-point Likert scale, a score of “1” representing a pure Savings word and a score of “7” representing a pure Consumption word.

Figure 2

Serial Position Curve by Condition and Word Type

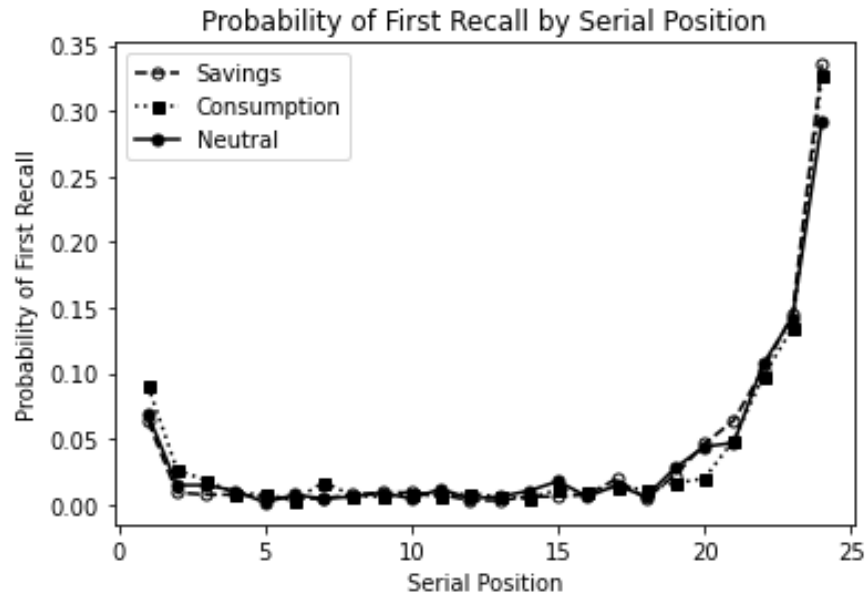
Note. The figure above indicates the probability that participants recalled a word with a certain serial position in the free recall task. The Savings-Savings curve relates to Savings words that were recalled in the Savings condition. The Savings-Neutral curve relates to Neutral words that were recalled in the Savings condition. The Consumption-Consumption curve relates to Consumption words that were recalled in the Consumption condition. The Consumption-Neutral curve relates to Neutral words that were recalled in the Consumption condition. The Neutral words relates to Neutral words that were recalled in the Neutral condition. Consumption words in the Consumption condition seemed to have a higher probability of being recalled at nearly every serial position, indicating that they were more memorable than Savings words and Neutral words. Across all conditions, a strong recency and primacy effect was apparent.

Figure 3

Lag-Conditional Response Probability Curve by Condition

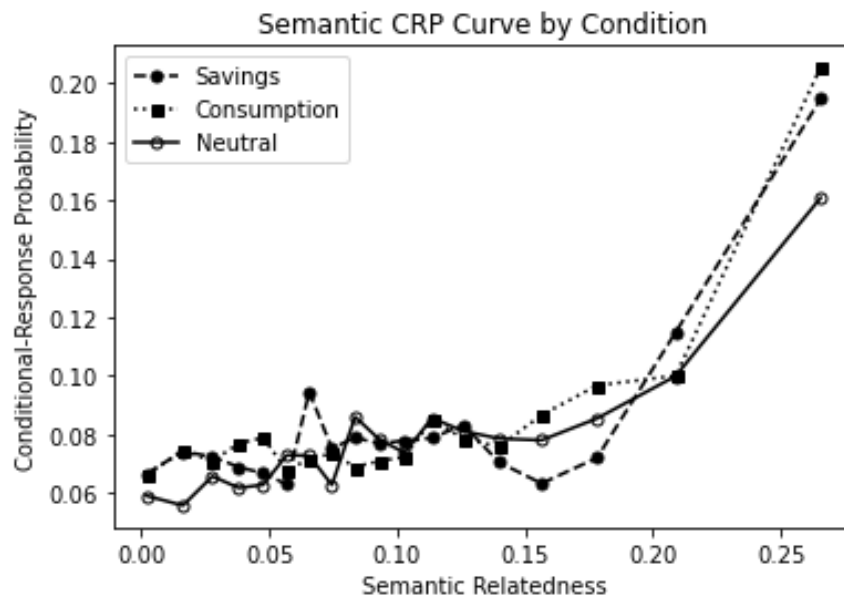
Note. The figure above indicates the probability that participants recalled a word from serial position $i + \text{lag}$ immediately after recalling a word from serial position i . There appears to be no substantial difference between the conditions.

Figure 3

Probability of First Recall by Condition

Note. The figure above indicates the probability with which participants recalled a word with a certain serial position first. All three conditions demonstrate similar primacy and recency effects.

Figure 4

Semantic Conditional Response Probability Curve by Condition

Note. The figure above indicates the probability that participants recalled a word immediately after another word with a certain degree of semantic similarity. Participants from the three conditions were more likely to recall words that were semantically related to the just-recalled word.