Journal of Integrated Social Sciences
www.JISS.org, 2016 - 6(1): 49-74

Original Article:

THE EFFECT OF MINDSET ON DECISION-MAKING

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Abstract

There are a variety of factors that affect our decision-making, including cognitive biases, information accessibility, past experiences, and personal relevance. Determining such situational and dispositional factors that influence our decision patterns will help clarify reasons for current spending and credit habits among young adults. In this study we explored how different mindsets, specifically abstract versus concrete mindsets, affect decision-making. We also examined if connection to future self or childhood socioeconomic status modified the relationship between mindset and decision-making. We predicted individuals in the concrete processing condition would make safer and more immediately gratifying decisions, and participants in the abstract processing condition would make riskier and more future-oriented decisions. Consistent with our hypotheses, participants lower on future self-continuity were more likely to make immediately gratifying decisions, but only when they were in the concrete processing condition. Also, on average, participants in the abstract condition made riskier choices, but only if they were higher on future self-liking. The results of this research help us understand what guides our decision-making process and has implications for how we are taught to process information in educational settings.

Keywords: decision-making, temporal discounting, delay of gratification, abstract-thinking, concrete-thinking

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INTRODUCTION

"Making a decision was only the beginning of things. When someone makes a decision, he is really diving into a strong current that will carry him to places he had never dreamed of when he first made the decision."
- Paulo Coehlo

As the author Paulo Coehlo's quote illustrates, our choices establish downstream effects in our lives. However, decisions may not necessarily be the "beginning" of things as Coehlo suggests. In fact, a variety of factors influence our decisions, nudging our behavior in different directions. For example, emotions, mental representations, previous experiences, and perceived relevance, among other factors, affect decision patterns.

In this research, we asked whether mindset, or a way of thinking, affects decision patterns. Mindset is a manner of thinking or construing objects or actions. We propose that the mindset we adopt in a given context influences subsequent decision patterns. We make hundreds of choices each day. For example, we decide whether or not to hit the snooze button, what to eat for breakfast, whether we should take that new job offer, and if we want to go for an afternoon jog. Adopting a particular mindset may be one manner of swaying our choices to promote particular decision patterns.

Most decisions we make involve some aspect of time and uncertainty. Because of this, we focused on intertemporal decisions and risky decision-making in this research. Most decisions we make are complex and involve time, risk, and several other factors (e.g., magnitude, importance, social, emotional, or learning aspects). But the more complex choices become, the more challenging it becomes to understand what factors determine choice patterns, and why. Therefore, we chose two tasks that independently decompose decision-making into the basic dimensions of time and risk. These tasks have the advantages of being simple and easy to interpret. Moreover, the tasks parallel each other in their format. They are less likely to mimic real-world decisions; however, research suggests that individuals' preferences in these tasks correlate with important real-world outcomes. A representative sample of research related to decisions, mindset, and individual differences is reviewed in the following sections.

Intertemporal and Risky Choices

Imagine sitting down at your desk every morning. You open up your computer and have a choice to make. You can check Facebook or check your work email and start your daily work tasks. Checking Facebook is immediately satisfying. But if you check your work email and start your work tasks, you will be able to finish your work earlier and leave earlier, offering a delayed benefit. Almost every choice we make traverses time and involves intertemporal tradeoffs. Intertemporal choices are defined as decisions with effects that unfold over time. When it comes to deciding between time-based outcomes,

we discount the value of outcomes based on the delay to the outcome (Mazur & Logue, 1978). Similarly, most choices we make involve some level of uncertainty and when it comes to deciding between uncertain outcomes, we discount the value of these outcomes based on the probability they will happen (Green & Myerson, 2004).

A common intertemporal tradeoff we experience is the choice between immediate gratification and delayed gratification. Each day we make choices between tasty desserts or maintaining a healthy diet, spending money on desirable goods or saving for retirement, and exercising or watching TV. The more proximate option is generally ephemeral and more immediately satisfying. The later option often matches our long-term goals and has greater overall benefits. Indeed, choices about spending money and investing, insurance, marriage, diet and exercise, drug use, education, work and play, and procreating are all intertemporal decisions.

Intertemporal decisions are studied in a range of fields, including economics, psychology, and neuroscience. Across these fields, research suggests that humans and animals tend to prefer immediately gratifying options more than later, but greater options (Mazur, 2001). This preference for sooner, smaller rewarding options is called temporal discounting (often called delay discounting in animal literature). Optimal decision-making involves at least occasionally delaying gratification and forgoing immediate gratification in pursuit of long-term goals (Fehr, 2002). In humans, research suggests that higher rates of temporal discounting (i.e., a stronger preference for immediate gratification) relate to inferior real world outcomes such as poorer academic outcomes (Mischel, Shoda, & Peake, 1988), gambling, and drug addiction (see Reynolds, 2009 for a review). Therefore determining what causes temporal discounting or determining ways to reduce temporal discounting are important areas of research.

Several explanations for temporal discounting exist. Two are considered here: the "hot-cool" perspective and the construal level perspective. First, sometimes we use our gut instinct to make a decision, while other times we use rational thinking. Kahneman (2011) suggests that we have two systems of thinking, an intuitive, automatic system that is accountable for many of our everyday decisions (i.e., System 1) and a deliberate, logical part of the mind that is able to rationally analyze and solve problems (i.e., System 2). System 1, although adaptive in many situations, is more likely to make mistakes in judgment; by contrast, system 2 takes more mental effort. System 1 is often referred to as a "hot" system and system 2 is often described as a "cool" system.

Regarding the hot-cool systems, Chang and Pham (2013) showed that temporal proximity increases preferences for emotionally rather than practically appealing options. Chang and Pham (2013) theorize that emotion-driven choices over weight our current emotions. Similar research proposes we undervalue future emotions, such as anxiety (van Boven, Kane, McGraw, & Dale, 2010). Relatedly, emotive stimuli, such as an appetizing picture of a dessert, can increase the probability of present-oriented decisions (Li, 2008; van den Bergh, Desitte, & Warlop, 2008). State (e.g., positive or negative mood) and trait

(e.g., neuroticism) level affect shape choices as well (Augustine & Larsen, 2011). In other words, in-the-moment "hot" emotions may prompt us to indulge in immediately gratifying behavior. Delaying gratification, in contrast, requires more mental effort to consider future emotions and possibilities.

The idea that a hot system enhances immediate gratification and a cool system allows for delayed gratification largely stems from work by Mischel and colleagues in young children, usually 4-5 years of age. In this delay of gratification paradigm, children are presented with a treat (e.g., a marshmallow or cookie) and the option to have that one treat instantly or to have two treats at a delay. Mischel and colleagues showed that children who delayed gratification were more academically and socially skilled as teenagers (Mischel, Shoda, & Peake, 1988), had higher SAT scores (Shoda, Mischel, & Peak, 1990), and had better adaptive functioning (Ayduk et al., 2000).

By operating in one or the other system, we more readily access memories and ideas available to that respective system. This is a phenomenon known as the "availability bias" (Tversky & Kahneman, 1973). The availability bias relies on how easily information comes to mind. For example, more salient, frequent, and recent information tends to be more accessible. Therefore if an event is frequently advertised in media or highly emotional it will more readily come to mind.

The availability bias and ease of cognitive access also relates to Construal-Level Theory (CLT). CLT suggests that the manner in which a decision is represented influences choices. Objects, events, and decision options exist at different psychological distances and this affects how we think of (i.e., "construe") them (Trope & Liberman, 2010). The greater the psychological distance between the individual and the object or event, the more abstract the object or event. Closer psychological distances activate a more concrete mindset (for a review, see Liberman & Trope, 2003). Temporal distance (i.e., now or in a few years?), spatial distance (i.e., here or miles away?), and social distance (i.e., me or you?) all contribute to psychological distance.

Because intertemporal choices inherently involve an option that is temporally (and therefore psychologically) closer and an option that is temporally (and psychologically) more distant, this suggests that these options are each construed differently. The proximate option is construed more concretely whereas the distal option is construed more abstractly. Another way to think of concrete and abstract mental representations is mindset, which is reviewed in detail below.

Many choices also involve uncertainty. Imagine you have an extra $500 to invest. Should you place it in a relatively safe investment or choose stocks that are riskier but offer the possibility of a higher payoff? Often in life we gamble between safer bets and riskier options that offer greater potential for higher gains but also the potential for no gains or losses. As the risk level increases, we mark down the subjective value of the risky option. Like with temporal discounting, each option (i.e., the safe and risky options) can be construed as more or less psychologically distant. In this case, however, the riskier option

is more distant because of the uncertainty. The safer option is psychological closer because it is more concrete.

As suggested above, probability discounting takes a similar form to temporal discounting. In this case, individuals are more likely to choose a risky option as the level of chance of receiving that option increases. However, as Green and Myerson (2004) point out, temporal discounting and probability discounting are not identical and likely require distinct underlying decision processes. Although much research tends to focus on these two types of decision-making independently, Green and Myerson (2004) argue that temporal discounting and probability discounting should be studied in conjunction using similar experimental procedures. They specifically suggest this would allow researchers to identify whether either type of discounting underlying problem behaviors. Here, we extend on this idea and use similar experimental procedures to study temporal and probability discounting in an effort to determine if decision patterns can be nudged by a mindset manipulation.

Mindset

William James (1890), a leading early psychologist, was one of the first to suggest that goal-directed behavior, such as decisions, is preceded by a cognitive representation. Our mindset can determine how we mentally represent a decision. Mindset is an approach or manner of understanding information. Although mindset has been studied in many domains, such as education (e.g., growth versus fixed mindset), we focused here on abstract and concrete mindsets, akin to what is presented in CLT. In this way, we were able to more readily build on earlier research in the field on CLT and decision patterns.

An abstract mindset involves more general, context-independent mental processing. A concrete mindset involves specific, context-dependent mental processing. Abstract ideas do not hold an explicit place is space and time (Freitas, Gollwitzer, & Trope, 2004). In other words, abstractions do not have a material locus. For example, we cannot picture the concept of "peace" or "knowledge," because both of these are abstract concepts. Concrete entities *do* hold a specific place in time and space, and they *do* have a material referent. We can picture a concrete entity, such as how we made our dinner or a specific musical artist. Both of these construal levels, or mindsets, involve our current thought mode or a way of processing information and can persist across contexts (Luchins, 1942). When we are in certain mindset, we might be more prone to thinking about the future or better at perspective taking. In other words, mindset, like Kahneman's (2011) System 1 and System 2, shapes the accessibility of information and can lead us to construe the world or our experiences in differing ways, and accordingly adjust choices and behaviors.

In this vein, Freitas, Gollwitzer, and Trope (2004) found that an abstract mindset led participants to consider information that affected long-term goals (e.g., accurate self-knowledge), whereas a concrete mindset led participants to consider more immediately gratifying information (e.g., positive self-evaluations). Also, Malkoc, Zauberman, and

Bettman (2010) showed that manipulating mindset (abstract versus concrete) affects participants' present bias in a series of experiments. Present bias refers to how much an individual over weights more temporally proximate events compared to later events. For example, if you were to choose between $10 tomorrow and $15 in 30 days, you might choose $10 tomorrow. If you were asked to choose between $10 in 90 days and $15 in 120 days, you might choose $15 in 120 days. Even though each choice involves a 30-day span, individuals tend to demonstrate a present bias by selecting the sooner option when it is close in time but showing a preference reversal and selecting the later option when both options are farther away in time.

Malkoc, Zauberman, and Bettman (2010) suggest that most individuals operate, by default, in a concrete mindset, which emphasizes the present. However, inducing an abstract mindset in an unrelated task led to later reduction in present-bias. Together, this research suggests that an abstract mindset can influence decision patterns by prompting individuals to consider the "intangibles" or the more abstract options. In this case, the intangible outcomes were more future-oriented outcomes. Moreover, the effect of mindset on choices persists over time and tasks.

Many tasks have been used to manipulate mindset, with two of the most common being the exemplar/example and why/how tasks (e.g., Fujita, Trope, Liberman, & Levin-Sangi, 2006; Gilead, Liberman, & Maril, 2013). These two tasks have convergent behavioral findings (explained below). Also, neuroimaging shows that sensorimotor brain regions support concrete representations of both objects and actions (Gilead, Liberman, Maril, 2013). This suggests that concrete representations of objects and actions rely on reconstructing sensory experiences or motor actions in the brain. In other words there is a tie to directly experiencing the physical object/action and thinking of the object/action.

The exemplars/examples task effectively manipulates the representation of objects as abstract or concrete (Fujita et al., 2006). Thinking of exemplars requires the participants to construe a superordinate, more general category. In other words, the participant transforms an object into an abstraction, which induces an abstract mindset (Gilead, Liberman, & Maril, 2013). In this task, participants placed objects into their superordinate categories. For example, they were asked to respond to the prompt, "St. Norbert is an example of a _____," obliging participants to adopt an abstract mindset. Thinking of an example asks the participant to construe a subordinate, specific category, which induces a concrete mindset by focusing the participants' attention on the concrete objects. In this case, participants were asked to respond to a prompt such as, "_____ is an example of a college," compelling participants to adopt a concrete mindset.

The why/how manipulates the representations of actions as abstract or concrete. Like objects, actions can be identified at varying levels of abstraction (Vallacher & Wegner, 1989). Specifically, Action-Identification theory suggests that identifying *why* actions are performed requires a higher level of abstraction than identifying *how* an action is performed (Vallacher & Wegner, 1989). Pinpointing *why* we perform actions requires

situation-invariant relationships between the action and the perceived reason for the action. For example, the reason why we "lock a door" could be identified as "to ensure safety." Safety is an abstract concept that cannot readily be pictured. By contrast, identifying *how* actions are performed requires a little to no abstractions because it involves concrete, physical actions. For example, how we "lock a door" could be identified as "putting a key in the lock and turning the key." We can readily picture this tangible action, like the exemplar/example task promotes picturing a concrete object in the example condition.

Individual Differences

Not only does mindset affect decision patterns, but individual differences in life history and personal style affect choices. For example, individuals that grow up with lower socioeconomic status learn to treat resources as scarce, fleeting, or unreliable. Similarly, some individuals view their "self" as more or less consistent over time. The following research further explains these ideas.

Each individual's "default" decision pattern may vary by previous experiences or by future self-continuity. For example, Griskevicius, Tybur, Delton, and Roberts (2011) found that for the participants that grew up in resource-plentiful environments, mortality cues led them to take less risk and value the future more. By contrast, participants in the resource-scarce environments preferred more risk and value the present. Griskevicius et al. (2011) argued that this pattern of results is based on life history strategies that result from early ecological factors. Individuals who grow up in a poor, resource scarce environment invest in a "fast" strategy that favors immediate fulfillment of goals. By contrast, richer, resource plentiful environments promote a slow strategy that favors long term goals.

In a similar vein but on a different time frame, Ludvig, Madan, and Spetch (2014) showed that when individuals were reminded of a previous experience winning, it caused them to become more risk seeking. However, when individuals were primed with cues of losing, there was no effect. In other words, both distant (i.e., life history) and recent (i.e., priming) past experiences influence decisions, in a context-dependent manner.

Just as our past experiences compound to influence decisions, our relationship with our future self also influences choices. For example, Bartels and Ripps (2010) found that connection to one's future self correlates with intertemporal choices. In their research, Bartels and Ripps (2010) conducted five related studies, with two focusing on the correlation between intertemporal choices and future connectedness and three focusing on fictional characters who undergo life changing events that reduce future connectedness. Together, their findings suggest future connectedness correlates with more patient choices by increasing the personal relevance of the delayed options. Their research primarily focused on long delays (i.e., years rather than days or weeks) for both monetary and nonmonetary goods. Moreover, Ersner-Hershfield et al. (2009) found that future self-continuity related to greater patience in laboratory tasks and related to accrual of financial assets. The authors suggest that future continuity may be important for increasing saving

behavior; however, neither researcher examined the association between future continuity and risky choice.

Joshi and Fast (2013) studied temporal discounting in relation to perceived power and future self-connection. They examined whether perceived social power influenced how connected individuals felt to their future self. Power was manipulated in three related studies by randomly assigning social roles or by randomly assigning participants to recall and write about a situation when they had power. Joshi and Fast (2013) found that when individuals felt they had power, it increased their connection with their future self, and, therefore, they were more likely to pick a future-oriented reward. In other words, higher perceived power enhanced the personal relevance of future rewards. Joshi and Fast's (2013) research provides us with evidence that perceived power, via a heightened connection to one's future self, plays a role in decision-making. This work also demonstrates the possibility that future self-connectivity, as an individual difference factor, modifies the relationship between decision context and decision patterns.

Current Research

In this study, we asked how mindset affects decision patterns. We examined the impact of two types of mindset, abstract and concrete processing, on intertemporal choices and risky decision-making. Based on the previous research reviewed here, we expected participants in the concrete processing condition to make more immediately gratifying and safer decisions and participants in the abstract processing condition to make future-oriented and risker decisions. Just as connectedness to one's future self modified the relationship between power and temporal discounting (e.g., Joshi & Fast, 2013), we also expected one's connection to future self to modify the relationship between mindset and decision-making. For example, if participants feel closer to their future self, they will be more likely to make more future-oriented decisions depending on their mindset. We also expected childhood socioeconomic status to modify the relationship between mindset and decision patterns, as proposed in life history theory (e.g., Griskevicius et al. 2011). For example, we predicted lower SES would relate to a more impatient and risk seeking decision pattern depending on mindset, where a concrete mindset would further enhance impatience but reduce risk seeking.

METHOD

Participants

A total of 47 students volunteered to participate in this study for course credit. The sample consisted of 15 males and 32 females between the ages of 18-22 years old enrolled in undergraduate-level courses from a private, liberal arts college in the upper Midwest. Three participants were excluded from the intertemporal choice task and five participants

were excluded from the probability discounting task because they always chose the same option or they did not complete the mindset task adequately. Descriptive information about participants can be found in Table 1. All participants provided written informed consent according to the SNC IRB policies.

***Table 1*. Demographic Information**

Measure	M (SEM)
N	47
Age	19.7 (0.16)
Sex	68% F

Design

Intertemporal choices and risky choices are typically studied using either fill in the blank pricing tasks or binary choice tasks. Binary choice tasks are better established, stem from animal literature (e.g., Mazur, 2001), and place less cognitive demand on the participants (Smith & Hantula, 2008). They are also readily adaptable to measuring both intertemporal choices and risky choices in experimentally similar procedures, which Green and Myerson (2004) suggest as an important avenue of research.

We examined participants' decision patterns using binary intertemporal choice and probability discounting tasks. Therefore, participants' proportion of delayed choices and risky choices, respectively, were our dependent variables. For the intertemporal choice task, we employed a 2 X 2 X 5 mixed design, where mindset (abstract versus concrete) and overall future self-continuity (distant versus close) were between subject factors and delay (5, 10, 20, 30, or 60 days) to the later option was a within subject factor. For the risky decision task, we also used a 2 X 2 X 5 mixed design, where mindset (abstract versus concrete) and future self-liking (low versus high) were between subject factors and risk (25%, 40%, 50%, 60%, and 75%) for the risky option was a within subject factor.

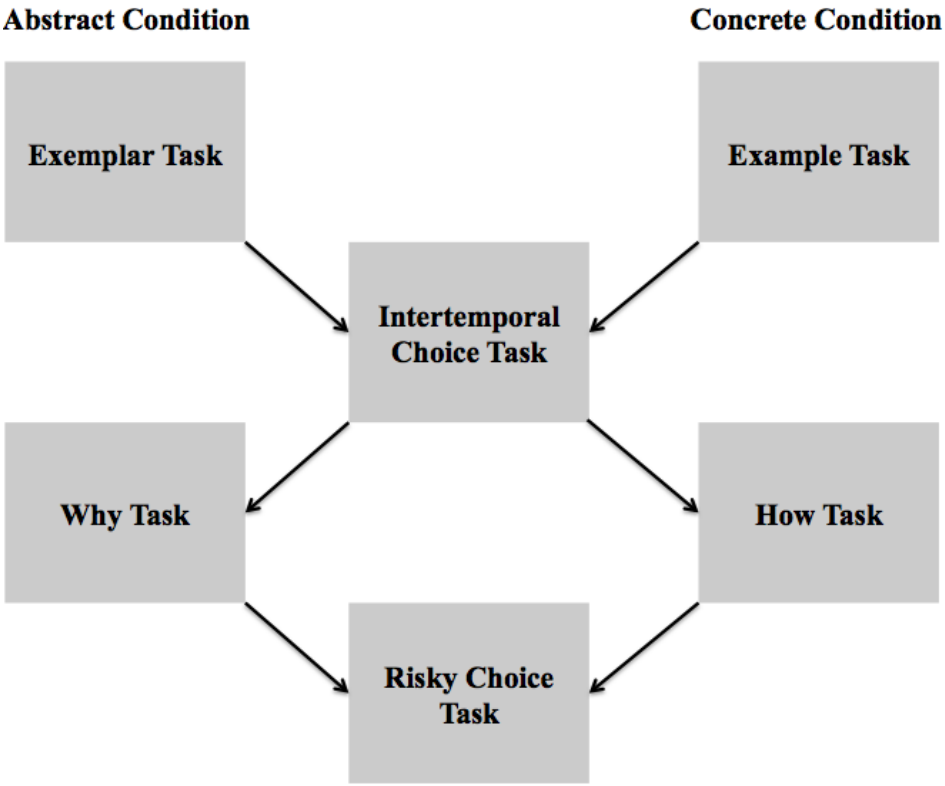
Procedure

Participants were asked to complete a short questionnaire that asked participants their gender, age, and several questions inquiring about connectedness to one's future self (see Appendix A). Central to our hypotheses, participants were asked to indicate how *similar* and *connected* they felt to their future self ten years from now using a series of overlapping circles. Participants also used a 7 point Likert Scale to indicate how much they *cared* and *liked* their future self, 10 years from now. We summed participants' scores on these four scales to create an overall future self-continuity score. Lastly, participants were

asked three questions concerning their socio-economic status growing up (Griskevicius et al., 2011). For example, participants were asked to rate on a Likert scale, 1 strongly disagree to 7 strongly agree, "my family usually had enough money for things when I was growing up," "I grew up in a relatively wealthy neighborhood," and, "I felt relatively wealthy compared to the other kids in my school."

Participants were randomly assigned to one of two conditions: an abstract-mindset condition or a concrete-mindset condition. The mindset manipulations we chose were based on previous research showing that these two manipulations induce abstract and concrete mindsets respectively and share similar underlying brain networks (e.g., Gilead et al., 2013). In other words, neural correlates were found for both abstract and concrete mindsets, which add to the validity and reliability of both manipulations. We chose to use two manipulations, one prior to each decision task, so that the mindset effect would be robust during each of the decision tasks.

Participants completed four tasks: an exemplar/example task, an intertemporal choice task, a why/how task, and a risky decision task. All participants completed these tasks in the same order, with the only difference being mindset condition. That is, the abstract condition participants completed the exemplar and why tasks, whereas the concrete condition participants completed the example and how tasks (Figure 1). For a list of stimuli for the exemplar/example task and why/how task, see Appendix B.



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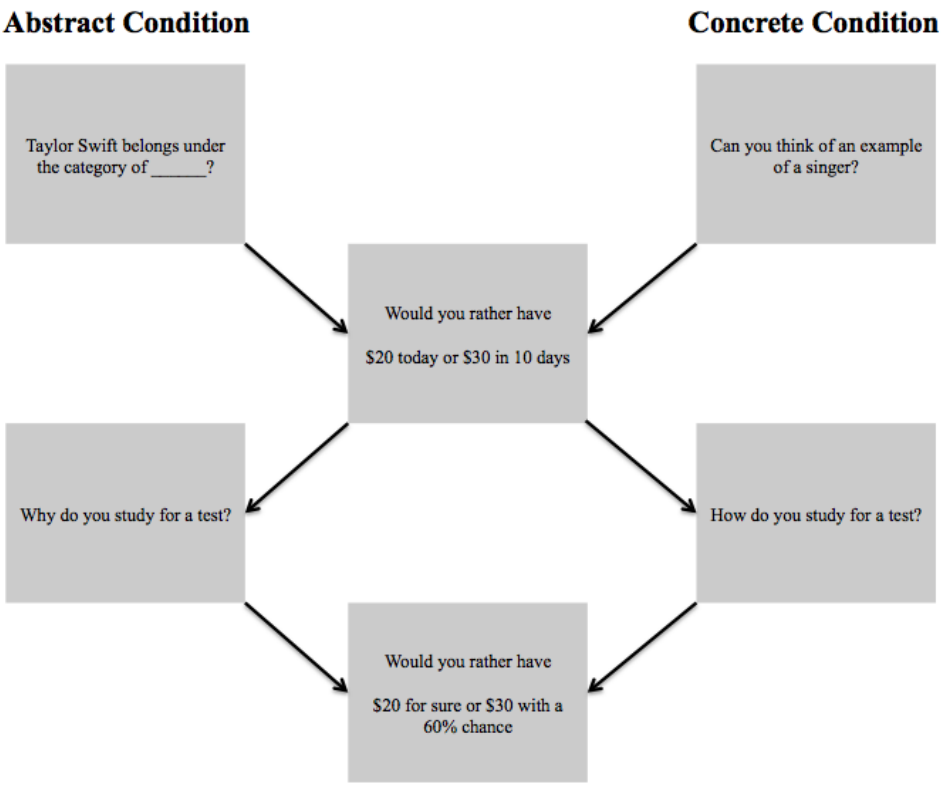

Figure 1. a) General procedure. b) Example of procedure.

Participants in the abstract-mindset condition were first asked a series of exemplar questions that required them to provide a category for each item (Gilead et al., 2013; Fujita et al., 2006). For example, "St. Norbert belongs under the category of a ____." An appropriate response would be, "college." Participants in the concrete-mindset condition were first asked a series of example questions that required them to provide an example of different objects (Gilead et al., 2013; Fujita et al., 2006). For example, "Can you think of an example of a college?" An appropriate response would be, "St. Norbert College."

Next, participants were asked to make a series of intertemporal choices. Participants were asked to make a series of choices between an option that comes today or an option that comes after some delay. For example, participants may have been asked to choose between $20 today or $20.50 in 5 days, $35.00 in 10 days, $24.00 in 20 days, $50.00 in 30 days, or $21.00 in 60 days.

Following the completion of intertemporal choice task, participants in the abstract condition were asked to answer *why* they participate in certain activities (Gilead et al., 2013; Vallacher and Wegner, 1989). For example, participants were asked, "Why do you

lift weights?" An example response may be, "to build muscle." Participants in the concrete condition, in contrast, were asked to answer *how* they would perform each activity (Gilead et al., 2013; Vallacher and Wegner, 1989). For example, "How do people lift weights?" An example response may be, "by repeatedly lifting a dumbbell." Participants were asked the same set of risky decision-making choices as participants in the abstract-processing condition.

Lastly, participants were asked a to make a series of risky decisions. These decisions included an option that comes for sure and an option that comes with some chance. For example, participants had to choose between $20 for sure or $25 with a 25% chance. Once participants completed the last set of questions, they were instructed to inform the experimenter and were debriefed.

RESULTS

First, we examined the interrelationships between childhood SES, future continuity, and decision-patterns using Spearman's rho correlations. Childhood SES did not correlate with future continuity, proportion of later choices, or proportion of risky choices. Future self-liking positively correlated with the proportion of risky choices, $\rho(42) = 0.38$, $p = 0.01$, 2-tailed. Higher scores on future self-liking related to a higher proportion of risky choices. No facets of future continuity correlated with the proportion of delayed choices. The proportion of delayed choices did not correlate with the proportion of risky choices, $\rho(42) = 0.19$, $p = 0.24$, 2-tailed.

Next, we used generalized estimating equations (GEE) to examine whether mindset, future self-continuity, and the choice properties (e.g., delay or risk) impacted choice patterns. For simplicity in interpretation, future self-continuity (the total score) and future self-liking were dichotomized based on median splits for the intertemporal choice and risky choice data, respectively. GEE is an alternative to generalized linear mixed model method (Liang & Zeger, 1986). GEE allowed us to take into account repeated measurements, dichotomous choices, and the correlations between choices across the task. We were also able to model both within- and between-subjects factors using GEE. All tests reported are 2-tailed.

Intertemporal Choice Results

First, we assessed intertemporal choice patterns. Choice was modeled using a binary logistic distribution and trials were treated as repeated measurements with mindset (abstract versus concrete) and future self-continuity (distant versus close) as between subjects factors and the delay to the later option (5, 10, 20, 30, or 60 days) as a within subject factor.

As expected, there was a main effect of delay, Wald χ^2 (4, N = 44) = 92.25, p < 0.001. As the delay to the later option increased, participants were less likely to choose the later option (Figure 2B). Consistent with our hypothesis, there was a main effect of future self-continuity, Wald χ^2 (1, N = 44) = 15.37, p < 0.001. Participants who felt closer to their future selves were more likely to choose the later option (Figure 2C). Counter to our hypothesis, there was not a main effect of mindset, Wald χ^2 (1, N = 44) = 1.35, p = 0.25. In other words, participants chose a similar proportion of later options regardless of which mindset they were in (Figure 2A).

However, these main effects were qualified by an interaction between future self-continuity and mindset, Wald χ^2 (1, N = 44) = 7.44, p = 0.006 (Figure 2D). Participants in the abstract mindset chose a similar proportion of later choices regardless of their score on future self-continuity; participants in the concrete condition chose a greater number of later choices, but only if they were higher on future self-continuity. This interaction is consistent with our prediction that future self-continuity would modify the relationship between mindset and choice patterns. There was not a three-way interaction, nor were there two-way interactions between delay and mindset or future self-continuity, *ps* > 0.90.

In order to better understand the interaction between future self-continuity and mindset, we ran two independent means *t*-tests to assess whether future self-continuity predicted delayed choices for the concrete and abstract mindset, separately. Indeed, there was no effect of future self-continuity in the abstract mindset, t(22) = 0.01, p = 0.97. In other words, future continuity did not predict the proportion of later choices in the abstract mindset condition. Participants chose a similar proportion of the later option in the abstract mindset regardless of their future self-continuity.

However, there was a significant effect of future continuity in the concrete mindset, t(18) = -2.37, p = 0.03 (equal variances not assumed). This result held when controlling for childhood SES, F(1,17) = 4.65, p = 0.046, η_p^2 = 0.22. In the concrete mindset, the participants with greater future self-continuity were more likely to choose the later option, M = 0.62 (SEM = 0.04) and the participants with lower future-self-continuity were more likely to choose the *today* option, M = 0.45 (SEM = 0.06). In other words, participants delayed gratification if they expressed greater future continuity and chose immediate gratification if they expressed lower future continuity – but this difference by future continuity only occurred when participants were engaged in a concrete mindset. The abstract mindset fully mitigated the effect. The mean difference in proportion of later choices between the two groups in the concrete condition was -0.18 (95% C.I.: -0.34, -0.02).

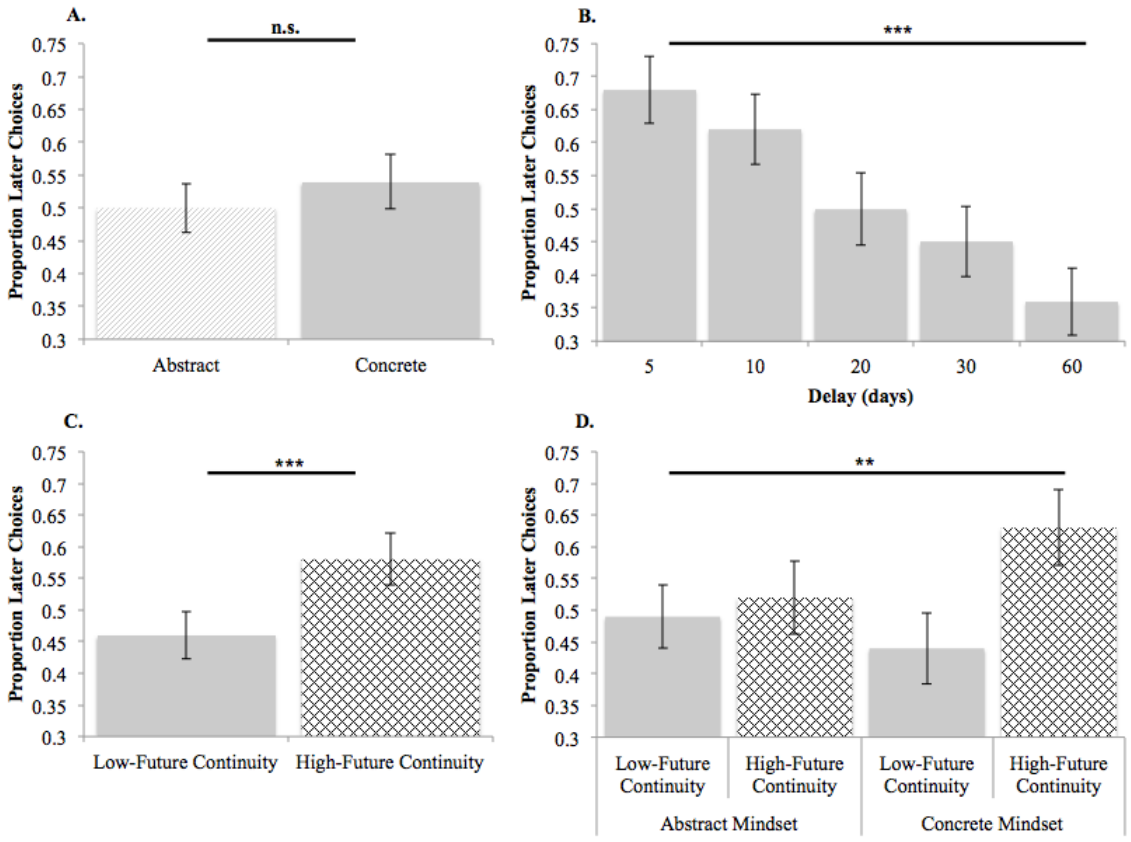

Figure 2. Estimated marginal mean proportion of later choices A) in the Abstract and Concrete conditions, B) by delay to the later reward in days, C) in individuals low and high on future continuity, and D) individuals lower and higher on future self-continuity by mindset condition. n.s.=not significant, $^{**}p<0.01$, $^{***}p<0.001$. Error bars indicate 95% confidence intervals based on GEE analysis.

Probability Discounting Results

Second, we turned to the risky decision task. Again, choice was modeled using a binary logistic distribution and trials were treated as repeated measurements with mindset (abstract versus concrete) and future self-liking (low versus high) as between subjects factors and the probability of the risky option (25%, 40%, 50%, 60%, and 75%) as a within subject factor.

As expected, there was a main effect of chance, Wald χ^2 (4, N = 42) = 182.24, p < 0.001, such that participants chose the probabilistic option more often when the probability was higher (Figure 3B). For example, participants chose the risky option 11% (SE = 2.1%) of the time (over the certain option) when there was a 25% chance of the risky option. By contrast, participants chose the risky option 63% (3.1%) of the time when there was a 75% chance of the risky option.

There were also main effects of both mindset, Wald χ^2 (1, N = 42) = 15.44, p < 0.001, and future self-liking, Wald χ^2 (1, N = 42) = 42.66, p < 0.001. Participants in the abstract mindset chose the risky option 37% (*SE* = 2.4%) of the time, whereas participants in the concrete condition chose the risky option 23% (*SE* = 2.3%) of the time (Figure 3A). Participants lower on future self-liking chose the risky option 20% (*SE* = 1.9%) of the time, whereas participants high on future self-liking chose the risky option 42% (*SE* = 2.8%) of the time (Figure 3C).

These main effects, however, were qualified by an interaction between mindset and future self-liking, Wald χ^2 (1, N = 42) = 4.576, p = 0.03. This finding is depicted in Figure 3D. Participants in the abstract mindset who were also high on future self-liking chose the risky option most often (*M* = 54%, SE = 4.0%). In other words, an abstract mindset promoted even riskier decision patterns among those individuals highest on future self-liking.

There was also an interaction between mindset and probability, Wald χ^2 (4, N = 42) = 10.37, p = 0.04. Participants in the abstract mindset more often chose the risky option at lower chance levels than participants in the concrete mindset. Finally, there was an interaction between future self-liking and probability, Wald χ^2 (4, N = 42) = 9.774, p = 0.04. Participants who were higher on future self-liking more often chose the risky option at lower probabilities than those lower on future self-liking. There was not a three-way interaction, p = 0.30.

Like before, we set out to unpack these results further, focusing on the interaction between mindset and future self-liking. Based on the pattern of the results (e.g., Figure 3D), we examined the proportion of risky choices in the concrete mindset compared to the abstract mindset for future self-liking groups separately. Although there was not an effect of mindset in the participants with lower future self-liking, p = 0.55, there was an effect of mindset in the participants with higher future self-liking, t(13) = 2.18, p = 0.05. This latter result generally held when controlling for childhood SES, F(1, 12) = 4.4, p = 0.058, η_p^2 = 0.27. In other words, the mindset manipulation did not have an effect among those participants lower on future self-liking. The mindset manipulation did have an effect among those participants high future self-liking. Among the participants with higher future self-liking, those in the abstract mindset chose the risky option 54% of the time (*SE* = 8%). By contrast, those in the concrete mindset chose the risky option only 35% (*SE* = 5%) of the time. The mean difference between the groups was 19% (95% C.I.: 0.2%, 38%).

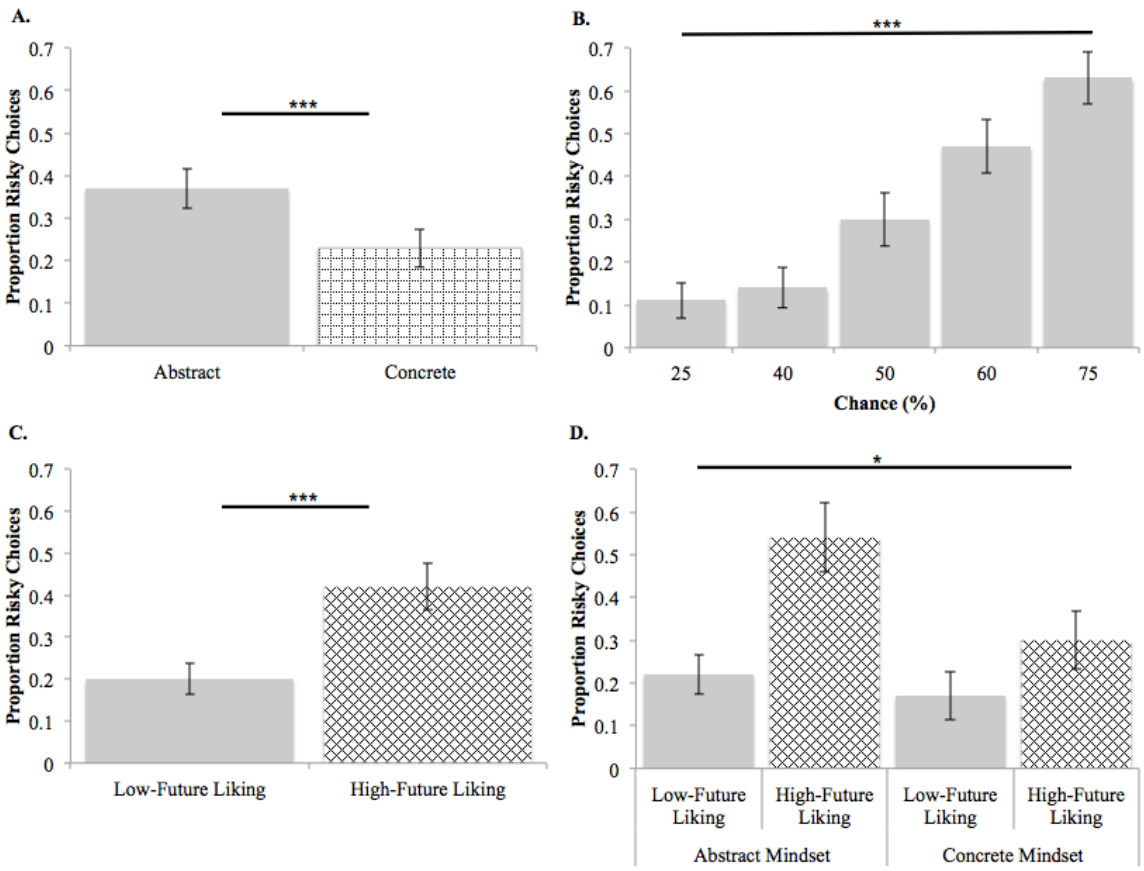

Figure 3. Proportion of risky choices A) in the Abstract and Concrete condition, B) by chance of the risky option, C) for individuals low and high on future liking, and D) for individuals lower and higher on future self-liking by mindset. *p<0.05; ***p<0.001; Error bars indicate 95% confidence intervals based on GEE analysis.

Childhood SES

Lastly, we examined whether childhood SES had an effect on the proportion of later choices or risky choices, depending on mindset. We examined Childhood SES separately from future self-continuity because of power limitations. Future research should include larger samples to better study these individual differences in conjunction. For ease of interpretation, we analyzed each mindset condition separately and conducted independent samples t-tests comparing choice based on childhood SES (where low and high were determined via a median split).

In the abstract condition, there was not an effect of SES on proportion of later choices, $t(22) = -0.03$, $p = 0.97$. There was not an effect of SES on proportion of later choices in the concrete condition, $t(18) = -0.72$, $p = 0.48$. In other words, childhood SES did not relate to delay of gratification regardless of mindset.

In the abstract condition, there was an effect of SES on proportion of risky choices, $t(21) = -2.64$, $p = 0.02$. Participants with a higher childhood SES were more likely to choose the risky option ($M = 44\%$, $SE = 6.7\%$) than the participants with lower childhood SES ($M = 25\%$, $SE = 3.5\%$). The mean difference between groups was -19% (*95% C.I.:* -34.7, -4.1%). In the concrete condition, there was not an effect of childhood SES on the proportion of risky choices, $t(17) = -0.03$, $p = 0.98$. In other words, childhood SES related to risky choices, but only in the abstract condition (Figure 4).

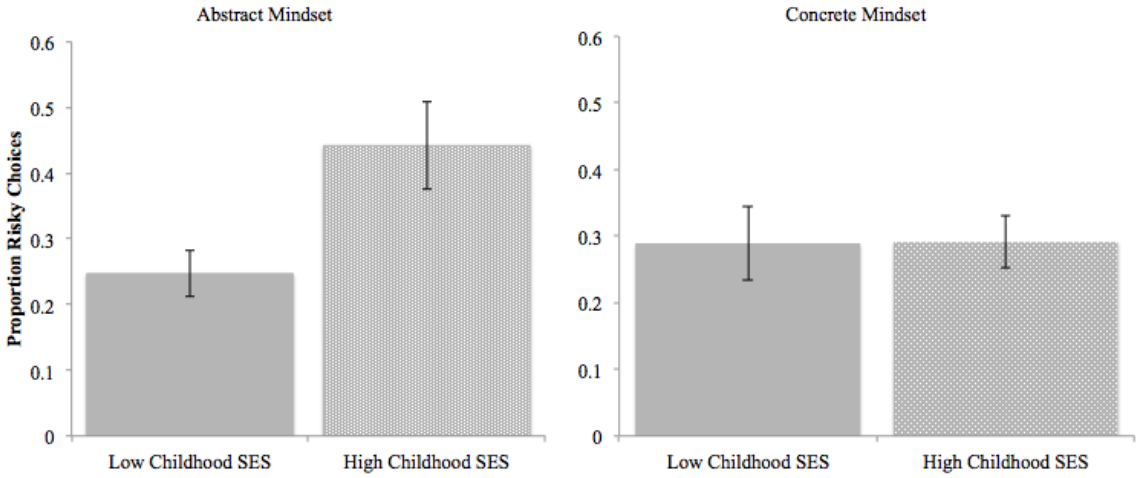

Figure 4. Proportion of risky choices by low and high childhood SES for the abstract mindset and the concrete mindset. There was an effect of childhood SES in the abstract mindset condition ($p = 0.02$) but not in the concrete mindset condition ($p = 0.98$).

DISCUSSION

The results from this study provide evidence that mindset affects decision-making, but this effect differs based on individual differences in future self-continuity and childhood SES. We found that the combined effect of low future continuity and a concrete mindset led to more impatient choices (See Figure 1). This suggests that a concrete mindset increases the salience of the more concrete (i.e., sooner) option, but only if the individual already felt less connected with his/her future self. On the other hand, there was not an effect of an abstract mindset or childhood SES on patience in intertemporal choice.

We also found the combined effect of future self-liking and an abstract mindset led to riskier decisions. This suggests that an abstract mindset allows participants to consider more uncertain options, but only if they are high on future self-liking. In addition, the

combined effect of high childhood SES and an abstract mindset also led to riskier decisions. Interestingly, there was not a correlation between childhood SES and future self-measures, indicating that these are two distinct factors modifying the relationship between mindset and decision patterns. A possible explanation for this is that SES could be considered a sociological/ecological effect and future self-continuity is primarily psychological. Together, these results support our hypothesis that individual differences in future continuity and childhood SES modify the relationship between mindset and decision-making.

The results from this study are consistent with and extend upon previous research. Bartels and Rips (2010) investigated psychological connectedness and intertemporal choice. Their results indicated that connection to one's future self is a strong moderator of the decisions people make. The current research supports Bartels and Rips findings, going one step further to how future self-continuity interacts with mindset. We also demonstrate that a distinct interaction between future self-liking and mindset relates to risky choices. As suggested by Green and Myerson (2004), the patterns of results for temporal and probability discounting are distinct, suggesting two different mechanisms underlie these decision patterns. However, it also seems likely that the two are highly related because both were associated with the combined effect of self-continuity and mindset.

Previous research has also shown a relationship between temporal perspective, creative thinking, and decision-making, which supports the idea that the way individuals think and process information can affect the decisions they make (Forster et al., 2004). This work may have implications for how we are taught to process information in academic settings. More specifically, if students are taught to engage in a more concrete mindset relative to an abstract mindset, what effects will that have on future decisions? According to this research, individuals that process information more concretely show a safer decision pattern.

Dweck developed a term for a related type of mindset, growth mindset, which is similar (although not identical) to an abstract mindset. Growth mindset is defined as, "the core belief that abilities are malleable and not fixed" (Dweck, 2015). On the flip side, a fixed mindset involves thinking abilities are innate and cannot change over time. It would be interesting to examine how growth mindset in education or household settings contributes to future self-continuity across the lifespan. This also begs the question of whether gender differences exist in future self-continuity, as they do with growth versus fixed mindset (e.g., Dweck, 2015). For example, a fixed mindset is thought to underlie some of the gender disparities in science and math fields. Does this fixed mindset translate into low (or high) self-continuity in adulthood? Future research should examine the relationship between future self-continuity, abstract, concrete, and growth mindsets more specifically to better understand similarities and differences across these seemingly related concepts.

This research applies not only to psychology, but also to physical health. For example, many of our dietary choices revolve around choices between immediately tempting treats and a well-balanced diet that will be beneficial down the road. For example, maintaining a healthy diet for long-term health involves avoiding unhealthy, but tasty foods that have concrete and ephemeral characteristics that tempt us. We found that a concrete mindset promoted impatience in individuals with lower future-continuity. Therefore, perhaps avoiding adopting a concrete mindset in favor of a more abstract mindset could promote healthier choices in some individuals. Future research should examine whether these results extend to the health domain.

Decision patterns also surface in relation to the criminal justice system. For example, criminal activity involves considering future consequences and risk. Like in fiscal or health choices, concrete mindsets may promote more impulsive choices in some individuals. Interestingly, in our work, we observed that individuals with higher SES actually adopted a riskier choice pattern when they engaged an abstract mindset. It is difficult to know, based on our findings, what the baseline decision pattern is across individuals. However, we can potentially use this work to better understand why individuals become involved in criminal activity and how they process future or risky consequences.

As mentioned above, we found childhood SES was related to risky choices, but only in the abstract condition. This is of interest because we initially hypothesized those individuals with high childhood SES would be more likely to make safer decisions, which is consistent with a slower life strategy. Although this was true of those individuals in the concrete processing condition, it was not true in the abstract processing condition, which leads us to wonder why? Griskevicius et al. (2011) found that high childhood SES led to more risk averse choices when participants were primed with mortality cues. One possibility for the difference in findings may relate to the manipulation (mortality versus mindset), such that an abstract mindset nudges the high SES participants in a risk seeking direction. Perhaps individuals with a higher childhood SES in the abstract processing condition felt secure and felt they were able to make those risky decisions because of monetary security? Further research is necessary on this area of decision-making.

These results also demonstrate the importance of examining the psychology of decision-making within the context of social and economic environments. For example, research from the last several decades shows that financial decision-making patterns departs from rational choices that most economic models predict (Frydman & Camerer, 2016). In other words, people use cognitive biases and heuristics in their decisions. In recent times, there have been increases in credit card debt, debt from college loans, and inadequate savings for retirement. It will be important for research from psychology to inform households, managers, and economic/social policy to aid decision-makers and promote financial literacy. Here, we suggest that mindset can influence decision patterns, but only in certain individuals. For example, adopting an abstract mindset increased risky

choices, but only in those individuals high on future self-liking. Taken together, these results suggest ways to increase patience and risk seeking or averse behavior in spending and investing habits; however, it is difficult to know whether we are nudging individuals to be more or less patient and risky by inducing mindset. Future research should add a baseline condition to better understand ways in which mindset impacts decision patterns.

This research could be a potential springboard for determining interventions in impulsivity or risky behavior seen in many mental illnesses, such as substance abuse, ADHD, pathological gambling, and eating disorders. For example, we found that mindset can impact both temporal discounting and probability discounting; however, only for certain individuals. Therefore, when testing interventions to help promote patience or reduce risky behavior, it will be important to bear in mind individual differences that could facilitate or hinder the efficacy of the intervention. Here, we point to two such individual difference factors that will be important to take into consideration: childhood SES and future continuity. Future research should consider testing mindset manipulations, while taking these social and psychological factors into consideration, in patient populations.

The study does possess some limitations. We had a relatively small, homogenous sample size with a disproportioned male/female ratio. Moreover, decisions are complex and it is difficult to mimic real world decisions in the laboratory. It will be important for interdisciplinary efforts with sociology to examine related decision patterns in households. Future research should investigate how an individual becomes connected to their future self, examine gender differences, and build on the concept of growth-mindset and how that affects decision-making. Future research should further examine the relationship between SES, sociological factors, and decision-making. Indeed, it will be important to focus on a variety of aspects of one's life in order to fully comprehend how and why they certain decision patterns unfold and ways to develop low-cost nudges to promote advantageous decision patterns in diverse populations and reduce socioeconomic problems in spending, investment, and health decisions.

In sum, we found that 1) engaging a concrete mindset increased impatience among individuals with lower levels of future self-continuity, 2) engaging in an abstract mindset increased risk-seeking among individuals with higher levels of future self-liking, and 3) engaging in an abstract mindset increased risk-seeking among individuals with higher childhood SES. We suggest that mindset could be a useful tool to promote healthy decision-making strategies in finance, health, and lifestyle behaviors. However, we also submit a mindset intervention may only be effective for a subset of the population, and individual differences in future self-continuity and childhood SES help explain who might most benefit from such interventions.

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APPENDIX A

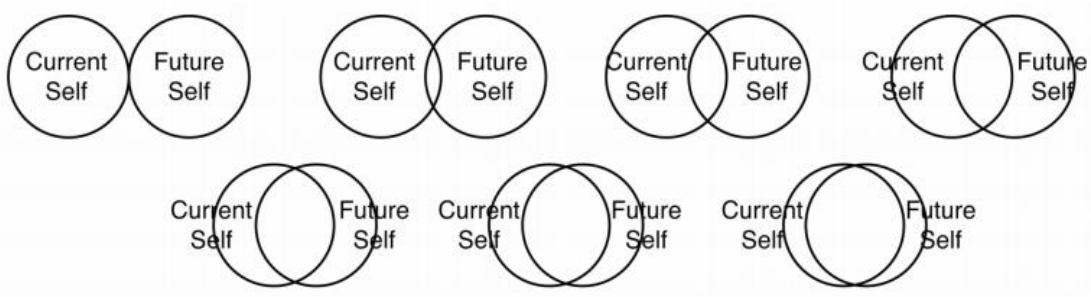
Connectedness questionnaire

Instructions: **Before we begin the experiment we would like to ask you a few questions about yourself. Please answer accurately and honestly. Please let the experimenter know if you have any questions.**

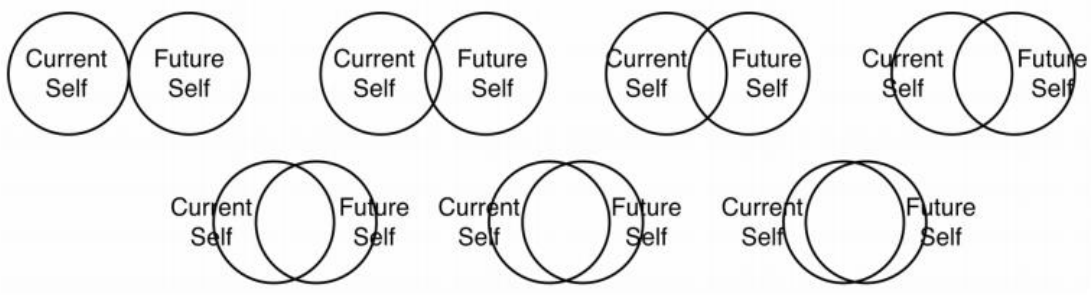
1. Sex (circle your response) M F

2. Age_____

3. Please select the circle pair that best describes how *similar* you feel to your future self 10 years from now. Circle your response.



4. Please select the circle pair that describes how *connected* you feel to your future self 10 years from now.



5. How much do you *care* about your future self, 10 years from now? (circle your response)

Don't care at all			*Neutral*			*Completely care*
1	2	3	4	5	6	7

6. How much do you *like* your future self, 10 years from now? (circle your response)

Don't like at all			*Neutral*			*Completely like*
1	2	3	4	5	6	7

Please use this 7-point scale when answering the following three questions.

Strongly Disagree			*Neutral*			*Strongly Agree*	*Do not wish to disclose*
1	2	3	4	5	6	7	00

7. _____My family usually had enough money for things when I was growing up

8. _____I grew up in a relatively wealthy neighborhood

9. _____I felt relatively wealthy compared to the other kids in my school

APPENDIX B

List of stimuli

How/Why	Exemplars/Categories
Study for a test	Singer
Taking a test	Actor/Actress
Take notes	Dog
Type a paper	Basketball
Read	Beer
Make a bed	Book
Wash dishes	City
Painting a room	Car
Washing hands	Television
Brush teeth	Fast food
Drink Coffee	Dance
Eat	Queen
Watch TV	Ocean
Make a list	Board game
Greet someone	Soda
Do laundry	Traffic Sign
Locking a door	Flower
Voting	Author
Paying rent	Chair
Exercising	Headache pill
Plant a garden	Piano
Read newspaper	Hockey
Call someone	Tablet
Join the army	Pants
Make dinner	Soap
Surf the internet	Chocolate
Ride a bike	Vegetable
Diet	Professor
Tie shoe laces	Tree
Play an instrument	Sign