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Unstuck from the concrete: Carryover effects of abstract mindsets in intertemporal preferences

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ABSTRACT

Prior research has demonstrated that individuals show decreasing levels of impatience as the delay of consumption gets longer (i.e., present-bias). We examine the psychological underpinnings of such present-biased preferences by conceptualizing timing decisions as part of a series of judgments. We propose that shifts in the abstractness of processing (focusing on details vs. broad aspects) triggered by aspects of an earlier (related or unrelated) decision systematically influence the degree of present-bias in subsequent decisions. The results of five studies show that the processing mindset (concrete vs. abstract) evoked in previous related and unrelated decisions influences the level of construal evoked in subsequent decisions and moderates the extent of present-bias without changes in affect. We further show the default mindset is concrete (displaying high present-bias) and thus the effect of construal is eliminated when the subsequent intertemporal task is inherently more abstract.

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Introduction

Imagine an individual who is shopping for a camera online. Her delivery is scheduled for 3 days later. How impatient would she be to receive this camera (i.e., how much would she pay per day to avoid the delay in shipment)? Would her impatience over a given day be any different if her delivery was scheduled for 10 days later? An extensive literature indicates that it would be. For instance, Malkoc and Zauberan (2006) demonstrated that people require higher daily premiums to avoid a 3-day delay (about \$5, \$1.8 per day) than a 10-day delay (about \$10, \$1 a day). We refer to such a decrease in required premiums as delay increases as *present-bias* (Thaler, 1981). In this paper we examine whether previous tasks people engage in prior to the intertemporal decision affect decision-makers' present-bias. For instance, would present-bias in shipment preferences depend on the type of cameras that were evaluated prior to the shipment decision (e.g., considering two digital cameras vs. considering one digital and one traditional camera)? Alternatively, imagine another person receiving a gift certificate from amazon.com. Might his present-bias depend on the article he read on newyorktimes.com 5 min earlier? These are the types of

questions we address in this paper by examining the role of prior decisions and the processing they evoke on intertemporal preferences encountered on subsequent occasions.

On any given day, people routinely make a series of decisions like the ones previously mentioned, often moving from one context to another. Every act they engage in has the potential to influence decision-making on later occasions. Indeed, recent research has examined how prior decisions can lead to differences in the activation of goals (Dhar & Simonson, 1999; Novemsky & Dhar, 2005), various mindsets, such as implementation (vs. deliberation; Gollwitzer & Bayer, 1999), promotion (vs. prevention; Higgins, 1997), which-to-buy (Xu & Wyer, 2008) and shopping momentum (Dhar, Huber & Khan, 2007), as well as personality traits (Bargh & Chartrand, 2000; Khan & Dhar, 2006). These differences in activation then affect subsequent behaviors, such as goal fulfillment, indulgent consumption, and creativity (for a review see Wyer & Xu, 2010). In our work, we extend prior research by examining consumers' mindset abstraction and its role in subsequent intertemporal decisions in general and present-bias in particular. We argue that while some situations evoke concrete mindsets (enhancing focus on the context and the details), other situations facilitate abstract mindsets (enhancing focus on the big picture; Freitas, Gollwitzer, & Trope, 2004). These mindsets then influence how decision-makers process and represent related or unrelated information and, most central to our work, subsequently affect their intertemporal preferences.

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Intertemporal decisions involve a tradeoff between the timing and the cost of the outcome. As described previously, online purchases often involve intertemporal tradeoffs. Other important instances of intertemporal tradeoffs that routinely influence our lives include people deciding whether to spend money immediately or to save it for retirement or whether to indulge in consumption with short term benefits or to choose more healthy options with longer-term benefits. Given the prevalence and importance of intertemporal tradeoffs in everyday life, extant research has explored how such decisions are made and what factors affect these decisions (for a review see Frederick, Loewenstein, & O'Donoghue, 2002).

One of the main findings in this literature is that people are present-biased. In line with the literature, we define present-bias (often referred to as hyperbolic discounting; e.g., Thaler, 1981)¹ as people's tendency to show decreased impatience (e.g., discounting of future outcomes) as the time horizon (i.e., length of delay) increases. For example, Thaler (1981) found that to delay a \$250 lottery prize for 3 months, people required an extra \$50 (a monthly premium of \$16.70), but when delaying the same amount for 1 year, four times as long, they required an extra \$100 (a monthly premium of only \$8.30), implying a much lower discount rate over longer periods. An extensive literature has focused on establishing this phenomenon of decrease in discount rates from short to long time horizons across a variety of settings, identifying its boundary conditions and its possible psychological drivers (e.g., Malkoc & Zauberman, 2006; Rachlin & Raineri, 1992; Zauberman & Lynch, 2005). However, all of this work has focused on the emotions or cognitions that are evoked by the target outcome to be delayed (e.g., the \$250 lottery prize), with no consideration of the possible role of earlier tasks.

Unlike this previous research, in the current work we conceptualize intertemporal decisions as a part of a series of decisions that might or might not be related to each other. In particular, we propose that prior decisions and tasks can alter mindset abstraction without directly changing the affect or cognition about the focal outcome, and this mindset can carry over to later decisions, having systematic effects on the way people make intertemporal tradeoffs. We hypothesize that people in concrete mindsets process information in a detailed and context-dependent manner, leading to present-biased preferences that are manifested in a lower rate of discounting in longer than shorter time periods. When their thinking is abstract, however, their information processing is decontextualized, allowing them to see higher level considerations and leading to less present-biased preferences that show similar discounting rates for short and long time horizons. That is, we predict an interaction between mindset abstraction and time horizon on rate of discounting.

To test this moderation hypothesis, we use a sequential task structure and introduce three novel manipulations of abstraction. We manipulate mindset abstraction using tasks that are affect-free and are independent of the timing of the decision. These three tasks are theoretically motivated to shift the processing of information from concrete to abstract, are implemented *prior* to the target timing decision, and do not directly focus on the target event. Importantly, in the third study, we employ a supraliminal semantic prime to alter mindset abstraction, which provides evidence that abstract thinking can be activated automatically and non-consciously, as recently suggested (Bar-Anan, Liberman, Trope, & Algom, 2007). In addition, in the last study we identify a boundary condition of our proposed mechanism and show that if the subsequent intertemporal task inherently

triggers more abstract, less contextual processing, then the moderating role of mindset abstractness on the degree of present-bias is eliminated.

Theoretical development

Intertemporal choice and present-bias

Extensive research on intertemporal choice has demonstrated multiple anomalies that violate the assumptions of the standard rational economic model (e.g., Frederick et al., 2002). Of all the behavioral anomalies that have been reported, the best documented, and arguably the most important, is present-biased preferences (i.e., hyperbolic discounting; Strotz, 1955; Thaler, 1981). That is, people use a higher discount rate when delaying outcomes over shorter periods (e.g., 3 months) than over longer ones (e.g., 1 year). This effect has been replicated repeatedly with humans and lower animals (e.g., Ainslie & Herrnstein, 1981), with both relatively naive and sophisticated participants (Shelley, 1993) and with hypothetical and real outcomes (Kirby & Herrnstein, 1995).

Although present-bias has been consistently demonstrated, there has been relatively less research on its psychological underpinnings. The explanations offered have been mostly affective, arguing that visceral mechanisms are responsible for present-bias (Loewenstein, 1996). This line of research has suggested that forgoing a current outcome is painful and leads to a feeling of deprivation (Hoch & Loewenstein, 1991), resulting in impulsiveness and impatience that manifests itself in present-biased preferences (e.g., Rachlin & Raineri, 1992). Recent research, however, showed that cognitive and perceptual processes may also play a role in individuals' bias toward the present (Malkoc & Zauberman, 2006; Zauberman, Kim, Malkoc, & Bettman, 2009; Zauberman & Lynch, 2005). These more recent explanations argue that the timing of events leads to changes in the way events are represented. For instance, Zauberman and Lynch (2005) demonstrated that temporal distance from events systematically and differentially influences perceptions of the amount of resource slack available for time and money, which in turn can account for the pattern of discounting across resources, including present-bias. Malkoc and Zauberman (2006) suggested another cognitive account of present-biased preferences, demonstrating that the framing of the decision (delaying a present outcome vs. expediting a future outcome) moderates the extent of present-bias. Their results indicate that deferral decisions involve inherently concrete representations. Their findings also show that the different degree of concreteness with which consumers represent the outcome in delay and expedite frames can explain the differential present-bias observed under the two frames. This account is consistent with other research showing that temporal distance affects the concreteness of outcome representations (Trope & Liberman, 2003) and that an increase in the vividness of an outcome leads to difficulties in delaying gratification for that outcome (e.g., Metcalfe & Mischel, 1990).

Based on research showing that delaying present outcomes into the future is an inherently concrete task (Malkoc & Zauberman, 2006) and consistent with the notion that people tend to focus on the local context of decisions (e.g., Dhar & Wertenbroch, 2000), we argue that unless something triggers individuals to take a more global perspective, they will be in a concrete mindset and thus show a relatively high degree of present-bias. Our goal is to examine whether prior tasks can shift people's mindsets before they make a subsequent timing decision from concrete to relatively more abstract, attenuating present-bias. We argue that if the processing activated during an earlier task evokes a more global and abstract mindset, it would attenuate the well-established finding of present-bias. We also show that if the discounting task

¹ We use the terms present bias, hyperbolic discounting and decreasing impatience interchangeably to refer to the phenomenon of a declining rate of discounting with time.

is itself inherently more abstract, then the effect of mindset abstraction on present-bias is reduced.

Mindset, abstraction, judgment and decisions

Previous literature has defined a mindset as judgmental criteria and cognitive processes that, once activated, persist over several tasks and contexts (Luchins, 1942; Luchins & Luchins, 1959). Smith (1994) argued that like other types of knowledge structures, accessibility of cognitive procedures can vary in memory. As a result, an accessible process or procedure is more likely to be recruited on subsequent occasions, indicating that a particular activated mindset might have significant consequences on later intertemporal tradeoffs. In the last decade, researchers have examined various types of mindsets, including the extent of implementation (vs. deliberation; Gollwitzer & Bayer, 1999; Gollwitzer, Heckhausen, & Steller, 1990), focus on promotion (vs. prevention; Higgins, 1997), and a which-to-buy mindset (Xu & Wyer, 2008).

In the current work, we focus on a different type of mindset – abstract (vs. concrete) mindsets (e.g., Freitas et al., 2004). We define concrete mindsets as cognitive procedures that are bounded by the context and include information structures present in the immediate situation. Alternatively, abstract mindsets are cognitive processes that are broad, lead to decontextualized information processing, and are more inclusive of information that is not immediately available. We explore the persistence of such mindsets and their effects on subsequent timing decisions, specifically on the extent of present-bias.

Abstraction has been studied across multiple disciplines (e.g., Brown, 1958; Johnson, 1984; Paivio, 1971; Vallacher & Wegner, 1989), and the concreteness/abstractness continuum has been found to affect a variety of processes. For instance, concrete words are recognized quicker (Strain, Patterson, & Seidenberg, 1995), are better remembered (Paivio, 1971), and lead to narrower categorization (Rosch, 1975). Abstraction increases comparability of otherwise non-comparable options (Johnson, 1984; Malkoc, Zauberaman, & Ulu, 2005) and enhances creativity (Förster, Friedman, & Liberman, 2004). Abstract representations are more general, inclusive, superordinate, and decontextualized compared to concrete representations, which are more specific, detailed and contextual, typically explained in terms of greater psychological distance for abstract representations.

Consistent with these findings, construal level theory (CLT; Liberman, Trope, & Stephan, 2007) has demonstrated that abstraction resulting from psychological distance (temporal, spatial, interpersonal or hypothetical) of the decision-maker from the focal event/object affects its representation. For instance, an event occurring in the distal future is represented more abstractly and thus decision-makers evaluating or describing these events show increased creativity (Förster et al., 2004), more reliance on broader categories (Liberman, Sagristano, & Trope, 2002), and heightened use of dispositional characteristics (Henderson, Fujita, Trope, & Liberman, 2006). Similarly, Vallacher and Wegner (1989) argued that more basic and context specific representations are evoked when people have low action identification compared to when they have high levels. They demonstrate that the act of making a list can be identified either as high level, focusing on the “why” (i.e., getting organized) or as low level, focusing on the “how” (i.e., writing things down). Research on CLT, however, mainly examined how the representation of a given object (or event) affects cognitions related to that specific object or event (e.g., attending an event in the future, interacting with a person with power, describing a distant location). Recent work has started to extend these findings by demonstrating that thinking about high level “why” considerations (as opposed to low level “how” considerations) produces similar effects on a variety of phenomena,

including self control (Fujita, Trope, Liberman, & Levin-Sagi, 2006), self regulation (Freitas et al., 2004), and activity enactment (Liberman, Trope, Macrae, & Sherman, 2007).

Support for generality of abstraction and its possible automatic carryover effects on decision-making, however, is sparse. Most notably, literature on processing orientation (global vs. local) during a task has been found to affect responses in ensuing contexts. Förster and Higgins (2005) found that a more holistic and global processing style, manipulated through a perceptual letter identification task (i.e., Navon letters; Navon, 1977), led to greater promotion regulatory focus on a later task, whereas a more contextual and local processing style led to greater prevention focus. Finger (2002) further showed that manipulation of processing orientation with visual and perceptual tasks (i.e., mazes) led to more general and broad thinking, increasing performance on subsequent tasks that required holistic processing. Overall, these findings suggest that performance on a subsequent, unrelated task can be affected by the abstraction of the processing style used in an unrelated prior task.

Mindset abstractness and present-bias

Building on this prior work, we propose that mindset abstraction can be evoked in seemingly unrelated contexts, even in the absence of explicit manipulations of psychological distance or global/local processing, and can then persist to influence present-bias in subsequent intertemporal decisions. We argue that if present-bias is driven by concrete and contextual representations, then promoting an abstract mindset should decrease the extent of such contextual thinking and thus attenuate present-bias. Supporting this point, in a correlational study Vallacher and Wegner (1989) reported that people who construe events abstractly also have decreased chronic impulsivity and increased temporal consistency.

H1. Decisions made by individuals who are in abstract mindsets will show a smaller decline in their discount rates from short to long time horizons (i.e., less present-bias) than those who are in concrete mindsets. That is, there will be an interaction of mindset abstraction and time horizon on discount rates.

We provide several different demonstrations of this interaction between mindset abstraction and time horizon below. The next question is then whether this interaction occurs for all discounting tasks. Our theory suggests that thinking more abstractly (e.g., more general statements, a greater number of higher order considerations, or use of more abstract language) leads to less present-bias by changing the processing style employed, encouraging more inclusive and less localized consideration and decreasing reliance on the available context. If this is the case, then a discounting task that is inherently more abstract (less concrete and contextual) should be less affected by changes in mindset abstraction. In other words, if the basic framing of the discounting task itself encourages a more general, less contextual response, then the effect of mindset abstraction on discount rates should be attenuated, and possibly eliminated.

The semantic framing of the deferral decision can affect the degree to which the discounting task itself encourages more or less general processing. Prior research has shown that delay frames describe the task as a departure from the present, highlighting how long one needs to wait to obtain the outcome in the future. Such departures from the present are associated with concrete representations (Malkoc & Zauberaman, 2006). Alternatively, date frames shift the focus to the future moment the outcome will occur, without focusing the individual on the time frame they will need to wait. This increased focus on the future is associated with more abstract representations (Trope & Liberman, 2003) and results in sig-

nificantly lower discounting than delay frames (LeBoeuf, 2006; Read, Frederick, Orsel, & Rahman, 2005). Furthermore, there is evidence suggesting that a task presented in date format will lead to less concrete representations than the same task presented in delay format (Kim, Malkoc, & Zauberman, 2010). If this is the case, our proposed mechanism implies that the effect of mindset abstraction will be stronger when the task is presented in delay format (as in the previous experiments) than when the description is in the more abstract date format.

H2. Changes in the presentation format of the deferral decision (date vs. delay) will moderate the interaction between mindset abstraction and time horizon (i.e., present-bias) such that there will be a stronger interaction under delay than under date format. That is, there will be a three-way interaction between presentation format, mindset abstraction, and time horizon.

This perspective is distinct from previous research that established a link between the concreteness of outcome representation and present-bias (Malkoc & Zauberman, 2006). Malkoc and Zauberman (2006) focused on the concreteness/abstraction of the focal outcome (e.g., \$250 jacket vs. \$250 prize) and demonstrated that the extent to which this outcome is represented concretely (e.g., the specific jacket I would purchase with the \$250 prize) affects the extent of present-bias. In this manuscript, we make a distinction between the concreteness/abstraction of the outcome and the general mindset (which is not about how a given outcome is represented, but refers to the processing style employed). Previous work showed that the manipulation of outcome concreteness influences present-bias in both concrete frames (e.g., delaying outcomes from the present, where the focus is on the immediate consumption to be delayed) and in abstract frames (e.g., expedite frames, where the focus is on the future, more abstract, outcome). We theorize and demonstrate that mindset abstraction, however, only influences a more concrete and contextual task and loses its effect when the task is more abstract and decontextual.

Our theorizing also differs from the work examining the relationship between higher level construal and self control (Fujita et al., 2006). Fujita et al. (2006) demonstrated that when prompted to construe related or unrelated events at higher levels (e.g., thinking about *why* to maintain health, categorizing objects in broad categories), people showed an increased level of self control when faced with temptations. Self control and present-bias are related phenomena, as lapses of self control often manifest themselves in impatience (e.g., spending money as opposed to saving). However, present-bias is not simply high levels of impatience, but instead decreasing impatience over time. That is, present-bias focuses more on the implication of intertemporal inconsistencies and not simply the (in)ability to regulate behavior at a given point in time. Thus, the current paper takes a unique focus by specifically examining how the processing abstractness (mindset) that is evoked by earlier tasks affects present-bias.

To test our theory, across four studies we use multiple manipulations to vary processing abstractness (mindset). Our general empirical approach (see Spencer, Zanna, & Fong, 2005) is to first have participants engage in a task that is theoretically motivated and is hypothesized to change mindset (level of abstraction). Then, in a pretest we test the ability of that manipulation to change abstractness level as measured by the behavior identification scale (BIF; Vallacher & Wegner, 1989). After validating that each manipulation indeed leads to changes in participants' mindset, we conduct a study to test the mindset's effect on present-bias by asking participants to make deferral (delay) decisions for two different points in time. Note that present-bias is defined as the decline of discounting from a short time period to a long time period. As such, testing for present-bias requires comparison of

discounting between two time periods. To achieve this goal, in all of our studies, participants are asked to delay a certain outcome over two different time periods (e.g., 3 days and 10 days).

In an attempt to triangulate evidence, we use separate manipulations to demonstrate the moderating role of mindset abstraction on the extent of present-bias. In addition, we use written protocols to further validate our construct (Experiments 1A and 2). Specifically, we use two different coding methods to operationalize mindset abstraction and then use these variables in mediation analyses to confirm that processing abstraction (triggered by our manipulations and revealed thru participants' thought protocols) is responsible for our effect. Lastly, in Experiment 4 we test a direct implication of our theory and identify a boundary condition of our effect by demonstrating that framing of the discounting task (delay interval vs. future date) moderates the carryover effect of mindset abstractness (H2). Across our five experiments, the results demonstrate that people's default mindset is concrete and shows high levels of present-bias (Experiment 1B), and that evoking relational (vs. item-specific) thinking (Experiments 1A, 1B, 2 and 4) or priming with concrete and abstract words (Experiment 3) is sufficient to evoke an abstract mindset. To our knowledge, our work is the first to establish the link between relational (vs. item-specific) thinking and abstraction of processing and use it to manipulate abstraction, which then carries over to influence intertemporal preferences and attenuate present-bias.

Experiment 1A: Comparing alignable and non-alignable options

Overview

Experiment 1A was designed to test our abstraction hypothesis in a common setting and show that a simple product comparison task could both influence mindset abstraction and moderate the degree of present-bias in a subsequent product delivery timing decision. As discussed earlier, we define abstract (concrete) thinking as the extent of decontextualized (contextualized) processing and the ability to incorporate elements that are not readily available in the context. In this experiment, we manipulated mindset abstraction by using a comparison task that presented options in a way that either made it simple or difficult to engage in attribute level comparisons, similar to the example in the introduction of this paper. Johnson (1984) showed that evaluating options that are not directly comparable leads to more abstraction in thinking. Similarly, presenting options with non-alignable attributes (no shared common attributes) leads to more general and abstract thinking than using alignable attributes (shared attributes, with different attribute values; Malkoc et al., 2005; Zhang & Markman, 2001). In line with these findings, we manipulated thinking abstraction by using alignable and non-alignable attributes to describe alternatives (see Appendix A). We tested the validity of the alignability manipulation with a separate pretest and predicted that comparing non-alignable attributes would lead to higher action identification (more abstraction). After establishing the validity of the manipulation, we tested its effect on present-bias and predicted that the non-alignable condition would lead to lower present-bias, mediated by the relative degree of abstraction in the attributes mentioned.

Method

Participants and design

One hundred and two undergraduate students participated in this study. We recruited participants in one of two ways. Some of

the participants completed this study as the first task in a 45 min experimental session and were paid \$10 in return. Others were recruited on campus and were provided with a chocolate bar as their compensation. The data collection method did not interact with the variables of interest (all $F_s < 1$), so the data were collapsed on this variable. The study followed a 2 (alignability: alignable vs. non-alignable) \times 2 (time horizon: 3 days vs. 10 days) mixed design. Alignability was manipulated between subjects and time horizon was manipulated within-subjects.

Procedure

The experiment had two parts. In the first part, participants were given a scenario asking them to imagine shopping for a camera. They were provided with two options presented on seven attributes and were asked to compare and contrast these two cameras (see Appendix A). In the alignable condition, participants compared two digital cameras with alignable differences. In the non-alignable condition, participants compared a digital camera with a traditional camera based on non-alignable differences. In both conditions, participants were told to: "Describe in as much detail as you can the pros and cons of purchasing camera X vs. camera Y". Next, as the focal timing decision, participants made a decision regarding the shipment of the camera they had chosen. Specifically, they were told that their delivery was scheduled for the same day and they had the option to delay it in order to save money. They indicated how much they would need to save in order to delay the delivery of the camera. Time horizon was manipulated within-subjects by varying the delivery delay to be either 3 or 10 days. Finally, participants completed a written funnel debrief examining whether they detected any connection between the two tasks (e.g., Bargh & Chartrand, 2000); no participant reported detecting a connection.

Results

Pretest. Fifty-one undergraduate students, who were not part of the main experiment, completed the alignability manipulation previously described, followed by the 19-item version of the action identification scale (BIF; Vallacher & Wegner, 1989), as adapted by Liberman and Trope (1998). In this task participants classify 19 tasks (e.g., taking a test) as lower level (e.g., answering questions) or higher level (e.g., showing one's knowledge). The dependent measure was the total count of the tasks that participants identified to be high level. As expected, a one-way ANOVA produced a main effect of alignability on action identification ($F(1, 49) = 4.24, p < .05$), indicating that participants had higher action identification (i.e., more tasks were identified as high level) when participants evaluated products on non-alignable attributes ($M = 12.08, SD = 4.78$) compared to those who evaluated products with alignable attributes ($M = 9.56, SD = 3.90$). This result shows that evaluation of alternatives that were described with non-alignable attributes induced a more abstract mindset than evaluation of alignable attributes.

Present-bias. The main dependent measure was the daily premiums corresponding to participants' shipping preferences, calculated by dividing the dollar amount participants indicated would compensate for the delay in delivery by the number of days of delay.² Please note that to test for present-bias and declining impatience (i.e., hyperbolic discounting) our analysis compares the

delay premiums or discount rates at two points in time. To be consistent with prior research, we refer to the effect of delay discounting being greater for the longer (vs. shorter) time horizons as delay premiums 'declining over time.'

We conducted a 2 (alignability) \times 2 (time horizon) mixed ANOVA, treating time horizon as a repeated factor. Replicating prior findings, time horizon had a significant main effect ($F(1, 100) = 57.06, p < .01$), indicating that participants' per day willingness to pay to avoid a delay in delivery was higher for 3 days ($M = \$3.75, SD = 3.14$) compared to 10 days ($M = \$2.47, SD = 2.16$). Alignability did not produce a significant main effect ($F(1, 100) = 1.34, p = .25$). Most importantly, the analysis showed the predicted two-way interaction between time horizon and alignability ($F(1, 100) = 5.47, p < .05$), demonstrating greater present-bias in preferences when participants had previously evaluated products with alignable attributes, compared to those who had previously evaluated products on non-alignable attributes. Specifically, as can be seen in Table 1 and Fig. 1, in the alignable condition, daily premiums showed a greater decline over time ($M_{3days} = \$4.24, SD_{3days} = 3.28; M_{10days} = \$2.56, SD_{10days} = 2.21; F(1, 50) = 54.649, p < .01, \eta^2 = .52$) than in the non-alignable condition ($M_{3days} = \$3.26, SD_{3days} = 2.95, M_{10days} = \$2.38, SD_{10days} = 2.13; F(1, 50) = 12.34, p < .01, \eta^2 = .20$).

These analyses demonstrate the predicted two-way interaction between mindset and time horizon. However, these findings do not provide direct process evidence. Next, we analyze participants' written thought protocols to test the underlying process we hypothesized more directly.

Thought listings. As previously discussed, participants described the pros and cons of purchasing camera X and camera Y in as much detail as they could. Coding of these written thought protocols allowed us to more directly test our hypothesis that abstraction of mindset leads to lower present-bias. As mentioned earlier, we define mindsets as judgmental criteria and cognitive processes that persist over time. One way to make the two non-alignable (and non-comparable) options easier to evaluate is to create new and more abstract attributes (Johnson, 1984). Based on this, we hypothesized that participants evaluating non-alignable cameras would rely more on abstract attributes and this variability in decision-making would mediate the effect of alignability on present-bias. To test this idea, open-ended responses were coded by two independent raters blind to the experimental conditions and to the hypotheses ($r = .92$). The raters classified the attributes mentioned as either abstract or concrete. Concrete aspects of a product were defined as those that are directly associated with the object and represent the features a product possesses (e.g., Bettman & Sujan, 1987). Similarly, abstract aspects were defined as attributes that are general, are inferred from concrete attributes and represent benefits that are provided by one or more attributes.³

We expected that more abstract (vs. concrete) attributes would be mentioned by the participants in the non-alignable than those in the alignable condition. A 2 (attribute type: abstract vs. concrete) by 2 (alignability: alignable vs. non-alignable) mixed ANOVA, with attribute type as a repeated factor, supported this prediction. As expected, we found an attribute type by alignability interaction ($F(1, 100) = 13.44, p < .01$). Specifically, whereas participants in both conditions mentioned a similar number of concrete attributes ($M_A = 4.00, SD_A = .83, M_{NA} = 3.96, SD_{NA} = 2.09; F(1, 100) = .01, p = .90$), the mention of abstract attributes more than quadrupled in the non-alignable condition ($M_{NA} = 1.98, SD_{NA} = 1.41$) compared to the alignable condition ($M_A = .42, SD_A = .57; F(1, 100) = 47.36$,

² Note that it is not possible to calculate discount rates in this experiment because the decision does not include an explicit base amount (i.e., the cost of the transaction in the absence of a timing decision). To provide consistency, in this paper we report a simple measure of monthly premiums across all experiments. In Experiments 2 and 3, where compounded annual discount rates are possible to calculate, a similar pattern of results holds for this measure.

³ Some common examples of the concrete aspects were size, zoom, resolution, price, picture preview function, delete images, battery life and memory. Common examples of the abstract aspects included quality, storage, sharing, editing, ease of usage and time efficiency.

Table 1

Daily, weekly or monthly premiums, means and (standard deviations) for Experiments 1A, 1B, 2 and 3.

	Concrete mindset	Abstract mindset
<i>Experiment 1A</i>		
Daily premium 3 days	\$4.24 (3.28)	\$3.26 (2.95)
Daily premium 10 days	\$2.56 (2.21)	\$2.38 (2.13)
<i>Experiment 1B</i>		
Daily premium 3 days	\$6.19 (10.58)	\$4.72 (4.96)
Daily premium 10 days	\$2.63 (3.16)	\$2.46 (2.63)
<i>Experiment 2</i>		
Weekly premium 4 weeks	\$7.12 (6.96)	\$4.11 (3.11)
Weekly premium 10 weeks	\$4.58 (3.41)	\$3.95 (2.28)
<i>Experiment 3</i>		
Monthly premium 3 months	\$7.56 (9.66)	\$7.04 (9.07)
Monthly premium 12 months	\$4.79 (6.14)	\$5.61 (8.28)

$p < .01$). Since the means for these variables are very low and might be in violation of the GLM assumptions, we repeated the analyses using a non-parametric test and reached the same conclusion for the concrete (Kolmogorov–Smirnov $Z = 1.19$, $p = .12$) and the abstract (Kolmogorov–Smirnov $Z = 2.77$, $p < .01$) attributes.

To more directly test the idea of a relative increase in abstraction, we formed an abstractness index by taking the ratio of abstract attributes to the total number of attributes mentioned for each participant. Using this relative degree of abstraction as a dependent measure produced very similar results, ($F(1, 100) = 50.66$, $p < .01$; $M_A = .08$, $SD_A = .11$; $M_{NA} = .35$, $SD_{NA} = .25$). Once again, we repeated the analysis using a non-parametric test and replicated the findings (Kolmogorov–Smirnov $Z = 2.87$, $p < .01$).

To further examine the hypothesized role of this relative degree of abstraction in shifting present-bias, we conducted a mediated moderation analysis. We predicted that the moderating role of alignability on present-bias is mediated by degree of abstraction, measured from the verbal protocols. As suggested by Judd, Kenny, McClelland (2001), for this analysis we computed a difference score between 3 days and 10 days conditions to create a “present-bias” variable. This new variable was used as the dependent variable. In this analysis we find that alignability significantly predicts present-bias ($\beta = .79$, $t(100) = 2.34$, $p < .05$) and relative degree of abstraction ($\beta = -.272$, $t(100) = -7.12$, $p < .01$). Furthermore, an increase in the extent of abstraction leads to a significantly lower level of present-bias ($\beta = -2.434$, $t(100) = -3.47$, $p < .01$). More importantly, as predicted, once we controlled for the

relative degree of abstraction, the effect of alignability on the extent of present-bias was no longer significant ($\beta = .198$, $t(100) = .49$, $p = .63$; Sobel test of mediation, $z(100) = 2.39$; $p < .05$). These findings provide further support for our theory, which indicates that the alignability manipulation influences abstractness of processing and that this change in abstraction is responsible for the difference in present-biased preferences.

Discussion

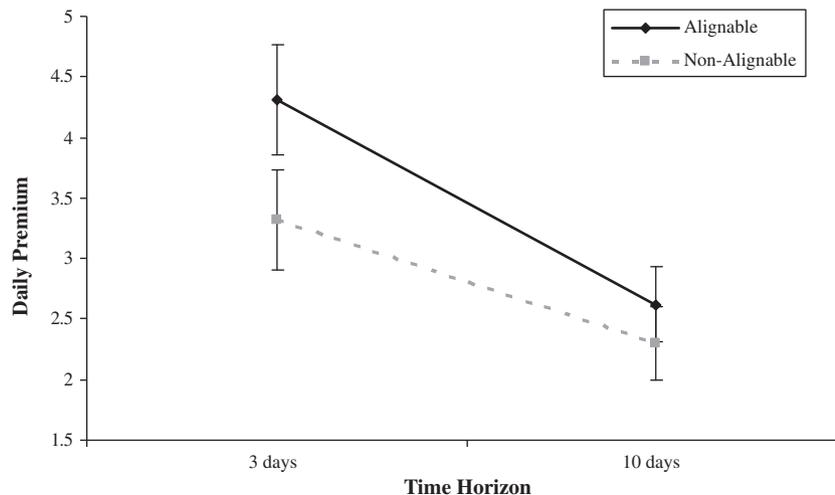
The results of Experiment 1A support our hypothesis that abstraction of thinking evoked during a prior task moderates the degree of present-bias observed in a subsequent task. Specifically, we employed an alignability manipulation, systematically varying the abstraction necessary to compare the two products (Johnson, 1984; Malkoc et al., 2005), and showed that increased abstractness triggered by the manipulation leads to higher action identification levels (pretest) and to lower present-bias. Furthermore, analyses of the written protocols provide more direct evidence that abstraction in thinking drives this effect. We find that the relative degree of abstraction of the attributes mentioned mediates the effect of alignability on present-bias, with participants mentioning a higher proportion of abstract attributes demonstrating a lower level of present-bias.

Experiment 1A demonstrated that abstract mindsets lead to lower levels of present-bias than concrete mindsets, (i.e., there is an interaction between alignability and time horizon on discount rates), supporting H1. However, this experiment does not examine the default level of mindset and present-bias when there is no prior task. Consistent with prior work, we suggest that the default mindset when delaying outcomes is concrete and thus would be associated with high levels of present-bias. Experiment 1B was conducted to directly test this assertion by adding a control condition without an initial choice task.

Experiment 1B: Examining the default mindset

Method and procedure

Five hundred and twenty-one participants completed the study online and were compensated for their time in a 3 (alignability: alignable vs. non-alignable vs. control) \times 2 (time horizon: 3 days vs. 10 days) mixed design. Alignability was manipulated between subjects and time horizon was manipulated within-subjects. The proce-



Note: Error bars represent standard errors of the mean.

Fig. 1. Results of Experiment 1A, showing the time horizon by alignability interaction.

ture for this experiment was identical to the one of Experiment 1A, with the exception of an additional control condition. Participants in the control condition skipped the initial camera evaluation and choice and only responded to the shipment timing decisions.

Results

We expected that the level of present-bias observed in the control condition and the alignable condition would not be significantly different from each other but would be different from the non-alignable condition. We used contrast coding to test this prediction. The first contrast tested whether the combined control and alignable conditions were different from the non-alignable condition (C1), while the second contrast directly compared whether the alignable and control conditions were different from each other (C2). A regression analysis compared the effect of each of these contrasts on present-bias. The extent of present-bias (measured as the difference between daily premiums for 3 and 10 days) was the dependent variable and the effects coding associated with the two planned contrasts were the independent variables, with the time it took participants to complete the study used as a covariate. As expected, the analysis showed that C1 was significant ($\beta = -.71$, $t(518) = -2.09$, $p < .05$), while C2 was not ($\beta = .08$, $t(518) = -.155$, $p = .88$). As can be seen in Fig. 2 these findings demonstrate that the default mindset shows levels of present-bias similar to ($M_{3days} = \$5.36$, $SD_{3days} = 9.08$, $M_{10days} = \$2.24$, $SD_{10days} = 2.45$) those in the alignable (more concrete) condition ($M_{3days} = \$6.19$, $SD_{3days} = 10.58$, $M_{10days} = \$2.63$, $SD_{10days} = 3.16$), but higher levels than the non-alignable (more abstract) condition ($M_{3days} = \$4.72$, $SD_{3days} = 4.96$, $M_{10days} = \$2.46$, $SD_{10days} = 2.63$).

Discussion

The results of Experiment 1B show that the default mindset is similar to the concrete mindset and different from the abstract mindset. The levels of present-bias under the default and concrete mindset conditions are not statistically different, while present-bias under abstract mindset is significantly lower than the remaining two conditions. This is consistent with our hypothesis that abstraction attenuates present-bias by lowering the default levels of impatience.

Experiments 1A and 1B, although showing the predicted effect of processing abstraction on time preferences, used a manipulation that varied abstraction in a way that is somewhat related to the focal outcome. That is, participants indicated their preference for delaying the delivery of a camera, and the evaluation of that camera was also used to manipulate abstraction in processing. In addition,

although inconsistent with the results of Experiment 1B, one might argue that variation in participants' specific choice in the first task might have affected their subsequent timing decisions. Therefore, to further test H1, it is important to show that this carryover effect of mindset abstractness on intertemporal decisions can be replicated with a manipulation that is completely unrelated to the outcome that is being discounted over time. The next experiment addresses this issue.

Experiment 2: Elaborating on a person or a group of people

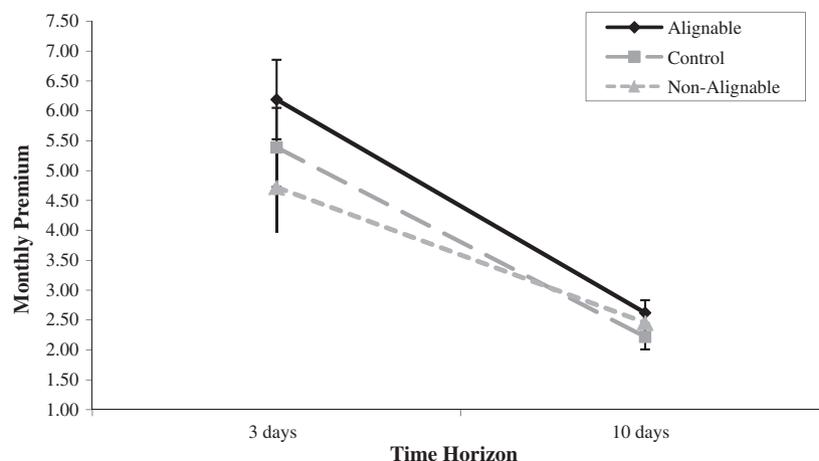
Overview

Experiment 2 examined the robustness of our results by using an unrelated prior task and provided converging evidence with a different manipulation. In this study, we manipulated mindset abstraction by asking participants to think about the implications of a policy issue either for a general group or for a specific individual. Prior research has shown that different information processing strategies are used in thinking about persons or groups (Hamilton & Sherman, 1996). Although this line of research has focused on impression formation, their findings suggest that when people think about groups (vs. individuals), the representation of information is more abstract and the processing is more general and holistic. That is, individuals are perceived to have more unity and entitativity (coherence) compared to groups, which have the potential to have dissimilar members. Incorporating dissimilar features to form impressions requires extracting the gist of an event, which represents a step beyond the details of the current situation (Levy, Freitas, & Salovey, 2002; Smith & Trope, 2006). Accordingly, we hypothesized that thinking about the broad implications of an issue for the general population would facilitate more abstract processing and lead to a lower level of present-bias, compared to thinking about the implications of a policy for a specific and concrete person.

Method

Participants and design

One hundred and seventeen undergraduate students participated in a 1-h long experimental session to fulfill a course requirement. The experiment was the first task presented to the participants in the session. The study followed a 2 (thinking abstractness: abstract vs. concrete) \times 2 (time horizon: 4 weeks vs. 10 weeks) mixed design. Thinking abstractness was manipu-



Note: Error bars represent standard errors of the mean.

Fig. 2. Results of Experiment 1B, showing the extent of present-bias for abstract, concrete and default mindsets.

lated between subjects and time horizon was a within-subjects factor.

Procedure

The experiment had two parts. In the first part, presented as an unrelated task, participants were asked to think about the Digital Millennium Copyright Act (DMCA), passed to prevent music piracy over the internet. We outlined the implications of this act on several constituencies and asked participants to think about the pros, cons, and implications of DMCA (see Appendix B for complete instructions). In the abstract thinking condition, participants focused on how the general population of music consumers would be affected by this act. In the concrete thinking condition, they focused on a specific consumer, like their roommate, and thought about how this specific person would be affected by this act. All participants were provided with extra space and were asked to write down their thoughts. In the second part of the experiment, presented as a separate study, participants completed a cash refund study as the focal task. They imagined that they had purchased a consumer electronic product that qualified for a \$45 cash refund and decided when they would like to receive this cash refund. Specifically, participants were asked how much they would require in order to delay the delivery of this cash refund by 4 weeks and 10 weeks. Finally, participants completed a written funnel debrief; no participant reported detecting a relationship between tasks.

Results

Pretest. Sixty-one undergraduate students, who did not participate in the main study, completed the elaboration manipulation described above, followed by the 19-item version of the action identification scale described in Experiment 1A. As before, the dependent measure was the total count of the tasks that participants identified to be high level. As expected, we found a main effect of thinking abstractness on action identification ($F(1, 59) = 6.29, p < .05$), indicating that more tasks were identified as high level when participants were thinking about the broad implications of the DMCA policy ($M = 12.77, SD = 3.42$) compared to those thinking about its implications for a specific individual ($M = 10.33, SD = 4.16$). These findings indicate that the elaboration manipulation influenced participants' thinking abstractness and action identification.

Present-bias. The main dependent measure in this experiment was weekly premiums. We conducted a 2 (thinking abstractness) \times 2 (time horizon) mixed design ANOVA, treating time horizon as a repeated factor. Time horizon had a significant main effect ($F(1, 115) = 8.46, p < .01$), indicating that participants' willingness to pay to avoid a delay in the delivery of the cash refund was higher for 4 weeks ($M = \$5.63, SD = 5.59$) compared to 10 weeks ($M = \$4.27, SD = 2.91$), consistent with prior findings. Thinking abstractness also produced a significant main effect ($F(1, 115) = 7.03, p < .01$), indicating that participants in the concrete mindset required higher weekly premiums ($M = 5.84, SD = 4.65$) than those in the abstract mindset ($M = 4.01, SD = 2.55$). Most important, however, the analysis showed the predicted two-way interaction between time horizon and mindset abstractness ($F(1, 115) = 8.46, p < .01$), demonstrating less present-bias when participants thought about the broad implications of this issue for a general population compared to when they thought about a specific exemplar. Specifically, as can be seen in Table 1 and Fig. 3, in the concrete thinking condition weekly premiums showed a greater decline over time ($M_{4weeks} = \$7.12, SD_{4weeks} = 6.96, M_{10weeks} = \$4.58, SD_{10weeks} = 3.41; F(1, 58) = 11.24, p < .01, \eta^2 = .16$) than in the abstract thinking condition ($M_{4weeks} = \$4.11, SD_{4weeks} = 3.11, M_{10weeks} = \$3.95, SD_{10weeks} = 2.28; F(1, 57) = .66, p > .1, \eta^2 = .01$).

Thought listing. Next, to more directly test our theory, we coded and analyzed the participants' written responses. Since the DMCA manipulation did not include any attribute information, as in study 1, in this analysis we utilized a different abstractness dimension reflected in the written protocols. Prior research has shown that there is a relationship between cognitive functions and linguistic abstraction. Semin and Fiedler (1991) developed the linguistic category model (LCM), which distinguishes among four different types of categories (from most concrete to most abstract): (1) descriptive-action verbs, (2) interpretive-action verbs, (3) state verbs and (4) adjectives. An index that is a composite of the frequencies of these categories was then used to draw connections between language and social cognitive functions. We predicted that participants who have thought about the implications of DMCA on the general population of consumers (vs. a specific consumer) would use more abstract language in their reasoning.

To test this idea, two independent raters blind to the experimental conditions and to the hypothesis coded the data⁴ for the frequency of the linguistic categories ($r = .89$). Based on this coding, the linguistic abstraction index was calculated (Semin & Fiedler, 1988).⁵ We then computed a one-way ANOVA⁶ to test the effect of our elaboration manipulation on language abstraction. The results produced a significant main effect ($F(1, 115) = 13.89, p < .01$), indicating a higher level of linguistic abstraction when participants thought about implications of DMCA on general consumers ($M = 2.94, SD = .26$) than when they thought about a specific consumer ($M = 2.76, SD = .26$).

To more directly examine the role of language abstraction in participants' timing preferences, we conducted a mediated moderation analysis (Judd et al., 2001). We predicted that the effect of mindset on present-bias would be mediated by the extent of language abstraction. As in Experiment 1A, we calculated present-bias by taking the difference of weekly premiums between 4 and 10 weeks. Our results indicate that thinking specificity about the implications of DMCA is a significant predictor of present-bias ($\beta = .262, t(115) = 2.91, p < .01$) and of relative degree of linguistic abstraction ($\beta = -.328, t(115) = -3.73, p < .01$). Furthermore, an increase in the extent of linguistic abstraction leads to a significant decrease in the degree of present-bias ($\beta = -3.36, t(115) = -3.81, p < .01$). Importantly, as predicted, once we have controlled for the degree of linguistic abstraction, the effect of the elaboration manipulation on the extent of present-bias was no longer significant ($\beta = .17, t(115) = 1.85, p = .07$; Sobel test, $z(115) = 2.35, p < .05$). This significant mediation suggests that abstraction in processing and language was responsible for the observed decline in present-bias.

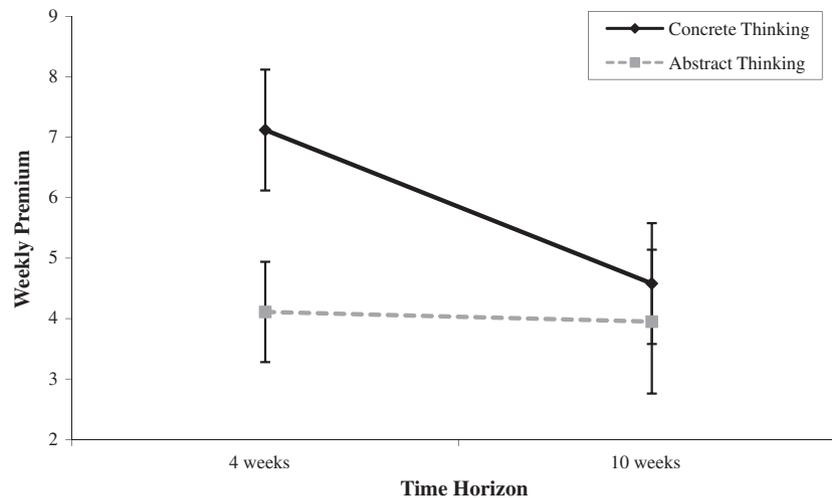
Discussion

Study 2 manipulated processing concreteness using an unrelated task and replicated the results of Experiment 1 by demonstrating the carryover effect of the mindset abstractness evoked in an earlier task. Specifically, thinking about the implications of the Digital Millennium Copyright Act for the general population resulted in participants' impatience declining less with time, compared to those who thought about the implications of this act for a concrete and specific person. Furthermore, the analyses of the written protocols provide further evidence that it is indeed abstraction in thinking (as reflected in written language) that leads to attenuated present-bias, providing further support for our the-

⁴ The raters were provided with the definition of each category and a list of examples that are most commonly used in daily language (Semin & Fiedler, 1988).

⁵ The index was calculated by summing up the frequency of descriptive-action verbs, interpretive-action verbs ($\times 2$), state verbs ($\times 3$) and adjectives ($\times 4$); and then dividing it by the total frequency. The resulting index varies from 1 to 4, where higher numbers indicate higher abstraction (Semin & Fiedler 1988).

⁶ Twenty participants who did not provide verbal protocols were excluded from these analyses.



Note: Error bars represent standard errors of the mean.

Fig. 3. Results of Experiment 2, showing the time horizon by thinking concreteness interaction.

ory. It is noteworthy that the written protocols varied greatly in content across participants, yet the coding of the linguistic abstraction produces a reliable, albeit small, effect.

Study 2, although employing an unrelated task in manipulating mindset abstraction, still relied on participants' elaboration of information to trigger the observed shift in processing abstraction. That is, participants were instructed to process the given information in either an item-specific or relational manner to evoke a mindset. The important question of whether abstract mindsets can be evoked in a prior incidental task and below consciousness still remains unanswered. Experiment 3 addressed this issue by using a more subtle manipulation of thinking abstraction.

Experiment 3: Semantic priming of abstract and concrete words

Overview

To further test the robustness of the effect, in Experiment 3 we manipulated thinking abstractness with a supraliminal priming task using either concrete or abstract words. Research on linguistic abstraction (e.g., Semin & Fiedler, 1988) has established that some words (e.g., action verbs) are represented and processed more concretely than others (e.g., adjectives). Furthermore, recent research in neuroscience provides evidence that brain activation is different for abstract and concrete concepts (Binder, Westbury, McKiernan, & Medler, 2005), suggesting that different words can alter processing abstractness. Supporting this point, Stapel and Semin (2007) have demonstrated that when primed with adjectives (vs. action verbs) people showed a tendency to be less context-dependent, have a more global focus, and be more inclusive in categorization tasks. To utilize this linguistic effect, we used a priming task that involved searching for nouns or adjectives in a word search task similar to those used in previous research (e.g., Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001; Sheeran, Webb, & Gollwitzer, 2005). We predict that participants primed with abstract words will be in an abstract mindset, will have higher action identification levels, and will show less present-bias compared to those primed with concrete words.

Method

Participants and design

Two hundred and thirty-one undergraduate students participated in an half-hour long experimental session and were paid

\$5 for their participation. This experiment was the first task presented to the participants in the session. The study followed a 2 (prime: abstract vs. concrete) \times 2 (time horizon: 3 months vs. 1 year) mixed design. Priming was a between subjects factor and time horizon was manipulated within-subjects.

Procedure

The experiment had two parts. In the first part, presented as an unrelated task, participants completed a word search puzzle. The prime words in both conditions related to fruits (see Appendix C). In the concrete condition, we used the names of 10 fruits (e.g., apricot, strawberry). In the abstract condition, participants were provided with abstract concepts (i.e., adjectives) representing the characteristics of fruits (e.g., juicy, healthy). Upon the completion of this puzzle, in the second part, participants were provided with the focal task, a gift certificate scenario, presented as a separate study. Participants imagined receiving a \$75 gift certificate from www.amazon.com and made a decision regarding when they would use this gift certificate. Specifically, they indicated how much compensation they would require to delay the redemption of this gift certificate by 3 months and by 1 year. Finally, participants completed a written funnel debrief, and again no participant detected any connection between the tasks.

Results

Pretest. Two hundred and thirty-two undergraduate students, who were not a part of the main experiment, were asked to complete the word search puzzle described above, followed by the 19-item version of the action identification scale described in Experiment 1A. As before, the dependent measure was the total count of the tasks that participants identified to be high level. As expected, we found a main effect of priming task on action identification ($F(1, 230) = 4.36, p < .05$), indicating that more tasks were identified as high level when participants were primed with abstract words ($M = 10.96; SD = 3.63$) compared to concrete words ($M = 10.00, SD = 3.34$). These findings indicate that the priming manipulation indeed influenced participants' thinking abstractness and action identification.

The priming manipulation in Experiment 3 was implemented using unrelated adjectives and nouns. Recent research has indicated that adjectives are more affect-laden than nouns (Custers & Aarts, 2005), suggesting that our manipulation might have confounded affect and representation. To make sure this was not the case, we ran a separate pretest, where the word search task was

followed by the PANAS scale (Watson, Clark, & Tellegen, 1988), measuring the participants' mood. The results ($N = 319$, a deliberately higher sample size of the same population to rule out a power issue) indicated that neither the positive ($M_{Abstract} = 2.53$, $M_{Concrete} = 2.55$; $F(1, 317) = .109$, $p = .74$) nor the negative mood ($M_{Abstract} = 1.43$, $M_{Concrete} = 1.42$; $F(1, 317) = .043$, $p = .84$) was associated with the priming manipulation. These findings indicate that abstract and concrete mindset primes did not have a differential impact on mood.

Present-bias. The dependent measure in this experiment was monthly premiums. We conducted a 2 (priming) \times 2 (time) mixed design ANOVA, treating time horizon as a repeated factor. Time horizon had a significant main effect ($F(1, 229) = 45.03$, $p < .01$), indicating that participants' willingness to pay to avoid a delay in redemption of the gift certificate was higher for 3 months ($M = 7.28$; $SD = 9.33$) compared to 1 year ($M = 5.23$; $SD = 7.35$). Priming did not produce a significant main effect ($F(1, 229) < 1$). Most important, however, the analysis again showed the predicted two-way interaction between time horizon and concreteness priming ($F(1, 229) = 4.66$, $p < .05$), demonstrating lowered present-bias when participants were primed with abstract concepts compared to concrete words. Specifically, as can be seen in Table 1 and Fig. 4, in the concrete priming condition monthly premiums showed a greater decline over time ($M_{3months} = 7.56$, $SD_{3months} = 9.66$, $M_{12months} = 4.79$, $SD_{12months} = 6.14$; $F(1, 107) = 26.49$, $p < .01$, $\eta^2 = .20$) than in the abstract priming condition ($M_{3months} = 7.04$, $SD_{3months} = 9.07$, $M_{12months} = 5.61$, $SD_{12months} = 8.28$; $F(1, 122) = 16.93$, $p < .01$, $\eta^2 = .12$).

Discussion

Experiment 3 used a supraliminal priming task to manipulate processing concreteness and replicated our previous findings. The results indicate that even when manipulated with a subtle priming task, processing abstractness activated on a former occasion carries over to subsequent settings, influences action identification, and attenuates the extent of present-bias. Participants who searched for abstract words identified more items to be high level compared to those who searched for concrete words (pretest). Moreover, those who were primed with abstract words show a more moderate decline in their impatience over time compared to those who were primed with concrete words. Note that the primary task in these experiments did not directly encourage participants to con-

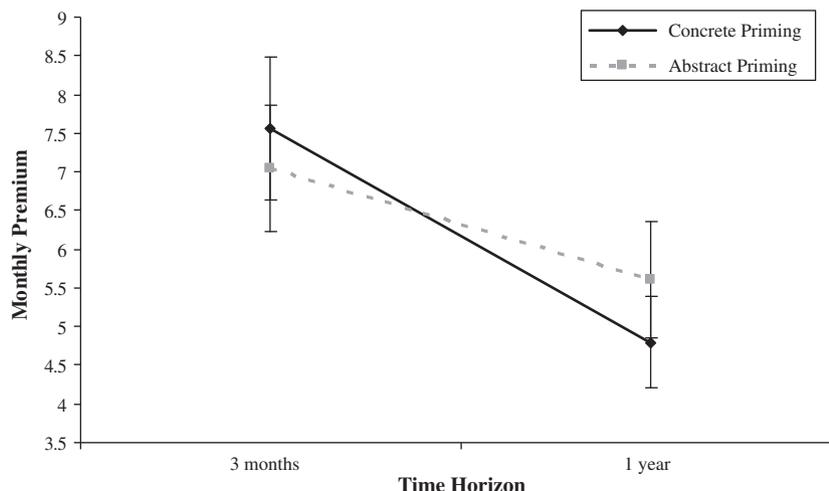
strue events more abstractly. As we indicated earlier, most research in the construal level theory literature has focused on the construal that is evoked as a part of the task and mostly due to a deliberative process (e.g., imagine taking a class that will start next (this) semester, indicate why (how) you need to maintain good health). These manipulations directly manipulate construal above the level of consciousness. Instead, in this experiment our participants were merely exposed to either concrete nouns or abstract adjectives. To our knowledge, these studies are the first to demonstrate the effect of a semantic prime on construal levels, indicating that construal might not require conscious awareness or elaboration and can be automatically activated.

Overall, these findings indicate that processing abstraction, manipulated with an unrelated task below awareness, led to differences in the extent of present-bias, directly supporting the notion that thinking abstraction in incidental prior contexts is an important determinant of decreasing impatience. The first three studies support H1 and show that earlier related or unrelated tasks can alter the abstraction of a decision-maker's mindset, which then moderates the extent of present-bias observed. The next study is designed to extend these findings by testing H2.

Experiment 4: Discounting over delays and dates

Overview

Experiment 4 was designed to test H2, examining boundary conditions for our findings. In particular, our theory suggests that thinking abstractly changes the processing style and decreases the reliance on the available context, thus leading to lower present-bias. If this is the case, then processing abstractness should only have an impact in situations that are more context-dependent and concrete. In another words, if the framing of the discounting task itself encourages a more general, less contextual response, then the effect of mindset abstraction should attenuate or disappear. To test this idea, we manipulated the representation of a given time horizon to be either in delay format (e.g., 3 months later) or in date format (i.e., May 17th, 2010). As mentioned before, delay frames describe the task as a departure from the present, highlighting how long one needs to wait to obtain the outcome in the future. Such departures from the present are associated with concrete representations (Malkoc & Zauberman, 2006). Alternatively, date frames shift the focus to the future moment the outcome will occur



Note: Error bars represent standard errors of the mean.

Fig. 4. Results of Experiment 3, showing the time horizon by processing concreteness prime interaction.

without focusing the individual on the time frame they will need to wait. This increased focus on the future is associated with more abstract representations (Trope & Liberman, 2003) and results in significantly lower discounting than delay frames (LeBoeuf, 2006; Read et al., 2005). Our proposed mechanism implies that the effect of mindset abstraction will be stronger when the task is presented in delay format (as in the previous experiments) than when the description is in the more abstract date format. This experiment also generalizes our results beyond consumer choice tasks by changing the experimental scenario to a retirement decision within an organization.

Method

Participants and design

One hundred and seventy-one undergraduate students participated in this study. Participants were recruited to participate in a 1-h experimental session and were paid \$10 in return. The study followed a 2 (alignability: alignable vs. non-alignable) \times 2 (time presentation format: date vs. delay) \times 2 (time horizon: 3 months vs. 1 year) mixed design. Alignability and description format were manipulated between subjects and time horizon was manipulated within-subjects.

Procedure

The experiment had two parts. In the first part, participants imagined that the company they were working for is considering the adoption of a new retirement plan. The company is considering two plans and is interested in getting feedback from employees. Participants viewed two options, described on seven attributes, and were asked to compare these two retirement plans (see Appendix D). In the alignable condition, participants compared two private retirement plans on the same attributes. In the non-alignable condition, participants compared a private plan with a government plan based on different attributes for each option. In both conditions, participants were told to: "Describe in as much detail as you can the pros and cons of choosing retirement plan A vs. retirement plan B". After forming their evaluation and making a decision, participants in the second part were introduced to the focal timing decision. They were informed that the retirement plan they chose qualified them for a one-time \$200 sign-up bonus, which was available immediately. However, due to high demand the plan sponsor gave them the option to delay receiving the bonus to a later date, and participants indicated the smallest amount they would demand to delay receiving this \$200 bonus. Time horizon was manipulated within-subjects by varying the time horizon to be either 3 months or 1 year. We also varied the time presentation format; this later time was either expressed in delay (i.e., 3 months) or date from the day of the experiment (e.g., May 17th, 2010) format.

Results

As before, the main dependent measure was the monthly premiums corresponding to participants' timing preferences, calculated by dividing the dollar amount participants demanded for the delay by the number of months. We conducted a 2 (alignability) \times 2 (time presentation format) \times 2 (time horizon) mixed ANOVA, treating time horizon as a repeated factor. Replicating prior findings, time horizon had a significant main effect ($F(1, 167) = 111.22, p < .01$), indicating that participants' per month willingness to pay to avoid a delay was higher for 3 months ($M = \$41.79, SD = 41.38$) compared to 1 year ($M = \$20.15, SD = 23.13$). Also replicating prior findings was the main effect of the time presentation format ($F(1, 167) = 8.78, p < .01$), indicating that participants' monthly willingness to accept a postponed

amount was higher when the time horizon was presented as delay ($M = \$37.34, SD = 37.38$) compared to date ($M = \$23.19, SD = 22.28$). Alignability did not produce a significant main effect ($F(1, 167) = .57, p = .45$).

Most importantly, the analysis showed the predicted three-way interaction between time horizon and alignability and presentation format ($F(1, 167) = 5.73, p < .05$). A closer examination of this three-way interaction (see Fig. 5) demonstrated that in a delay frame comparing non-alignable plans decreased present-bias⁷ ($M_{3-12} = 18.85, SD_{3-12} = 32.65$, compared to those who evaluated two alignable plans ($M_{3-12} = 31.38, SD_{3-12} = 32.66$; $F(1, 92) = 4.50, p < .05$; $\eta^2 = .05$). This significant two-way interaction replicates the findings of our first three experiments and shows the moderating role of mindset abstraction on present-biased preferences under delay frames. However, as predicted, when the time horizon is presented as date, we no longer observe this moderating role of the mindset manipulation. In particular, when the wait times are presented in date form, comparing alignable ($M_{3-12} = 13.68, SD_{3-12} = 20.72$) or non-alignable retirement plans ($M_{3-12} = 20.25, SD_{3-12} = 23.87$) led to similar levels of present-bias ($F(1, 75) = 1.67, p = .20$; $\eta^2 = .02$).

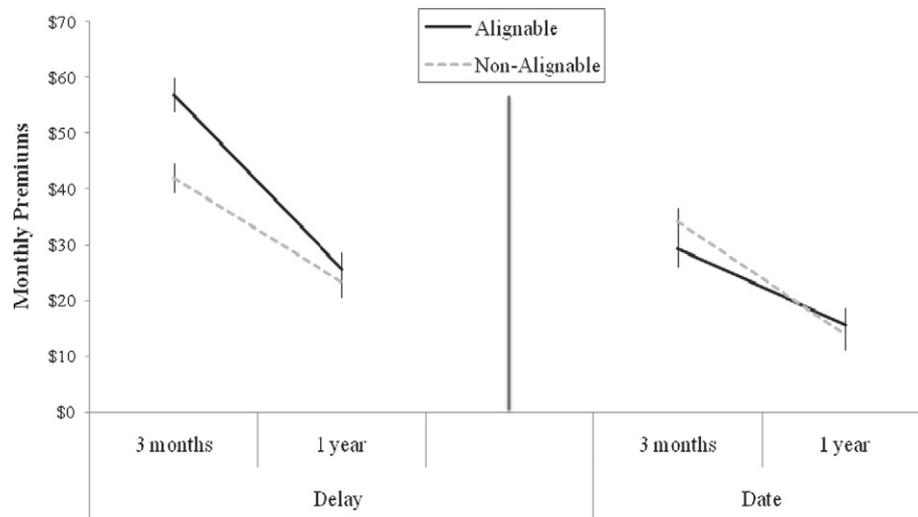
Discussion

The results of Experiment 4 further support our hypothesis that abstraction of thinking evoked during a prior task moderates the degree of present-bias observed in a subsequent task. More importantly, the results of this experiment provide further support for our proposed process. In particular, while we observe the moderating role of abstraction in the more contextual delay frame, where the abstraction mindset has an opportunity to effect decisions, we find that when the framing of the discount task itself is already relatively more abstract (i.e., date frame), manipulating processing abstraction no longer leads to a significant reduction of present-bias.

These results are noteworthy for several reasons. First, experiment 4 identifies a boundary condition for our general effect. We show that processing abstraction leads to the attenuation of the present-bias only when the task is more malleable to contextual factors (e.g., delay frame), but not when the task requires more generalized and decontextual processing (e.g., date frame). In doing so, this study extends our results and provides more direct evidence for the role of processing abstraction.

Second, the findings of this experiment also diverge from previous work on present-bias and outcome concreteness (Malkoc & Zauberman, 2006). Specifically, Malkoc and Zauberman (2006) demonstrated that a manipulation to increase the concreteness of the outcome (e.g., a \$200 bonus) significantly increases present-bias. Put differently, this prior work systematically increased the concreteness of the outcome (e.g., the jacket I will buy with this \$200 bonus) under both the delay and expedite frames and showed that these representations were linked to present-bias. Our work examines the role of mindset abstraction on present-biased preferences under different time presentations, without directly manipulating the outcome representations. Unlike the previous research, where manipulating outcome concreteness increased present-bias in both concrete and abstract frames, our results demonstrate that mindset abstraction only has an effect for the delay (concrete) frame, but not for the date (abstract) frame. Lastly, our results also shed light on the date/delay effect by providing evidence for a potential underlying mechanism. That is, our results are consistent with the notion that the date frame evokes more abstract processing than the delay frame and thus shows lower levels of impatience and present-bias.

⁷ The means indicate the extent of present bias and were calculated by taking the difference in monthly discounting for 3 months and 1 year periods.



Note: Error bars represent standard errors of the mean.

Fig. 5. Results of Experiment 4, showing the presentation by time horizon by alignability interaction.

General discussion

We propose a new conceptualization of intertemporal decisions in which intertemporal tradeoffs are part of a series of decisions. In particular, we argue that prior tasks can alter the abstractness of a mindset and change the way people make intertemporal choices in later related or unrelated contexts. The results of four experiments document that prior decisions and tasks that trigger abstract thinking systematically moderate individuals' intertemporal preferences by attenuating the otherwise robust phenomenon of hyperbolic discounting. Furthermore, the results using time horizons of varying lengths (days in Studies 1A and 1B, weeks in Experiment 2, and months in Experiments 3 and 4) indicate that the effect of mindset abstraction on present-bias is robust across various levels of time horizons. This is noteworthy, as length of delay is an inherent part of present-bias, where longer time horizons show less bias. Our results indicate that despite changes in time perspective, the effect of mindset abstraction on present-bias is rather stable.

Experiments 1A and 1B manipulated whether participants evaluated alignable or non-alignable alternatives. Evaluating non-alignable options leads later events to be identified at a higher level and present-biased preferences to attenuate. Furthermore, an analysis of written protocols describing participants' evaluation processes showed that reliance on higher level attributes and benefits mediated the effect of alignability on present-bias, providing additional support for the hypothesis.

Experiment 2 provided converging evidence by using a different manipulation. Participants were asked to elaborate on the consequences of a copyright act on either a single concrete person or on the general population. As predicted, we found evidence for the carryover effects of mindset abstraction on construal levels and on present-bias. In addition, this manipulation significantly altered the abstraction of the written language employed by participants in documenting their thoughts. More importantly, the language abstraction mediated the effect of elaboration specificity on present-biased preferences.

Experiment 3 used a semantic priming task to manipulate mindset abstractness. Participants searched for either concrete (nouns) or abstract (adjectives) words in a puzzle. Once again, these results supported our theory, demonstrating a significant effect of semantic priming on construal and present-bias and point-

ing to the possibility of automatic activation of construal. Taken together, the results of the first three studies provide consistent support for the moderating role of mindset abstraction on present-biased preferences.

Finally, Experiment 4 extended our findings by establishing the framing of the delay task as an important boundary condition. The discounting task was presented to participants either in a delay format (i.e., 3 months later) or in a date format (i.e., May 17th, 2010). Supporting the notion that mindset abstraction only has an effect when the basic task is inherently concrete and context-dependent, the results demonstrated that this effect is present when the task was described in delay format, but not when described in a naturally more abstract date format.

Theoretical contribution

Present-bias

The most well-established empirical finding in research on intertemporal choice is present-biased preferences – a decreasing level of impatience with longer time horizons. The findings reported in this paper are the first to examine the carryover effects of an unrelated task on present-biased preferences. Our account is distinct in that we propose and show that one can gain insight by conceptualizing intertemporal decisions as one in a sequence of decisions. This distinction is not trivial. Virtually every explanation of present-bias to date – whether using a visceral, cognitive or representational explanation – has focused on the responses triggered by the focal outcome to be delayed. Affect based explanations suggested that forgoing a current outcome (e.g., \$250 prize money) leads to a feeling of deprivation and results in present-biased preferences (Hoch & Loewenstein, 1991). More cognitive accounts indicated that present-bias is related to the representations associated with the outcome. Malkoc and Zauberman (2006), for instance, demonstrated that imagining the current outcome more concretely (e.g., the specific jacket one will buy with the \$250 prize) increases impatience and underlies present-bias.

Our results extend this literature by showing that non-focal tasks can also have an important influence on present-bias. Even when an earlier task does not change the cognitions or emotions that are associated with the outcome itself, the processing style evoked earlier carries over to influence intertemporal preferences.

As such, we identify processing abstractness as an important driver of present-bias. In addition, unlike previous work on concreteness and present-bias, we predict and demonstrate that mindset abstraction operates only when the task is relatively context-dependent. While previous outcome-based manipulations of abstraction focused on altering the representations of the outcome under different frames and descriptions (Malkoc & Zauberman, 2006), our work examines the role of mindset abstraction on present-bias without altering the outcome representation. We demonstrate that when the description of the discounting task is less contextual (e.g., date as opposed to delay), mindset abstraction no longer influences the extent of present-bias.

Construal level theory

Construal level theory (Trope & Liberman, 2003) posits that psychological distance (temporal, spatial, interpersonal or hypothetical) is related to the way people construe events and has important consequences for a variety of judgments and decisions. If a certain event is taking place at a distant time, to a distant person, at a distant location or at a hypothetical level, people tend to have more general, inclusive and superordinate representations compared to events that are happening now, to the person, here and in reality. Recent work in this literature has demonstrated the generality of this effect by showing that evoking higher construal levels leads to similar effects as people psychologically distancing themselves from the event or the object (Freitas et al., 2004; Liberman, Trope, & Stephan, 2007). The current article contributes to this line of work by showing that abstractness in information processing can be evoked even if the prior task is totally unrelated to the focal one. We show that having participants think in an abstract manner (among options in Studies 1A, 1B and 4 and across a group of people in Study 2) leads to changes in construal level in later unrelated tasks. To our knowledge, our work is the first to establish the link between relational (vs. item-specific) thinking and abstraction of processing and use it successfully to manipulate abstraction.

More importantly, the results of experiment 3 suggest that activation of abstract information processing might be more automatic and incidental than conceptualized to date. Manipulations of construal generally have involved a change in psychological distance (temporal, spatial, interpersonal or hypothetical) of the event/object from the decision-maker and demonstrated consequences for its representation. The current paper is, to our knowledge, the first to employ a semantic supraliminal prime to obtain the expected results on construal and present-bias. Simply searching for abstract or concrete words led to systematic differences in how events were construed during a later unrelated task. These results indicate that abstract thinking might be automatically activated, as some recent evidence suggests (Bar-Anan et al., 2007).

Last, we introduce three novel manipulations of processing abstractness to the CLT literature. Our results demonstrate that evaluating alignable vs. non-alignable information (Experiments 1A and 4) significantly alters participants' action identification and level of construal. In Experiment 2, we introduce item-specific vs. relational thinking as another source of construal. We show that thinking about consequences of an event for a group of people lead to more generalized thinking and higher level of abstraction than thinking about the consequences to a specific individual. Finally, Experiment 3 establishes semantic priming as yet another new non-target-specific way to manipulate abstraction. We show that priming participants with adjectives or nouns is sufficient to alter participants' action identification and change their construal.

Action identification

The current work also adds to the literature on action identification. Until now, research has discussed action identification as either an individual difference factor affecting a variety of phenomena (Vallacher & Wegner, 1987, 1989) or as being affected by the psychological distance of the outcome (Liberman & Trope, 1998). The results reported in our experiments extend these findings by showing that prior decisions that are not related to a given decision can alter consumers' action identification. Furthermore, we develop novel manipulations and demonstrate their ability to alter mindset abstraction and action identification. Our work also shows that action identification, while conceptualized as an individual difference, can also change as a function of the decision context (see also Liberman & Trope, 1998).

Mindsets and sequential decisions

Our findings also extend the growing literature on mindsets and sequential choice. Recent research has established that decisions and judgments are affected by both prior choices in the same domain (Novemsky & Dhar, 2005; Dhar and Simonson, 1999; Khan & Dhar, 2006) and by unrelated tasks (LeBoeuf & Shafir, 2004), suggesting that decision-making can be systematically affected by actions in which individuals have previously engaged. Until now, this literature has focused on the effect of prior choices on individuals' goals and self perceptions. We focus on the different levels of thinking abstraction evoked by prior tasks and show that such processing differences can have lingering effects on timing decisions in both related (Experiments 1A, 1B and 4) or unrelated situations (Experiments 2 and 3).

Context effects

The findings we report document an important instance where prior (incidental) tasks influence an otherwise robust phenomenon. We argue that present-biased preferences are caused, at least in part, by consumers' inability to take a broader perspective and see beyond the context triggered by previous tasks. Accordingly, we conjecture that systematic shifts in mindset abstraction (triggered by prior incidental tasks) may moderate other context and framing effects. For instance, the effect of separate vs. joint evaluations (Hsee, Loewenstein, Blount, & Bazerman, 1999), the asymmetric dominance effect (Huber, Payne, & Puto, 1982), and the compromise effect (Simonson, 1989) might all be attenuated when consumers are in more general and abstract mindsets.

Conclusions

We show that earlier unrelated tasks can induce a more abstract information processing mindset that is general, inclusive, and decontextualized. Moreover, these mindsets significantly attenuate the extent of present-bias, an otherwise robust phenomenon in intertemporal choice. We believe that our approach of conceptualizing intertemporal choices as a part of a series of tasks provides new insights into understanding how people trade off sooner, smaller outcomes with later, larger ones.

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Appendix A

Alignable condition

Digital camera X		Digital camera Y	
Camera size	Compact	Camera size	Compact
Battery life	4 h	Battery life	6 h
Resolution	3 mp	Resolution	4 mp
Optical zoom	3×	Optical zoom	2×
Digital zoom	2×	Digital zoom	3×
Interchangeable lens	None	Interchangeable lens	None
Print quality	Medium	Print quality	Medium

Non-alignable condition

Digital camera		Traditional camera	
Camera size	Compact	Focus	Auto, Manual
Battery life	4 h	Shutter speed	2 frames/s
Resolution	3 mp	Flash	Integrated
Optical zoom	3×	Power source	2 AA batteries
Digital zoom	2×	Resolution	4000 × 6000
Interchangeable lens	None	Screen	LCD
Print quality	Medium	Picture preview	None

Appendix B

Common description

The Digital Millennium Copyright Act effects several parties and has implications for numerous issues. For instance, DMCA has an impact on the artists who create the record, the recording companies who produce the record and the consumers who purchase and enjoy the record. A wide variety of issues are influenced by this act. These issues include, but are not limited to, the rights of the artists, the well-being of the music industry and general economy, as well as the welfare of consumers.

Abstract thinking manipulation

We ask that you think about a specific case relating to digital music piracy and the Digital Millennium Copyright Act. Next, please think about the pros and cons of the DMCA and its implications for consumers in general. In doing so, please focus on how the general population of consumers is affected by this act.

Concrete thinking manipulation

We ask that you think about a specific case relating to digital music piracy and the Digital Millennium Copyright Act. Next, please think about the pros and cons of the DMCA and its implications for a specific consumer. In doing so, please focus on how an individual consumer of music, like your roommate, is affected by this act.

Appendix C

Abstract priming condition

Word Search puzzle										Search words
F	Y	Z	D	T	V	I	K	N	J	Fruity
R	E	F	R	E	S	H	I	N	G	Vitamin
E	H	K	V	E	P	M	P	L	W	Healthy

Appendix C (continued)

Word Search puzzle										Search words
S	J	Q	A	M	A	I	T	A	A	Natural
H	R	S	N	T	Q	H	R	R	R	Juicy
S	U	O	I	T	I	R	T	U	N	Fresh
G	T	V	T	F	R	U	I	T	Y	Raw
Y	H	T	L	A	E	H	V	A	F	Nutritious
Y	C	I	U	J	K	E	S	N	M	Ripe
C	X	K	Z	Z	I	W	U	V	Y	Refreshing

Concrete priming condition

Word Search puzzle										Search words
M	Y	R	R	N	P	D	P	Z	G	Apple
U	R	C	A	E	J	P	I	A	R	Pear
L	R	V	R	E	G	F	N	N	A	Banana
P	E	O	E	Y	P	R	E	A	P	Cherry
S	B	E	R	R	M	D	A	N	E	Plum
L	W	T	O	C	I	R	P	A	S	Pineapple
M	A	V	T	I	K	X	P	B	W	Strawberry
N	R	H	C	A	E	P	L	F	N	Grapes
F	T	H	S	A	L	D	E	O	C	Apricot
O	S	C	H	E	R	R	Y	U	E	Peach

Appendix D

Alignable condition

Private retirement plan (A)		Private retirement plan (B)	
Government insured	Yes	Government insured	Yes
Early withdrawal penalty	12%	Early withdrawal penalty	10%
Loans	Permitted	Loans	Not permitted
Expected return on investment	Medium	Expected return on investment	Low
Estimated riskiness	Medium	Estimated riskiness	Low
Contribution limit	Yes	Contribution limit	No
Fees and expenses	Medium	Fees and expenses	Low

Non-alignable condition

Private retirement plan (A)		Public retirement plan (B)	
Government insured	Yes	Director of investment	Trustee
Early withdrawal penalty	12%	IRS reporting	None
Loans	Permitted	Eligibility requirements	None
Expected return on investment	Medium	Employer contribution	Permitted
Estimated riskiness	Medium	Cost index	Medium
Contribution limit	Yes	Withdrawals allowed	With limitation
Fees and expenses	Medium	Return index	Medium

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