**Personal Relevance and Mental Simulation Amplify the Duration Framing Effect**

# Gülden Ülkümen\*

# Manoj Thomas

\* Gülden Ülkümen is assistant professor of marketing, University of Southern California, 701 Exposition Boulevard, Hoffman Hall 516, Los Angeles, CA 90089-0804 (ulkumen@marshall.usc.edu). Manoj Thomas is assistant professor of marketing, Cornell University, 353 Sage Hall, Ithaca, NY 14853-6201 (mkt27@johnson.cornell.edu). The authors thank Vicki Morwitz for invaluable guidance, and Kristin Diehl, Debbie MacInnis and Wendy Wood for their comments on earlier versions of this manuscript. This work has benefitted from comments from conference participants at ACR 2009, SCP 2010, SPUDM 2011, and seminar participants at University of Southern California.

Different descriptions of the same duration (1 year, 12 months, 365 days) can influence consumers’ impressions of subjective duration, and thus affect their judgments and decisions. The authors propose that self-relevance is an important moderator of this duration framing effect. Consumers are less likely to adopt a 1-year self-improvement plan compared to a 12-month plan because it is perceived as longer and more difficult. Ironically, this bias is more likely to manifest for consumers for whom the plan is personally relevant. Personal relevance amplifies this effect because it prompts process-focused simulation of the plan, consequently increasing sensitivity to frame-induced duration cues.

One of the fundamental judgments that consumers must often make is the subjective duration of an activity. Evaluations of services and experiences usually depend on consumers’ perceptions of the duration of these services and experiences, and the associated wait-times and delays. For example, in deciding how much to pay for an insurance policy one might consider the length of coverage; the decision to replace an old car can be influenced by its judged lifetime. Duration perception is also important for many products and services that require persistent behavior monitoring and compliance on the part of the consumers. These include reward programs, patient treatment regimens, and smoking cessation and drug rehabilitation programs. Enrollment and adherence to these plans may depend on the perceived length of time required to achieve set goals.

For some of these services or experiences, perception of a longer duration may lead to more favorable evaluations. Whereas in other cases, it might lead to less favorable evaluations. In the case of self-improvement plans, such as adopting a diet, following an exercise regimen, and controlling spending necessitate continuous compliance throughout a designated duration. For example, the longer a consumer perceives a diet plan to require sustained effort, the less likely he or she is to adopt it

The present research is an attempt to understand the factors that influence consumers’ perceptions of subjective duration. Specifically, our research examines when and how varying the description of a given duration (“duration framing”) influences subjective impressions of duration, and how this impacts consumer judgments and decisions such as their expected success with a self-improvement plan. We propose and demonstrate that personal relevance and duration framing interactively influence consumers’ impressions of subjective duration and decisions that depend on those impressions. For instance, consumers’ likelihood of adopting a diet plan depends on whether it is framed as a 1-year plan, 12-month plan or 365-day plan, and these duration framing effects are stronger for consumers for whom such plans are personally relevant. We demonstrate that personal relevance enhances the tendency to engage in process-focused simulation of the plan, consequently increasing sensitivity to frame-induced duration cues.

**The Effects of Duration Framing**

There is good reason to believe that the way in which a time period is framed will influence the perceived duration of a self-improvement plan. For example, a diet plan can engender very different responses depending on whether it is framed as a 1-year plan, 12-month plan or 365-day plan even though these frames are normatively identical. Ülkümen, Thomas and Morwitz (2008) demonstrated that the units used to describe time periods can cause biases in judgments. These researchers compared two budget periods of different length, and found that budget estimates for 1 year are more than 12 times as large as budget estimates for 1 month. Furthermore, unitosity effects can occur even when the objective time period is kept constant. That is, frames that involve larger units may be perceived as longer because they are usually used to communicate longer time periods, and thus are associated with longer intervals. Consequently,1 year may feel longer than 12 months because people use years to refer to longer durations and months to refer to shorter durations. Monga and Bagchi (2012) have extended this work by showing that not only unitosity but also numerosity can cause biases in duration perception. The numerosity effect suggests that as the number increases, perceptions of length of an interval may increase. According to this notion, 365 days may feel longer than 12 months due to the numerosity of the former frame.

However, the extant literature does not clarify whether these duration framing effects (caused by unitosity and numerosity) will always matter, particularly given the view that framing effects are fickle and manifest only under conditions of superficial processing (LeBoeuf and Shafir 2003; Smith 1985). The present work extends the literature by identifying an important moderator of the duration framing effect: personal relevance.

**Personal Relevance and Duration Framing**

Although the influence of personal relevance on framing effects has not been explicitly studied, past findings imply that higher personal relevance would either attenuate or not impact such effects. One stream of research posits that framing effects are a manifestation of superficial processing, and can be eliminated by deeper thinking (e.g., Smith 1985). According to this view high personal relevance should eliminate framing effects to the extent that it increases processing motivation. A second view suggests that framing effects are hard-wired, and thus, unlikely to be eliminated by deeper thinking (e.g., Arkes 1991; see LeBoeuf and Shafir 2003 for a discussion). According to this perspective, personal relevance would not influence framing effects.

In contrast to these two views, we propose that personal relevance can, in fact, *exacerbate* framing effects when deciding whether to adopt a self-improvement plan. In particular, we hypothesize that consideration of a plan requires mental simulation to the extent that such a plan is personally relevant. We propose that this simulation will tend to amplify the impact of duration frames on perceived length, and thus the difficulty of the plan. Note that such a finding would imply, surprisingly, that consumers are more likely to fall prey to framing effects with plans they are most concerned about.

This proposition not only identifies when and how duration framing affects judgments, but also sheds light on the process behind framing effects in general by delineating the role of mental simulation. More generally, our demonstration contributes to the literature on framing effects by suggesting that framing effects caused by mental simulation are likely to be exacerbated, rather than mitigated, by personal relevance.

We next turn to a more detailed theoretical motivation of our account of the role of personal relevance and mental simulation in duration framing effects.

***EXPLORING THE PROCESS: ROLE OF MENTAL SIMULATION***

Consumers are frequently offered plans that promise improvement in different areas of consumption. For any consumer, some of these plans are in personally relevant domains, whereas others are not. Imagine a new diet plan. We postulate that consumers who are concerned about their weight will process information concerning this plan differently than those who are not concerned. A schematic representation of our proposed framework is depicted in Figure 1.

<Insert Figure 1 about here>

**Personal Relevance Triggers Mental Simulation**

We posit that for plans in personally relevant domains, consumers judge the likelihood of success by mentally simulating the plan. The notion that personal relevance can intensify the effects of mental simulation on behavior has precedence in a number of previous studies. Several researchers have concluded that imagining an event as though it is happening to oneself (rather than to another person or no person) amplifies the impact of such imagination on intentions (e.g. to donate blood) and behaviors (e.g., purchasing a cable service) (Anderson 1983; Gregory, Cialdini and Carpenter 1982; for a review see MacInnis and Price 1987, p. 487). Likewise, personal relevance has been shown to amplify visceral reactions to emotional imagery. In particular, Velasco and Bond (1998) found stronger responses on self-ratings and physiological measures when participants imagined themselves as participants rather than observers in emotional scenarios.

Consistent with this notion, recent brain imaging research on the “default network,” (for a review, see Buckner, Andrews-Hanna and Schacter 2008) suggest that subsystems responsible for autobiographical memories are connected with subsystems that use this autobiographical information during the construction of self-relevant mental simulations. This suggests a strong association between self-relevant information and mental simulation.

Evidence that simulation is more likely for personally relevant information can also be found in literature on stereotyping and empathy. Using EEG, Gutsell and Inzlicht (2010) found that motor neurons were active when participants observed a member of an ingroup perform a physical action, but not when participants observed a member of an outgroup perform the same action. The authors interpreted their results as suggesting that “a spontaneous and implicit simulation of others’ action states may be limited to close others and, without active effort, may not be available for outgroups” (p. 841). Similarly, a manipulation that focuses greater attention on the self (asking participants to close their eyes) was found to promote more extensive mental stimulation of scenarios describing unethical behavior (Caruso and Gino, 2011).

Building upon these findings from diverse literatures, we propose that high levels of personal relevance will both make mental simulation of a scenario more likely and enhance its impact on anticipated success of sustained self-regulation. When a consumer is presented with a self-relevant plan, he or she will spontaneously engage in mental simulation to judge the expected success of the plan.

**Mental Simulation Increases Sensitivity to Duration Cues**

Mentally simulating an event can increase sensitivity to its duration. Mental simulation of a behavior entails visualizing or thinking about the various steps in implementing it. This cognitive process directs attention to the duration and the temporal sequencing of events. Thus, during mental simulation people closely follow the temporal constraints of simulated events.

Evidence for a close correspondence between durations of actual events and their simulations comes from diverse streams of literature. Research on motor imagery finds that length of mental simulations is sensitive to changes in actual event durations. For example, Decety et al (1989) asked participants to mentally simulate walking to objects placed at varying distances from them, and found that the duration of mental simulations increased as the distance to the object increased. Narrative comprehension is another field that examines the relationship between mental simulations and event durations, since readers must simulate the duration of movements described in a story to comprehend it. These studies found that it took participants longer to read the sentence “Road 49 crosses the desert” when they were told earlier that the desert was 400 miles (versus 30 miles) in diameter (Matlock 2004). Moreover, young children’s expectations about the duration of an activity (e.g., walking vs. driving) influence their simulation of the speed of a narrative character’s movements (Feccia and O’Neill 2010). Taken together, these findings suggest that mental simulations are very sensitive to durations of events.

We propose that even though people are innately insensitive to the duration of an experience (for a review see Ariely and Loewenstein, 2000), mental simulation can increase sensitivity to duration. For example, a consumer who mentally simulates the process of following a diet plan can become more sensitive to the duration of the plan, compared to another consumer who does not engage in mental simulation. Therefore, we expect mental simulation to amplify frame-induced differences in duration perception.

**Process versus Outcome Oriented Simulation**

An important implication of our conceptualization is that mental simulation will increase sensitivity to duration only when it is process-focused. Previous literature distinguishes between two different types of mental simulation: outcome-focused simulation involves envisioning the outcome that one wants to achieve, and process-oriented simulation involves envisioning the process leading up to the desired outcome (Pham and Taylor 1999; Taylor et al 1998). Recent research in the area has demonstrated differential effects of process and outcome simulations on different marketing related outcomes such as product evaluations (Zhao, Hoeffler and Zauberman 2011), new product adoption (Castaño et al 2008), effectiveness of advertising claims (Escalas and Luce 2003, 2004), decision difficulty (Thompson, Hamilton and Petrova 2009), and preference consistency over time (Zhao, Hoeffler and Zauberman 2007).

Based on these studies, we propose that when evaluating personally relevant tasks consumers will tend to simulate the process (“how would it feel to be on this diet?”) rather than outcome (“how would it feel to lose weight as a result of this diet?). We further propose that under conditions of process simulation consumers will evaluate plan duration to decide whether or not to adopt the plan. Perceived plan duration is often an important determinant of adoption. In the case of self-improvement plans such as a diet, longer duration perceptions will lead to a lower likelihood of adopting the plan, since longer durations signal higher plan difficulty. Thus, frames that induce the perception of longer duration (e.g., “1 year” compared to “12 months”) will lead to expectations of lower success and lower likelihood of adopting the plan. We now turn to a formal statement of the testable hypotheses developed in this section.

**Hypotheses**

Several testable predictions emerge from the research reviewed above. First, we posit that the effect of duration framing on anticipated success following a plan will be moderated by personal relevance of the plan. Formally, we hypothesize:

H1: Duration framing will exert a greater influence on expected plan success under conditions of high (vs. low) personal relevance.

Furthermore, we posit that personal relevance will moderate framing effects because it amplifies the influence of frame-induced duration cues. Formally,

H2: Consumers will be more sensitive to perceived duration across frames when plans are personally relevant than when they are not personally relevant.

We also argue that personal relevance moderates duration framing effects because consumers naturally contemplate the process of following the plan for personally relevant goals. In contrast to process simulation, outcome simulation would not increase sensitivity to duration cues. Therefore, we do not expect outcome simulation to give rise to duration framing effects, regardless of level of personal relevance. Thus, we hypothesize that priming participants to engage in process versus outcome simulation will moderate the interactive effects of duration framing and personal relevance. Formally,

H3a: When a plan is personally relevant, the duration framing effect will manifest similarly when consumers are unprompted, and when they are explicitly instructed to engage in process simulation.

H3b: When a plan is not personally relevant, the duration framing effect will not manifest unless consumers are explicitly instructed to engage in process simulation.

H3c: The duration framing effect will not manifest under outcome simulation instructions, regardless of level of personal relevance.

We next test these predictions in five laboratory studies. The first two studies demonstrate that personal relevance amplifies the effect of duration cues that different descriptions of a time period can convey. Study 1A tests whether consumers for whom dieting is more (versus less) personally relevant are influenced more by the way a diet plan is framed (365 days, 12 months, 1 year). Study 1B operationalizes personal relevance in two different ways, and explores whether duration framing influences judgments pertaining to self (versus others), and when the consumers are more (versus less) concerned about the goal promoted by the plan. In study 2, we test the role of perceived duration in interactive effects of personal relevance and duration framing. Specifically, we examine the consequences of biased duration perception in the domain of personal finance, and examine whether consumers who are more (versus less) concerned about their finances discount delayed rewards at a higher rate. Study 3 shows that changing the interpretation of a long duration (opportunity versus difficulty) can reverse the duration framing effect. Finally, in Study 4, we provide evidence for two key processes postulated in our framework. This study tests (1) whether under high personal relevance duration framing influences judgments due to biased duration perceptions, and (2) whether personal relevance moderates this framing effect because it triggers process simulation.

***STUDY 1A: ONE YEAR/12 MONTHS/365 DAYS - PERSONAL RELEVANCE AS A MODERATOR***

The aim of Study 1A is to provide an initial demonstration that personal relevance can exacerbate duration framing effects (H1). Although previous literature hints that different descriptions of the same duration may influence duration perceptions, this possibility has not been empirically tested. To determine how various duration frames affect duration perceptions, first we ran a simple pretest. One hundred four participants from an online panel were asked to indicate which frame made a diet plan seem longest: (i) 365 days (ii) 12 months or (iii) 1 year. Subsequently, they were asked to indicate which time frame made a diet plan feel most difficult. The results are presented in Table 1. A chi-square test of equal proportions revealed that framing influenced perceived duration (χ2(2) = 31.98, *p* < .001). Thus, based on these choices, it appears that the 365-day frame is perceived as longer than 1 year (i.e., numerosity prevails), which is perceived as longer than 12 months (i.e., unitosity prevails). In the context of dieting, plans that were perceived as longer were also considered to be more difficult. Therefore, framing influenced perceived difficulty in a similar way (χ2(2) = 50.44, *p* < .001).

In Study 1A, participants were asked to indicate the likelihood of undertaking a rigorous diet plan that was described as a 12-month plan, 1-year plan or a 365-day plan. The results of our pretest establish 365-days frame as the frame that is perceived as longest, followed by the 1-year frame and the 12-month frame. Our conceptualization suggests that personal relevance should increase sensitivity to these frame-induced duration cues: diets that are perceived as longer should lead to lower expected success. Accordingly, we expect that when a plan is personally relevant, the 12-month plan will be associated with highest success, followed by the 1-year plan, and the 365-day plan. In contrast, when the personal relevance is low, the influence of frame-induced duration cues on expectancies should be diminished.

Method

*Participants and procedure*. One hundred eighty three students participated in the study. Participants were presented with the description of a diet, which required them to restrict their calorie intake for one year, 12 months or 365 days, according to the condition they were in. This diet plan required them to avoid a long list of foods including pasta, rice, and alcohol. It was suggested that maintaining this diet for the indicated duration would help maintain an ideal body mass index (BMI). After reading the description, participants indicated how likely they would be to adopt this diet (1 = Very unlikely, 7 = Very likely). To measure personal relevance, participants were asked to rate how concerned they were with their BMI (1 = Not concerned at all, 7 = Very concerned). Presumably, a diet plan that promises to improve participants’ BMI should be more personally relevant for participants who were more concerned with their BMI.

Results

*Likelihood to adopt diet.* The three levels of the duration frame variable were coded using two dummy variables; D1 and D2, where 1 year was set as the comparison group. The first dummy variable, D1 was coded as 1 when the duration was framed as 12 months and as 0 in all other conditions, and the second dummy variable, D2, was coded as 1 when the duration was framed as 365 days and as 0 in all the other conditions. The continuous personal relevance measure was mean-centered. The results revealed a main effect of personal relevance (b = .209, t = 2.30, *p* < .05), a significant two-way interaction between D1 and personal relevance (b = .317, t = 2.89, *p* < .05), and a significant two-way interaction between D2 and personal relevance (b = -.363, t = -2.57, *p* < .05). To explore this interaction we examined the effects of frame at one standard deviation above and below the mean personal relevance score, by mean-shifting the data (Aiken and West 1991). At high personal relevance, the dummy comparing 12 months to 1 year had a significant positive effect (b = .806, t = 2.46, *p* < .05), and the dummy comparing 365 days to 1 year had a significant negative effect (b = -1.032, t = -3.18, *p* < .005). At low personal relevance, the effects of dummy variables were not significant (p’s > .1).

In addition, a spotlight analysis at one standard deviation above the mean personal relevance measure showed that the diet was more likely to be adopted when framed as a 12-month diet than a 1-year diet (M12months = 3.45, M1year = 2.64), and it was least likely to be adopted when framed as a 365-day diet (M365days = 1.61). At low level of personal relevance, there was no difference between the likelihood of adopting 12-month or the 365-day diets, when compared to the 1-year diet (M12months = 1.72, M1year = 1.96, M365days = 2.11) (See Figure 2).

<Insert Figure 2 about here>

Discussion

The results of Study 1A offer preliminary support for the hypothesis that personal relevance can amplify duration framing effects (H1). As predicted, participants who were concerned about their BMI were sensitive to the way the diet duration was framed. Specifically, these participants were more (less) likely to adopt a diet when it was described using a frame that induced shorter (longer) duration perceptions. In contrast, framing did not influence the likelihood estimates of participants who were not concerned about their BMI.

***STUDY 1B: MULTIPLE OPERATIONALIZATIONS OF PERSONAL RELEVANCE***

In Study 1B we further examine the fundamental role personal relevance plays in the manifestation of framing effects (H1). In this study, personal relevance was operationalized in two different ways: perspective (self versus others), and concern with BMI. If both measures confirm to the predicted pattern of results, this will provide converging evidence for the role this key variable plays.

In this, and all remaining studies we limit our investigation to the two frames used most frequently to refer to annual plans, the “12-month” frame and the “1-year” frame.[[1]](#footnote-1)

*Method*

*Participants and procedure*. Sixty-five undergraduate and graduate students took part in the study for partial course credit. Participants were presented with the same diet plan as in Study 1, which was described as a plan that would help maintain an ideal BMI. This time, the diet plan was framed as either a 12-month plan or a 1-year plan.

We assessed personal relevance in two different ways: perspective (self versus others), and concern with BMI. After reading the diet plan, participants first indicated how likely they would be to adopt this diet plan, and then how likely an average student would be to adopt it (1=Not likely at all, 7=Very likely). Finally, we measured how concerned participants were about their BMI (1=Not concerned at all, 7=Very concerned). We expect to observe a larger effect of duration framing for those who are more (versus less) concerned with their BMI, as well as in estimates about the self (versus estimates about others).

*Results*

 *Personal relevance: Concern with BMI*. Participants’ reported concern for BMI was unaffected by the frame manipulation (M12months = 4.46, M1year = 4.27; F(1, 63) < 1). We conducted a regression analysis on likelihood to adopt the diet, with independent variables (i) a dummy variable for frame (12 months = 0, 1 year = 1), (ii) continuous personal relevance score, and (iii) a two-way interaction term. The results revealed a main effect of personal relevance (b = .425, t = 4.55, *p* < .001), and a significant two-way interaction (b = -.453, t = -2.99, *p* < .005). To examine the effect of frame at one standard deviation above and below mean personal relevance score, the data were mean-shifted. The dummy variable comparing the 1-year frame with the 12-month frame did not have a significant effect when personal relevance was low (b = -.01, t = -.02, p = .99), whereas it had a negative and significant effect when the personal relevance was high (b = -1.74, t = -4.29, *p* < .0001). A spotlight analysis showed that at one standard deviation above mean personal relevance, participants were more likely to start a 12-month diet than a 1-year diet (M12months = 3.12, M1year = 1.38, see figure 3A). At one standard deviation below mean personal relevance, there was no effect of frame (M12months = 1.49, M1year = 1.48).

*Personal relevance: Self vs. others.* A repeated measures ANOVA with the frame (12 months vs. one year) as the between subjects factor, and personal relevance (self versus average student) as the within subjects factor revealed a significant effect of frame (F(1,63) = 4.68, *p* = .034), and a significant two-way interaction (F(1,63) = 4.34, *p* = .041, see Figure 3B). When the judgment pertained to themselves, participants were more likely to start the diet in the 12-month frame than in the 1-year frame (M12months = 2.34, M1year = 1.43, F(1, 63) = 8.72, *p* < .01). But when the judgment pertained to an average student, duration framing did not affect the likelihood to adopt the diet (M12months = 2.17 vs. M1year = 1.96, F < 1).

<Insert Figure 3 about here>

*Discussion*

These results show that the duration framing effect manifests for judgments pertaining to self. However, duration framing did not affect their predictions about others’ responses. Furthermore, the effect did not manifest when the target was not relevant to personal goals: framing did not influence likelihood estimates of participants who were not concerned about their BMI. As predicted, participants who were concerned about their BMI were less likely to adopt the diet when it was described using the 1-year frame than the 12-month frame, presumably due to the longer duration perceptions elicited by the year frame. These results further demonstrate that personal relevance can amplify duration framing effects, and thus offer additional support for H1.

***STUDY 2: BIASED DURATION PERCEPTION INFLUENCES DISCOUNT RATES***

Our conceptualization suggests that personal relevance amplifies the duration framing effect because it increases participants’ sensitivity to perceived duration (H2). Specifically, we propose that when a plan is relevant to the consumers, they will be more likely to perceive a 1-year plan to be longer than a 12-month plan. This biased duration perception, in turn, should lead consumers to expect less success with 1-year plans than 12-month plans. In contrast, when the task is not so relevant to them, consumers will be less likely to perceive a 1-year plan as longer than a 12-month plan, and the duration framing effect should not manifest.

If the duration framing effect is driven by such biased duration perceptions, then we should observe the effects of duration framing in personal finance, a domain where duration perceptions are of utmost importance. In Study 2 we explore two natural downstream consequences of biased duration perception in financial judgments. First, we explore inter-temporal discount rates. Future outcomes are discounted at a higher rate when the wait seems longer. In fact, hyperbolic discounting can be explained by errors in perceptions of prospective duration (Zauberman et al. 2009). Thus, if the 1-year frame is perceived as longer than the 12-month frame, then we should observe higher inter-temporal discount rates for this frame.

In Study 2, we also examine consumers’ expectations of success with differentially framed saving plans. Just like dieting, saving requires consumers to expend continuous effort to control their impulsive spending throughout the designated duration. If consumers perceive 1 year as longer than 12 months, then they should expect to have lower success, and to save less with a 1-year saving plan than with a 12-month saving plan. However, both of these effects should occur only for those consumers for whom the plan is personally relevant.

Method

*Participants and procedure*. One hundred and eighty six participants were recruited from an online panel. Participants were presented with saving plan, which suggested that they eliminate different types of expenses to save money (i.e., eating out, concerts, premium TV channels). The plan was framed either as a 12-month or a 1-year saving plan. After reading the description, participants estimated how much money they could save in the indicated period following this plan, in an open-ended format. We predicted that participants in the 1-year frame will find it more difficult to adhere to the savings plan, and thus will expect that they will not be able to save much money. In contrast, participants in the 12-month frame will be more confident in their ability to save money.To assess the personal relevance of financial management, participants were asked to indicate how often they think about managing their finances, on a 100-point slider scale, anchored by “very infrequently” and “very frequently.”

Next, participants moved on to a separate task designed to assess the inter-temporal discount rate. For this purpose, we used a paradigm frequently used in the literature (Rachlin, Raineri and Cross 1991). Participants were given a series of choices between a smaller sooner reward and a larger, later reward. The larger reward was $1000 in all cases, which was delivered with a delay of either 12 months or 1 year. In all cases, the smaller reward was delivered today, and the order of presentation was sequential, from the highest value to the lowest value ($1000, $990, $980, $960, $940, $920, $900, $850, $800, $750, $700, $650, $600, $550, $500, $450, $400, $350, $300, $250, $200, $150, $100, $80, $60, $40, $20, $10, $5, $1, delivered today). That is, participants first were given a choice between $1000 delivered today and $1000 delivered in 1 year [12 months]. If the participant selected the immediate reward, then the program presented her with a second choice, this time between $990 delivered today and $1000 delivered in 1 year [12 months]. The task was terminated at the point where the participant indicated a preference for the larger, later reward. In this task, a participant who is indifferent between receiving $1000 today and $1000 in 1 year is extremely patient, and does not require any compensation for the 1-year delay. In contrast, a participant who would rather have $1 today rather than $1000 in 1 year is extremely impatient, requiring a very high compensation for the 1-year delay, and thus discounting the future at a very high rate.

Results

*Discount rates.* We calculated the discount rate (k) for each participant using the formula,

$v\_{d}=\frac{V}{(1+kd)} $,

In the above formula, *vd* is the discounted value of a delayed reward, *d* is the delay, and *k* is the discounting rate parameter proportional to the degree of discounting. A regression was performed on log-transformed discount rate (k) with independent variables (i) a dummy variable for frame (12-month = 1, 1-year = 0), (ii) continuous personal relevance score, and (iii) a two-way interaction term. The results revealed only a significant two-way interaction between frame dummy and personal relevance (b = -.029, t = -2.51, *p* < .01). To explore the interaction, we examined the effects of frame at one standard deviation above and below the mean personal relevance score. The dummy variable comparing the 12-month frame to the 1-year frame had a significant effect when the personal relevance was high (b = -1.04, t = -2.80, *p* < .01), whereas this dummy variable did not have an effect when personal relevance was low (b = .22, t = .66, *p* > .1). A spotlight analysis showed that at one standard deviation above mean personal relevance, participants discounted a reward more when it was delayed for 1 year than for 12 months (M12months = 0.04, M1year = 0.36).[[2]](#footnote-2) At one standard deviation below mean personal relevance, the discount rates did not differ across frames (M12months = 0.13, M1year = 0.09; see Figure 4A).

<Insert Figure 4 about here>

*Expected success as measured by estimated savings.* We mean-centered the continuous personal relevance measure. We performed a regression analysis on log-transformed savings with independent variables (i) a dummy variable for frame (12-month = 1, 1-year = 0), (ii) continuous personal relevance score, and (iii) a two-way interaction term. The results revealed only a significant interaction between frame and personal relevance (b = .012, t = 2.22, *p* < .05). To explore the interaction, we examined the effects of frame at one standard deviation above and below the mean personal relevance score. The dummy variable comparing the 12-month frame to the 1-year frame had a positive and significant effect when the personal relevance was high (b = .363, t = 2.09, *p* < .05), whereas this dummy variable did not have a significant effect when personal relevance was low (b = -.157, t = -1.01, *p* > .1). In addition, a spotlight analysis showed that at one standard deviation above mean personal relevance, participants estimated they would save more when the saving plan was framed as a 12-month plan than a 1-year plan (M12months = $3714, M1year = $562).[[3]](#footnote-3) At one standard deviation below mean personal relevance, there was no difference between the two frames (M12months = $3115, M1year = $2525, see Figure 4B).

**STUDY 3: LONG PERCEIVED DURATION: OPPORTUNITY OR DIFFICULTY?**

Results from Study 2 suggest that consumers perceive one year as longer than 12 months, and expect less success with a 1-year than a 12-month saving plan, when saving is personally relevant. This shows that when consumers perceive the duration of a saving plan as long, they focus on the difficulty of limiting their expenses for a long time. Yet, a long duration can also be interpreted as an opportunity to save more. To see if the biasing effect of duration framing can be reversed depending on the interpretation of duration as opportunity or difficulty, in this study we manipulate the interpretation of a long duration.

Method

One hundred and twenty nine participants were recruited from an online panel for a small compensation. The study had a 2 (frame: 12-month, 1-year) x 2 (interpretation: difficulty, opportunity) x 2 (personal relevance: low, high) between subjects design. Participants were shown either a 12-month or a 1-year saving plan. They were instructed to either imagine for how long they would have to limit their expenses (difficulty interpretation), or how much time they would have to save (opportunity interpretation). Next, as a measure of expected success, they estimated how much money they would save following this plan. Finally, to assess personal relevance of saving, participants indicated whether they were concerned about decreasing spending (yes/no).

Results

We log-transformed open-ended saving estimates. An ANOVA revealed an interaction between frame and interpretation (F(1,121) = 7.18, *p* < .01), which was qualified by a three-way interaction (F(1,121) = 5.84, *p* < .05). Planned contrasts suggest that in the high personal relevance condition, when a long duration is interpreted as difficulty, we replicate results from the previous study: participants expect less saving success with 1-year plans than with 12-month plans (M1year = 6.45, M12month = 8.01; F(1,121) = 4.45, *p* < .05). In contrast, when participants interpret a long duration as opportunity, they expect higher saving success with 1-year than 12-month plans (M1year = 8.44, M12month = 6.90; F(1,121) = 3.72, *p* < .05). In the low personal relevance condition, duration framing did not influence expected saving success (See Figure 5).

<Insert Figure 5 about here>

Discussion

Studies 2 and 3 demonstrate how duration framing and personal relevance can impact inter-temporal discounting and expected saving success, judgments closely associated with duration perception. These results suggest that under high personal relevance 1 year can be perceived longer than 12 months, and thus support H2. Participants were more willing to wait to receive a larger amount of money when the wait was framed as 12 months than as 1 year, resulting in lower discount rates. When consumers interpret a long duration as difficulty (opportunity), they expected lower (higher) saving success with a 1-year than a 12-month saving plan. As predicted, these effects are observed only under high personal relevance.

The results not only establish that frame-induced biased duration perception can be consequential, but also offer a technique for marketers to reverse the direction of duration framing by changing consumers’ interpretation of a long duration.

***STUDY 4: EXPLORING THE PROCESS—THE ROLES OF DURATION PERCEPTION AND MENTAL SIMULATION***

 Study 4 has two aims. First, we directly test the mediating role of duration perception. Second, we test the role of process-oriented mental simulation. A pivotal assumption in our conceptualization is that the effect of personal relevance is caused by process-oriented mental simulation. To test this assumption, we directly manipulated process-oriented simulation in this study. One third of the participants were assigned to the process-oriented simulation condition, one third to outcome-oriented simulation condition and another one third to a control condition without explicit simulation instructions.

We had three predictions with regards to the role of mental simulation. First, if personal relevance leads participants to spontaneously engage in process simulation, then under high personal relevance, we should observe the duration framing effect manifest both in the control condition, and the process simulation condition (H3a). Second, we predict that when participants are asked to mentally simulate the process, the framing effect will manifest even when the task is not personally relevant (H3b). Finally, since it is process, not outcome simulation that causes our effect, we do not expect outcome simulation to lead to the duration framing effect, regardless of level of personal relevance (H3c). If all three predictions are empirically supported, we can conclude that the effect of personal relevance is indeed caused by process simulation. Moreover, we test whether perceived duration mediates the abovementioned pattern (H2).

Method

*Participants and procedure*. Four hundred eighty seven participants were recruited from an online panel in exchange for a small payment. The study had a 2 (frame: 12-month, 1-year) x 3 (simulation: no simulation control, process simulation, outcome simulation) x 2 (personal relevance: low, high) between subjects design. As a manipulation of frame, participants were presented with either as a 1-year diet plan or a 12-month diet plan.

*Process versus outcome simulation*. To manipulate mental simulation, we adopted instructions from prior research (Escalas and Luce 2003, 2004). Specifically, participants were asked to mentally simulate either the process of following this diet (process simulation condition), or the end benefits of this diet (outcome simulation condition) while studying this diet plan. Detailed instructions used can be found in the Appendix. Participants in the no simulation control condition did not receive any simulation instructions.

*Dependent Measures*. After reviewing the diet plan, participants indicated how likely they are to adopt this diet (1=Not likely at all, 7=Very likely). Participants next responded to two items that aimed to measure perceived difficulty (Cronbach’s alpha = .75). They indicated how plausible it is to be on this diet for the indicated time period (1=Not plausible at all, 7=Very plausible), and how easy or difficult it is to think about situations where they break the diet in the indicated period (1 = Easy to think about breaking the diet, 7 = Difficult to think about breaking the diet). Both items were reverse coded, and thus a higher score on this scale indicates greater perceived difficulty of the diet. Then, participants indicated their subjective assessment of how long 12 months and one-year feel, relative to each other (1 = 12 months feel longer, 4 = They feel equally long, 7 = One year feels longer). Finally, as in the previous study, we used the natural frequency of engaging in the task as a measure of personal relevance. We measured whether participants were frequent dieters on a dichotomous scale (yes/no), and used this as the third factor in our analysis.

Results

*Likelihood to adopt the diet.* A 2 (frame: 12-month, 1-year) x 3 (simulation: no simulation control, process simulation, outcome simulation) x 2 (personal relevance: low, high) ANOVA on adoption likelihood revealed a main effect of simulation (F(2, 475) = 5.99, *p* = .003, a main effect of personal relevance (F(1, 475) = 67.18, *p* = .000, and a two-way interaction between frame and simulation (F(2, 475) = 7.09, *p* = .001. Most importantly, the predicted three-way interaction was significant, (F(2, 475) = 3.22, *p* = .041) ; (See Figure 6A).

Planned contrasts revealed that when personal relevance was high, likelihood to adopt the diet was higher in the 12-month frame than in the 1-year frame in the no-simulation control condition (F(1, 475) = 6.86, *p* = .009), and in the process simulation condition (F(1, 475) = 4.88, *p* = .028), suggesting that when personal relevance is high, consumers spontaneously engage in process simulation. In contrast, when personal relevance was low, although the framing effect did not manifest in the no-simulation control condition (F(1, 475) < 1), it did manifest in the process simulation condition (F(1, 475) = 4.04, *p* = .046). These results support our claim that process simulation can cause the duration framing effect even when personal relevance is low.

 Outcome simulation did not have the same effect as process simulation. Under conditions of outcome simulation, when personal relevance was low the effect of framing was not significant (F(1, 475) = 1.16, *p* > .1; when personal relevance was high the effect directionally reversed, but did not reach conventional levels of significance (F(1, 475) = 3.24, *p* = .08).

<Insert Figure 6 about here>

Taken together, these results show that for participants for whom dieting was personally relevant, the natural tendency was to simulate the process of being on the diet, even without instructions to do so. When dieting was not personally relevant, participants did not spontaneously engage in process simulation. Under these circumstances, the framing effect did not manifest, unless participants were explicitly instructed to engage in process simulation. Regardless of the level of personal relevance, the framing effect did not manifest under outcome simulation instructions. These results show that process simulation, but not outcome simulation is necessary for the observed framing effects to manifest, providing strong support for H3a-c.

*Duration perception.* A 2 (frame: 12-month, 1-year) x 3 (simulation: no simulation control, process simulation, outcome simulation) x 2 (personal relevance: low, high) ANOVA on relative time perception measure revealed a main effect of frame (F(2, 475) = 16.18, *p* = .000, a main effect of personal relevance (F(1, 475) = 13.42, *p* = .000, and a two-way interaction between time frame and simulation (F(2, 475) = 2.89, *p* = .05). These effects were qualified by a three-way interaction (F(2, 475) = 3.92, *p* = .021).

Planned contrasts reveal that when personal relevance was high, participants perceived 1 year to be longer than 12 months in the no-simulation control condition (F(1, 475) = 11.22, *p* = .001), and in the process simulation condition (F(1, 475) = 8.70, *p* = .003). In contrast, when personal relevance was low, participants perceived 1 year to be longer than 12 months in the process simulation condition (F(1, 475) = 3.65, *p* = .05), but not in the no-simulation control condition (F(1, 475) < 1) , (see Figure 6B).

Under conditions of outcome simulation, there was no difference in perceived duration length across frames in the high personal relevance condition (F(1, 475) < 1), or in the low personal relevance condition (F(1, 475) = 1.66, *p* > .1). These results show that process simulation plays a critical role, because it increases sensitivity to duration cues, whereas outcome simulation does not.

*Mediated Moderation Analysis.* We conducted a mediated moderation analysis to see if duration perception mediates the effect of the three-way interaction between frame, personal relevance and simulation type on adoption likelihood. We ran two multiple regression models. The first mediator model examined the effects of frame, personal relevance, simulation type and their higher-level interactions on perceived duration. The effect of the three-way interaction on perceived duration was significant (b = .760, *p* = .005). The second dependent variable model examined the effects of frame, personal relevance, simulation type and the interactions between these factors, as well as the main effect of duration perception on likelihood. This analysis revealed a significant and negative effect of duration perception (b = -.218, *p* = .002), and a significant and negative effect of the three-way interaction (b = -.904, p = .029). A bootstrap analysis confirmed that the conditional indirect effect of the three-way interaction between frame, personal relevance and simulation type on likelihood, through duration perception was significant (b = -.167; 95% confidence interval = -.38, -.04).

These results establish that (1) personal relevance moderates the observed framing effects because it triggers process simulation (H3a-c), and that (2) the frame-induced duration perceptions mediate the moderating role of personal relevance (H2).

***GENERAL DISCUSSION***

Consumers frequently consider plans that promise improvements in areas such as dieting and saving. We find that holding objective duration constant, framing of the duration of these plans can influence expectations of success. Compared to a 12-month plan, a 1-year plan is less likely to be adopted, because it can be perceived as longer (and in the case of these challenging self-improvement plans, more difficult). More importantly, we show that personal relevance moderates this effect of duration framing. We find that personal relevance amplifies this effect because it prompts process-focused simulation of the plan, consequently increasing sensitivity to frame-induced duration cues. We establish the robustness of the effect in five studies using plans in different domains, different criterion variables and different operationalizations of personal relevance.

**Contribution and Relationship to Previous Findings**

Our findings build on the literature on framing effects, and extend it by identifying (1) process simulation triggered by personal relevance as a moderator, and (2) frame-induced duration perceptions as mediators for the observed framing effects. Research on framing effects has shown that estimates are susceptible to the length of an estimation window (e.g., Chandran and Menon 2004; Gourville 1998), and can influence plans (Ülkümen et al. 2008), purchase intentions and behaviors (Hamilton, Ratner, and Thompson 2011). Unlike most papers in this literature, we hold the duration of the estimation period constant while changing its framing. Previous literature has identified frame-induced subjective feelings of confidence as an important mediator of the effects of framing on judgments (Ülkümen et al. 2008). We add to this framework by identifying frame-induced duration perceptions as another important mediator of framing effects, and showing how personal relevance moderates the effects of these mediators. These results demonstrate high personal relevance as an important condition under which frames influence likelihood judgments

The present research also furthers our understanding of mental simulations. While the consequences of using process versus outcome simulations have been studied, our knowledge of the factors that naturally trigger these simulations is limited (for an exception, see Zhao, Hoeffler and Zauberman 2011). We show that personally relevant plans may spontaneously trigger process-focused, as opposed to outcome-focused simulation.

A very important part of our theoretical framework is the idea that mentally simulating plans should increase sensitivity to perceived duration, which for self-improvement plans leads to an increase in sensitivity to plan difficulty. These findings are compatible with recent findings from the literature on mental simulations, demonstrating that process (versus outcome) simulation is associated with higher difficulty perceptions (Thompson et al. 2009).

 From a theoretical perspective, our findings challenge the commonly held view that cognitive biases are driven by lack of involvement with the task (Smith 1985). If like many other biases, duration framing influences thinking due to lack of motivation, then one would expect greater processing motivation resulting from high personal relevance to eliminate the effect. However, our results do not support this account, and hint that duration framing may influence judgments through a more cognitive process.

**Boundary Conditions**

We expect the demonstrated duration framing effect to manifest with a wide variety of tasks that depend on impressions of subjective duration. Most of our studies demonstrate the duration framing effect with tasks that are challenging and require continuous effort, such as diet plans, exercise regimens, and saving plans. For these tasks, frame-induced duration perceptions translate to difficulty inferences. However, Study 3 shows that the effect generalizes to tasks that are not necessarily perceived challenging (when saving for a long time is an opportunity). Moreover, the effect also occurs with tasks that do not require continuous compliance, but simply an assessment of the duration (discount-delay task, Study 2).

Note that the direction of the effect may change for plans that require consumers to extend a one-time, rather than continuous effort. For instance, a consumer who is considering performing a one-time, challenging task may have high expectancies if the perceived duration is long (e.g. “One year is a long time, so I surely will find time to pack a disaster preparedness kit”) due to greater perceived slack for time in the future (Zauberman and Lynch 2005).

Our findings suggest that frame-induced duration cues are used to make expectancy judgments regarding plans, and that the effect of these cues is amplified by personal relevance. We empirically determine the length perceptions evoked by different frames, using a pretest. Our main focus is studying the conditions under which these framing effects manifest, rather than understanding the relative influence of different framing components. Any frame describing a time period involves a time unit and a number to quantify this unit, and previous research has shown that consumer reaction to frames depends on a balance between the numeracy effect and the effect of the unit. For instance, when comparing 1 year and 12 months, 1 year is be perceived longer than 12 months because the year is a large enough to override the effect of the larger number. However, when comparing 1 year to 365 days, 365 days is perceived longer as the numeracy effect overrides the effect of the unit. We establish the relative prevalence of these two effects empirically in our pretest. Predicting their relative impact is beyond the scope of the present investigation and might be a fruitful avenue for future research.

**Other Possible Accounts**

It could be argued that the moderating role of personal relevance is not due to enhanced sensitivity to duration cues under high relevance, but rather due to random responses under low relevance. Our data does not support this account. When data from study 4 is submitted to Levene’s test of equality of variances, the results suggest that variance of responses do not differ across high (M = 3.79) and low (M = 3.14) personal relevance conditions (*p* > .05). Furthermore, the mediation analysis in study 4 shows that perceived duration mediates the moderating role of self-relevance. Thus, our data shows a consistent pattern with a causal structure, rather than a random pattern.

**Managerial Implications**

From a managerial perspective, our results suggest that marketers should be cognizant of the effects of framing on duration perception. Market research studies may not reveal existing framing effects, if they are conducted with participants who are not concerned about the plan or the product being studied. When promoting services, it may be best to select duration frames that are perceived longer for pleasurable experiences (e.g., a vacation) and those that are perceived shorter for effortful or painful experiences (e.g., an unpleasant treatment). If framing cannot be changed, marketers can reverse the direction of the effect by changing consumers’ interpretation of a long duration. Given that less personally relevant decisions are less influenced by framing, marketers can also de-emphasize relevance, for example, by wording the message in terms of other consumers.

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*TABLE 1*

*PRETEST RESULTS: FRAMING INFLUENCES*

*PERCEPTIONS OF DURATION AND DIFFICULTY OF A DIET*

|  |  |  |  |
| --- | --- | --- | --- |
|  | 365 Days | 12 Months | 1 Year |
| Which frame feels longest | 57% | 11% | 32% |
| Which frame feels most difficult | 61% | 4% | 35% |

*FIGURE 1*

*THEORETICAL FRAMEWORK*

Duration

Framing

Personal Relevance

Process Simulation

Perceived Duration Length

Expected Plan Success

Sensitivity to Duration Cues

*FIGURE 2*

*STUDY 1A: PERSONAL RELEVANCE INCREASES SENSITIVITY TO FRAMING*

*FIGURE 3*

*STUDY 1B: PERSONAL RELEVANCE MODERATES DURATION FRAMING EFFECT*

1. *MODERATING ROLE OF CONCERN FOR BMI*

 ***ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions. ansffect of this an 52 weeks)mediator. her important mediator, and showing how personal relevance ing effectsisions.***

1. *MODERATING ROLE OF SELF-OTHER PERSPECTIVE*

*FIGURE 4*

*FINANCIAL CONSEQUENCES OF BIASED DURATION PERCEPTION*

*A. STUDY 2: INTER-TEMPORAL DISCOUNT RATE*

*B. STUDY 2: EXPECTED SAVING AMOUNT*

*FIGURE 5*

*STUDY 3: INTERPRETATION OF DURATION REVERSES DURATION FRAMING EFFECT ON EXPECTED SAVING AMOUNT*

*FIGURE 6*

*STUDY 4: PERSONAL RELEVANCE TRIGGERS PROCESS SIMULATION, A PREREQUISITE*

1. *LIKELIHOOD TO ADOPT DIET*
2. *DURATION PERCEPTION*

*APPENDIX*

*STUDY 4: MENTAL SIMULATION INSTRUCTIONS*

*Process Simulation Instructions*

While you are reviewing the diet plan on the following screen, we would like you to imagine the PROCESS of following this diet. As you imagine, focus on how you would incorporate the diet into your daily routine. Imagine how you would feel if you were on this diet EVERY DAY. That is, focus on the process of avoiding the foods that are restricted by this diet—focus on how you would feel as you followed the diet.

*Outcome Simulation Instructions*

While you are reviewing the diet plan on the following screen, we would like you to imagine the END BENEFITS that you would receive from this diet. As you imagine, focus on the benefits you would gain from the diet. Imagine how you would feel if you achieved your ideal body mass index as a result of the diet. That is, focus on the end result of this diet—focus on how you would feel as a result of the diet.

1. We conducted an online search to examine the relative frequency of use of the 365-day, 12-month and 1-year frames. This search revealed that 365-day frame was the least frequently used among these frames. Based on these results, we included only the 1-year, and the 12-month frames in remaining studies. [↑](#footnote-ref-1)
2. Although this analysis was performed on logged discount rates, the means presented here and in Figure 4A reflect raw discount rates (k) for ease of explication. [↑](#footnote-ref-2)
3. Although this analysis was performed on logged savings measure, the means presented here and in Figure 4B reflect raw (dollar) amounts for ease of explication. [↑](#footnote-ref-3)