The bright side of dread: Anticipation asymmetries explain why losses are discounted less than gains

**Abstract**

The dread of future losses weighs more heavily than the pleasure of anticipating future gains, even after controlling for loss aversion. This happens because waiting for a gain is a mixed emotional experience that is both pleasurable (due to savoring) and painful (due to impatience), whereas waiting for a loss is a more unidimensional painful experience (dread). Anticipation predicts time preference, such that the more people enjoy anticipating [dread] an event, the more they prefer to delay it [get it over with]. In combination, these findings explain and mediate the "sign effect" in discounting, i.e., the fact that losses are discounted less than gains. Furthermore, this pattern of results remains robust even after controlling for loss aversion.

*Keywords*: intertemporal choice, temporal discounting, framing, affect

The bright side of dread: Anticipation asymmetries explain why losses are discounted less than gains

Many factors affect our desire to experience something now or postpone it (Frederick, Loewenstein, and O'Donoghue 2002; Lynch and Zauberman 2006; Frederick & Loewenstein, 2008). Some of these factors apply equally to gains and losses. For example, the uncertainty that a future event will obtain provides as strong of a reason to postpone something negative as to accelerate something positive. Similarly, the interest lost by delaying a $100 reward for a year is equivalent to the interest gained by delaying a $100 loss.

Despite these symmetries, laboratory studies of intertemporal choice typically find that the desire to have good things immediately is much stronger than the desire to postpone negative outcomes (Hardisty and Weber 2009; Mischel, Grusec, & Masters, 1969; Thaler 1981). Though this "sign effect," is a robust result, the reasons for it are not well understood. Perhaps as a result, the dominant models of intertemporal choice have largely ignored differences in discounting between gains and losses (though see Loewenstein & Prelec, 1992 and Scholten & Read 2010).

We hypothesize that the desire to postpone losses is weaker than the desire to accelerate gains because dread of future bad things is more intense than the pleasurable of anticipating good ones. The language for discussing emotions that accompany waiting is impoverished. We will use the term *impatience* to refer to negative emotions experienced while waiting for something positive to occur (e.g., waiting for a red light to turn green). We will use the phrase pleasurable anticipation to reference positive emotions associated with the contemplation of positive future experiences.[[1]](#footnote-1) We will use the term *dread* to refer to the negative experience of waiting for something negative to occur (e.g., thinking about a visit to the dentist).[[2]](#footnote-2)

Discussions of the relative strength pleasurable and aversive anticipation are rare ([though see Elster and Loewenstein 1992](#_ENREF_2)). To our knowledge, the only published empirical comparisons are a paper by Loewenstein (1987) which compared movie star kisses with electric shocks and a paper by Lovallo and Kahneman (2000) which compared time preferences for learning the outcome of different uncertain financial prospects. Neither of those papers attempted to measure anticipation directly, but rather inferred anticipatory utility from other responses. For example, Loewenstein (1987) found that people were willing to pay more for a kiss from a movie star in three days than for an immediate kiss, and inferred that the increased value of the delayed kiss was driven by savoring. However, we ran a replication of this study and found different results.

We recruited 207 U.S. residents from Amazon Mechanical Turk and followed the experimental procedure outlined in Loewenstein (1987). Participants were asked, "What is the most you would pay now to obtain four dollars immediately (no delay)? $\_\_\_\_\_\_", and entered a dollar amount. The next five questions (all on the same page) asked how much the participant would pay to obtain four dollars at each of five delays: "in three hours", "in twenty-four hours", "in three days", "in one year", and "in ten years". Participants then followed the same procedure for the other four events: "avoid losing four dollars", "avoid losing one thousand dollars", "avoid receiving a (non-lethal) one hundred and ten volt shock", and "obtain a kiss from the movie star of your choice".

We followed the same analytic strategy used in Loewenstein (1987), computing the present value of each future event using the ratio of future value over immediate value[[3]](#footnote-3). (Thus, a value of 1 indicates no temporal discounting and lower values indicate stronger discounting.) As seen in Figure 1A, the value of the "kiss from a movie star" event went down over time. At every time delay, the mean "kiss from a movie star" ratios were significantly less than 1, all *p*s< .01, indicating standard temporal discounting of this event. These results differ from those reported by Loewenstein (1987), in which the "kiss from a movie star" ratios first went up over time, and then down, as seen in Figure 1B. Why did the results of Loewenstein (1987) differ from our own? Fill-in-the-blank measures in intertemporal choice can be noisy (Hardisty et. al, 2013). As seen in Figure 1B, the confidence intervals on the original kiss from a movie star data were quite large. Thus, the original kiss from a movie star result may have been related to high variance, low power, or the specific sample used.

Figure 1A

*Results from our replication of Loewenstein (1987), showing maximum payment to obtain/avoid events at selected times, as a proportion of present value (N = 206). Error bars show 95% confidence intervals for the "kiss from a movie star" event.*

Figure 1B
*Original results from Loewenstein (1987) showing maximum payment to obtain/avoid events at selected times, as a proportion of present value (N = 30). Error bars show 95% confidence intervals for the "kiss from a movie star" event.*

 In our replication study data, we saw evidence for the "sign effect", with gains being discounted significantly more than losses overall. This asymmetry suggests that losses may be dreaded more than gains are savored. However, as in the original study, anticipation was never actually measured, but was only inferred from preferences. It is possible that differences in value over time were driven by factors other than anticipated emotions, such as perceived convenience or transaction costs.

Several papers have documented the importance of dread in intertemporal choice. Berns and colleagues (2006) assessed the dread for electric shocks using both self-report and fMRI of brain activation during the period preceding them. As expected, people who reported greater dread (they used the term "anticipatory anxiety") exhibited more activity in posterior elements of the cortical pain matrix, and had a stronger preference for immediate shocks. Such results demonstrate the efficacy of self-report measures of dread. More recently, Harris (2012) found that dread plays a key role in many people's choices about timing of many different aversive experiences. In contrast, demonstrations of the efficacy of *savoring* in the literature are rare, and we are not aware of any studies that directly measure the anticipation of positive events.

 Therefore, in Studies 1a and 1b, we directly measure anticipation and time preferences for financial gains and losses. We find that negative anticipation of losses is stronger than positive anticipation of gains, and that this asymmetry mediates the "sign effect" observed in classic intertemporal choice scenarios (Study 1a) and consumer choice (Study 1b). In Study 2, we extend the investigation beyond financial outcomes to a wide variety of gains and losses at different points in time (from three days up to five years). In Study 3, we show that these asymmetries in anticipation and time preference persist even when controlling for loss aversion. In Study 4, we explore the psychological drivers of the anticipation asymmetry, finding that while future gains evoke both *savoring* and *impatience*, future losses involve substantial *dread* but little *enjoying the moment*.

**Study 1a: Anticipation asymmetries mediate the sign effect in intertemporal choice**

*Methods*

201 participants recruited from Mechanical Turk chose between $49 today OR $60 in 89 days. These amounts referenced gains or losses depending on the condition to which respondents had been randomly assigned. Participants were then told to "Imagine expecting to receive [pay] $60 in 89 days.” and were asked “How psychologically pleasurable or displeasurable would the **anticipation** be? In other words, how would you feel **while waiting** for it?" They responded on a 201 point bipolar scale ranging from -100 "strongly dislike the feeling of waiting" on the left to +100 "strongly like the feeling of waiting" on the right, with 0 labeled "neutral.” Participants then answered 26 other choices between smaller smaller sooner and larger later rewards [penalties] and some demographic questions.[[4]](#footnote-4)

*Results*

 Eight participants failed the attention check and were excluded from the data set, leaving 193 participants for further analysis. The results are quite similar whether inattentive participants are excluded or not. For analyses with all participants included, see the online supplemental.

 *Time preference*

 Overall, participants’ desire for immediate gains was stronger than their desire to postpone losses, replicating the "sign effect" (Thaler, 1981). On the first choice, participants in the gain condition chose the sooner option 70% of the time, whereas particpants in the loss condition chose the later option only 26% of the time, *t*(191) = 6.8, *p* < .001. The remaining choices that followed their report of anticipatory pleasure or pain yielded similar results: SS was preferred by 57% of the time in the gain conditions compared to just 26% in the loss condition, *t*(191) = 10.7, *p* < .001. On average, these choices imply annualized discount rates of 332% for gains and 34% for losses (using the continuously compounded exponential formula, *V* = *A*e-*kD*).

*Anticipation utility*

 On average, anticipating a future $60 loss was rated as -36 (*SD* = 46), whereas anticipating a future $60 gain was rated as -5 (*SD* = 55), supporting our supposition that the negative emotions attending the expectation of bads are more intense than the positive emoptions attending the expectation of goods (*t*(191) = 5.6, *p* < .001, *d* = 0.8).

*Mediation*

 As summarized in Figure 2, expected anticipatory emotions mediates the sign effect. The valence of the event in question affects judgments of the associated anticipatory emotions, which in turn predicts preferences between temporally displaced outcomes. The mediation test was significant at *p* < .01 using a recommended bootstrapping test (Shrout & Bolger, 2002). However, the mediation was not complete – the valence of the outcome continued to affect temporal preferences, even after controlling for the expected (dis) utility of anticipation. Thus, the pleasures or pains of anticipation do not seem to fully explain why gains and losses are discounted at such different rates.

Figure 2

*Anticipation mediates the effect of sign on time preference. Direct effects (with standardized betas) are shown in parentheses, while reduced effects (in the full model) are shown without parentheses.*



 *Discussion*

As predicted, people dreaded a future financial loss more strongly than they enjoyed looking forward to an equivalent gain. Indeed the contemplation of future monetary rewards was not even positive, suggesting indifference or heterogeneity or conflict. We attempt to discriminate among these in Study 4.

 Also as predicted, anticipation partially mediated the effect of sign on time preferences, thus partly explaining the sign effect. In other words, people hate contemplating future losses, which makes waiting unattractive, leading people to choose later losses less often (lowering discount rates). In contrast, people are indifferent or conflicted when contemplating future gains, and thus preferences for immediate gains remain strong (high discount rates). In Study 1b, we show this same pattern of results in a consumer choice setting.

**Study 1b: Anticipation asymmetries mediate the sign effect in consumer choice**

*Methods*

100 participants were recruited from Mechanical Turk. Participants first completed an attention check ([similar to Oppenheimer, Meyvis, and Davidenko 2009](#_ENREF_9)), and were randomly assigned to the gain condition or the loss condition. On the next page, the instructions read, "Imagine that you need to buy a new air conditioning unit for your home. You have narrowed your choice down to the following two units:" Participants in the gain [loss] condition considered the following two options:

|  |  |
| --- | --- |
| **Model A**Price: $297.9210-year energy saved\*: $0[10-year energy wasted\*: $920]BTUs: 12,000Watts: 2,000Energy Efficiency Rating: 6.0 | **Model B**Price: $775.8410-year energy saved\*: $920[10-year energy wasted\*: $0]BTUs: 12,000Watts: 1,000Energy Efficiency Rating: 12.0  |

\* Energy saved [wasted] is the estimated difference in energy usage between the two AC units, based on 4 hours usage per day, 182 days per year, with an electricity rate of $0.1264 per kWh.

Participants indicated whether they would choose Model A or Model B. This was the main dependent variable. On the same page, participants read "Suppose that you chose Model B [Model A], and think about the **future energy saved [wasted]** over the next 10 years. How psychologically pleasurable or displeasurable would the **anticipation** of the energy saved [wasted] be? In other words, how would you feel **while waiting** for it?" and responded on a -100 to +100 number line labeled with "strongly dislike the feeling of waiting" on the left, "neutral" in the middle, and "strongly like the feeling of waiting" on the right. Finally, participants answered demographic questions.

*Results*

Six participants failed the attention check and were excluded, leaving 94 participants for the following analyses. The results are quite similar whether or not inattentive participants are excluded. For analyses with the full sample, see the online supplemental.

*Product preference*

Model A was the more "impatient" option, costing less money upfront but bringing higher energy costs in the long run. Therefore, we used the proportion of "Model A" choices as the key measure of time preference. In the positive frame, 59% of participants chose the "impatient" Model A, compared with 29% in the negative frame, *t*(92) = 3.0, *p* < .01, replicating the sign effect.

*Anticipation utility*

Participants predicted they would significantly dislike anticipating future energy waste (mean anticipation utility = -29, *SD* = 44), and would not particularly like or dislike anticipating a future energy savings (mean anticipation utility = -2, *SD* = 47). Reverse scoring the losses, this was a significant difference in the strength of negative anticipation of losses vs positive anticipation of gains, *t*(92) = 3.2, *p* = .001, *d* = 0.6, replicating the results of Study 1a.

*Mediation*

In a regression, anticipation utlity (reverse scored for losses) predicted choices while controlling for sign, standardized beta = .27, *p* < .01. Moreover, anticipation mediated the effect of sign on choices, as confirmed with a bootstrapping test, *p* < .01, replicating Study 1a. Once again, the mediation was only partial – the effect of sign on time preference remained significant at *b* = .21, *p* = .04 – even while controlling for anticipation utility. Therefore, other factors (beyond anticipation) may also contribute to the sign effect.

*Discussion*

Consumers are more likely to choose a more expensive, energy efficient product when future energy usage is presented in a negative frame (rather than a positive frame). This is consistent with the sign effect, with future gains discounted more than future losses. Furthermore, the effect of framing on choices was mediated by the assymetry in anticipation for gains and losses, replicating the results of Study 1a.

In Study 2, we explore the robustness of this anticipation asymmetry across twenty different events (10 gain and 10 loss), including classics from the literature such as the electric shock and kiss from a movie star. We also examine the assymetry across different time horizons, from 3 days to 5 years.

**Study 2: Anticipation asymmetries across domains**

*Methods*

Ten positive and ten negative events (listed in Table 1, below) were selected for the study, drawn from item categories listed most frequently by participants in the pilot study and from several "classic" examples from prior literature, including "a kiss from the movie star of your choice" or "twenty painful (but harmless) electric shocks." While these events certainly do not represent *all* gain and loss events that people may experience, they offer a broader range of domains than is typically investigated in intertemporal choice studies.

271 US residents (age *M*=42, *SD*=14) from a range of socioeconomic backgrounds were recruited and run online from the virtual lab of the Center for Decision Sciences. Participants first read a brief introduction and explanation, stating:

The following pages will ask questions about immediate and future gains and losses. When you see the word 'immediate,' it means the very near future -- today or tomorrow. Many of the following questions will ask how you would feel **while waiting** for things. In some cases, you may enjoy the process of waiting. For example, if a special holiday is a couple weeks away, the waiting may be pleasant. Other times, you may dislike the way you feel while waiting. For example, if you are waiting for a red light to turn green, the waiting may be unpleasant.

Participants then considered each of the twenty events in random order. Delay was manipulated between subjects to be either three days, one week, one month, one year, or five years. For each event, participants received the following question: "Assuming this event would definitely happen to you and you knew it were coming, **when** would you prefer it to happen?" Participants responded by choosing "immediately", "[specified interval]" or "don't care when." They then rated the anticipation utility of the event, with the question: "If this event were [delay period] away, how psychologically pleasurable or unpleasurable would the **anticipation** be? In other words, how would you feel **while waiting** for it?" Participants responded by clicking on a line (-100 = *strongly dislike the feeling of waiting* to 100 = *strongly like the feeling of waiting*, with 0 = *neutral*). Following these responses, participants completed some demographic questions with an embedded attention check.

*Results*

 After excluding participants who failed the attention check, 169 participants remained for further analysis.[[5]](#footnote-5) Time preferences were coded as +1 if participants wanted the event to happen "immediately," as -1 if they wanted it to occur at the end of the specified interval, and as 0 if they did not care.

 Our results, shown in Table 1, can be summarized as follows: (1) The anticipation of losses was judged to be much more negative (*M*=-45, *SD*=30) than the anticipation of gains was positive (*M*=18, *SD*=39), *t*(168)=8.4, *p*<.001, *d*=.65. We tested this for each of the five delay periods separately, and it was significant in every case. (2) Dread of losses was more common than savoring of gains (78% vs. 58%; *z*=12.9, *p*<.001). (3) Dread, when it occurred was also *stronger* than savoring, when it occurred. To test this, we compared only positive anticipation ratings of gains (*M*=50.4, *SD*=27.7) with negative anticipation ratings of losses (*M*=60.4, *SD*=28.7) and reverse scoring the losses, which was a significant difference, F(1,991)=33.6, *p*<.001. (4) Anticipation utility predicted time preference, such that the more a participant indicated enjoying the anticipation of an event, the more likely they were to want to delay it (*b*=-0.003, *F*(1,3376)=137.2, *p*<.001). (5) Respondents generally wished to accelerate gains (*M*=.52, *SD*=.34), but were ambivalent with respect to the timing of losses (*M*=0, *SD*=.50), *t*(168)=12.2, *p*<.001, *d*=.93, consistent with previous research (Yates and Watts 1975). We tested this with a mixed model with time preference as the dependent variable, participant ID and event as random effects, and sign (positive or negative) and anticipation utility as predictors. It revealed a main effect of sign, consistent with positive time preference: participants were more likely to delay negative events than positive events (*b*=-0.7, F(1,3376)=548.1, p<.001). It also revealed a main effect of anticipation utility, with more positive scores associated with a desire to delay events (*b*=-0.003, F(1,3376)=147.9, p<.001). There was no interaction, *b*=0.000, *F*(1,3376)=0.0, *p*>.5. (6) Temporal distance diminished the intensity of anticipatory (dis)utility *F*(4,164)=6.0, *p*<.001, *η2*=.13, as suggested by Loewenstein (1987).

**Table 1**

*Average anticipation utility and time preference (1 = immediately, 0 = indifferent, -1 = in the future) for each event, followed by the standardized betas for anticipation utility predicting time preference in a regression in Study 2.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Event** | **Anticipation Utility** | **Now Preference** | **beta**  |
| a free 5-day vacation to the destination of your choice | 28 | .19 | -.40\*\* |
| eating a nice meal out at a restaurant | 28 | .29 | -.25\*\* |
| a kiss from the movie star of your choice | 22 | .32 | -0.04 |
| receiving a good grade or performance review | 21 | .68 | -.22\*\* |
| getting a gift in the mail from a family member | 21 | .49 | -.29\*\* |
| spending time with your best friend | 21 | .44 | -.18\* |
| hour of favorite TV or book | 13 | .57 | -.20\*\* |
| receiving a $50 check | 13 | .78 | -.16\* |
| improved energy and health for 10 days | 9 | .69 | -.28\*\* |
| winning the lottery | 6 | .79 | -.28\*\* |
| doing difficult home cleaning and renovation for 5 days | -19 | .02 | -0.08 |
| an hour at the local Department of Motor Vehicles | -26 | .11 | -.19\* |
| paying a $50 fine | -27 | .02 | -.21\*\* |
| giving a stressful 60 minute improvised speech | -45 | 0.1 | -.20\* |
| being sick for 10 days | -47 | -.15 | -.26\*\* |
| a painful dental procedure | -53 | .18 | -.30\*\* |
| receiving a bad grade or performance review | -55 | .15 | -.25\*\* |
| a confrontation with your co-worker or family member | -57 | .18 | -.17\* |
| twenty painful (but harmless) electric shocks | -58 | .13 | -.23\*\* |
| having one of your legs amputated | -63 | -.56 | -.13† |

*Note: \*\*= p<.01, \*= p<.01,* †*= p<.10.*

To investigate the robustness of the relation between anticipation utility and time preference, we ran separate regressions for each of the 20 events, with the results summarized in Table 1. All 20 showed the expected directional trend: the more pleasurable the experience of waiting was predicted to be, the more people wished to defer it. The average standardized beta foranticipation utility predicting time preference was -.22, and seventeen of the regressions showed a significantly negative coefficient.

*Discussion*

 Dread of losses was stronger and more frequent than savoring of gains. Preferences to accelerate gains were more common than preferences to postpone losses, replicating the sign effect. Furthermore, greater positive anticipation for an event was associated with a preference to postpone it. Of course, anticipation utility is only one of many factors driving intertemporal choice. For example, although leg amputation was the most dreaded event that we studied, participants nevertheless preferred to postpone the event, presumably because the benefits of having a leg in the meantime outweighed the psychological cost of dread.

 In Studies 1 and 2, we made no attempt to equate the *subjective* magnitude of positive and negative events. Thus, our suggestion that that dread is stronger than savoring may simply reflect the fact that the set of negative events were more psychologically significant than the set of positive events (i.e., loss aversion). We addressed this in Study 3 by presenting each participant with pairs of positive and a negative event and adjusting the magnitudes until each participant was indifferent between accepting or rejecting the pair, indicating that the positive and negative event had been subjectively equated. We predicted that the results from Studies 1 and 2 would hold, even with subjective experience utility matched.

**Study 3: Controlling for loss aversion**

*Method*

 A sample of 134 U.S. residents (mean age=34, *SD*=12) was recruited from Amazon Mechanical Turk for a study on decision making. Participants first completed an attention check (similar to that used in Studies 1a and 1b). Twenty-eight participants failed the attention check and were excluded from further analysis. Participants then completed the following tasks: creating matched pairs of positive and negative events, then demographics, then ratings and choices for positive and negative events.

*Creating matched pairs*

 Five pairs of events (listed in Table 2) were presented to each participant, one at a time. The numeric values for each pair were adjusted in a dynamic fashion to find indifference points for each participant. Each pair consisted of a positive and negative event. The instructions for each pair read, "If you could choose whether to accept the following pair of events, would you take it? Assume that the events would happen right away (today or tomorrow):" For example, one of the pairs was "get a free, relaxing massage for 50 minutes AND spend time stuck in horrible traffic for 25 minutes." The response options were "Yes", "Unsure", and "No." Subsequent pairs were generated based on participants' previous answers, in an attempt to identify pairs of events that participants were indifferent between accept or rejecting. If participants indicated they would accept the current pair of events, the good option was made worse, or the bad option was made better. When participants indicated they were unsure, the values of the good and bad event that made them indifferent were recorded and a qualitatively new pair was presented. Similarly, if the adjusting procedure reached too fine a gradation (operationalized as less than one unit of change), the participant was likewise moved on to the next pair. If a participant maxed out the titration scale (for example, always accepting the massage and traffic bundle, no matter how much traffic would be required, indicating a noncompensatory choice process), they were sent to the next pair, their lack of indifference was recorded, and those items were excluded from further analysis. (The titration failure rates for each of the five pairs were .05, .10, .02, .04, and .23, respectively.)

*Demographics*

 Following the titration procedure, participants reported their gender, age, marital status, income, education, ethnicity, political affiliation, smoking status, and available financial resources. The demographic questions served as a filler between the titration and rating tasks.

*Event choices and ratings*

 Participants answered questions about individual gain and loss events, with the values determined by the earlier titration procedure. For example, if a participant earlier indicated that he was unsure whether he would accept a 50 minute massage and being stuck in horrible traffic for 40 minutes, then he would later answer questions about the 50 minute massage and the 40 minute traffic incident. Participants answered the following five questions about each individual event. (1) Assuming you knew this event were coming, when would you prefer it to happen: immediately or in one week?" (2a) Please imagine this event happening one week from now. Would experiencing this event be pleasurable or unpleasurable?" The response options were "pleasurable experience" and "unpleasurable experience" (2b) How strongly would experiencing this event affect your feelings at that time?" Responses were indicated by clicking on a line (with 100 different unique positions), labeled with "not at all" at one end, "strongly" in the middle, and "extremely" at the other end. (3a) If this event were one week away, would the anticipation be psychologically pleasurable or unpleasurable? In other words, how would you feel while waiting for it?" Response options were "like the feeling of waiting" and "dislike the feeling of waiting." and (3b) How strongly would anticipating this event affect your feelings while waiting for the event?" Participants responded on a number line, labeled with "not at all", "strongly", and "extremely."

*Results*

*Event Pair Titration*

 Median indifference points for each titrated pair are listed in Table 2. (We report medians rather than means because the distributions are all right-skewed.) It took participants an average of 6.4 questions (*SD*=3.5) to reach their indifference point on each pair. Notably, the median participant was indifferent between a $25 loss and a $49 gain for the financial items, replicating the 2:1 ratio typically found for loss aversion (Kahneman and Tversky, 1979).

**Table 2**

*Average experience utility, anticipation utility, and time preference for when to experience each event (1 = immediately, 0 = indifferent, -1 = in one week) in Study 3.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Event** | **Experience Utility** | **Anticipation Utility** | **Now Preference** |
| **Gain** | **Loss** | **Gain** | **Loss** | **Gain** | **Loss** | **Gain** | **Loss** |
| 50% chance of receiving [$49] | 50% chance of paying $25 | 38 | -37 | -13 | -21 | .94 | -.15 |
| get a free, relaxing massage for 50 minutes | spend time stuck in horrible traffic for [50] minutes | 55 | -55 | 6 | -27 | .33 | -.20 |
| watch really funny TV program for 30 minutes | watch boring, annoying commercials for [11] minutes | 35 | -27 | -5 | -14 | .73 | .27 |
| 70% chance of receiving [$26] | do a really boring online survey for 90 minutes | 32 | -36 | -15 | -20 | .88 | .27 |
| a complimentary dinner at a restaurant of your choice | endure [10] mild (and harmless) electric shocks | 50 | -47 | 20 | -32 | .-02 | .54 |

*Ratings of Experience Utility*

 Participants rated the experience utility of paired positive and negative events to be quite similar, as would be expected because those events were individually titrated and tailored for each participant. I.e., the rated experience utility of the gain and loss events in each pair were not significantly different (all *p*=.36 or greater), with one exception: in the fourth pair, participants expected watching the funny TV show as more pleasurable than watching the boring commercials would be unpleasurable (35 versus 27, *t*(103)=2.2, *p*=.03, *d*=.21). One possible explanation for this is that the titration concerned *immediate* events while the ratings concerned the experience of the events *in one week*. In any case, because the direction of the difference (the gain being rated as stronger than the loss) goes in the opposite direction as loss aversion, it provides a conservative test of our hypothesis.

 *Ratings of Anticipation Utility*

 As shown in Table 2, participants indicated that negative events would confer more negative anticipation than positive events would bring pleasurable anticipation. This was confirmed with a series of paired t-tests by reverse scoring the anticipation ratings for losses and comparing the gain and loss item in each pair. In every case, the difference was significant, at *p* = .05 or lower.

 In terms of *frequency*, 76% of the negative events were dreaded (i.e., anticipation value less than zero), whereas 50% of the gain events were savored, a significant difference as confirmed with a mixed model test, *F*(1,958)=75.2, *p*<.001. Pairwise proportion tests revealed that pairs one through four all showed the predicted effect, *p* < .01 or lower. The fifth pair had 74% savoring the dinner and 80% dreading the electric shocks revealed a non-significant difference in the predicted direction (z=0.9, *p*=.35).

 To compare the *intensity* of dread versus savoring, we compared only positive anticipation ratings of gains with negative anticipation ratings of losses. As predicted, the losses were dreaded (*M*=-39.6, *SD*=27.5) more than the gains were savored (*M*=34.9, *SD*=23.7), *F*(1,600)=7.4, *p*=.007. The interaction of sign and pair was not significant, *F*(1,600)=1.1, *p*=.35, indicating that the difference between gains and losses was roughly equal for all five pairs.

*Time Preference*

 As shown in Table 2, people generally preferred to have the positive events right away. (The exception was the complimentary dinner out, which half the participants preferred to have right away, and half preferred to postpone for a week.) In contrast, people's desire to postpone the negative events was much weaker, and in fact they often preferred the immediate loss. This difference between gains and losses was significant, *F*(1,598)=125.6, *p*=.001, replicating the sign effect.

 Ratings of anticipation utility predicted time preference, replicating the results of Studies 1 and 2, *F*(1,965)=45.6, *p*<.001. In other words, the more participants enjoyed anticipating a positive event, the more likely they were to choose to delay it, and the more participants dreaded a negative event, the more likely they were to choose to have it immediately. This relationship did not interact with sign or event pair, nor was there a three way interaction (all *p*s> .20).

*Discussion*

 In Study 3, we showed that even when opposing events are tailored to be equally significant, negative anticipation is still more pronounced than positive anticipation. Furthermore, the asymmetry in time preferences persists, and so does the ability of anticipation to predict time preferences. Therefore, the "dread looms larger" phenomenon (and associated downstream effects) is distinct from loss aversion.[[6]](#footnote-6)

If not loss aversion, then what drives this asymmetry in the anticipation? We hypothesize that anticipation of gains is a mixed emotional experience, while thinking about losses is a relatively unidimensional experience. When thinking about receiving a future $60, we look forward to the event and experience some pleasure while imagining it ("savoring"), but we also feel some deprivation that we don’t have it yet ("impatience"), and this makes the anticipation somewhat aversive as well. Overall, then, anticipation of gains is neutral or weakly positive. In contrast, when thinking about paying $60 in the future, we dislike thinking about the future loss ("dread"), but derive little positive enjoyment from the fact that we don’t have to pay yet ("enjoying the moment"). The net result is strong disutility when anticipating future losses. We test this account in Study 4.

**Study 4: Understanding the anticipation asymmetry**

*Method*

 One hundred and five participants (67% female, mean age = 35) were recruited from Amazon Mechanical Turk. Participants first read a brief introduction, stating:

Many of the following questions will ask how you would **feel while waiting** for things. In some cases, you may enjoy the process of waiting. For example, if a special holiday is a couple weeks away, the waiting may be pleasant. Other times, you may dislike the way you feel while waiting. For example, if you are waiting for a red light to turn green, the waiting may be unpleasant. In some cases, you might feel conflicted, and feel **both** happiness and unhappiness while waiting for an event. In other cases, you might not care about an event, and so feel **neither** happiness nor unhappiness while waiting.

Participants then considered 20 events (the same as used in Study 2) in random order. For each event, participants first indicated their time preference, with the question: "Assuming you knew this event were coming, **when** would you prefer it to happen? Immediately, or in one week?" Participants responded on a 7-point scale, from "strongly prefer immediately" to "strongly prefer in one week."

 Participants also rated the positive and negative anticipation of the event, with two questions. "If this event were one week away, how **pleasurable or happy** would the **anticipation** be? In other words, how would you feel **while waiting** for it?" (0 = *neutral*, 100 = *extremely like the feeling of waiting*) "If this event were one week away, how **displeasurable or unhappy** would the **anticipation** be? In other words, how would you feel **while waiting** for it?" (0 = *neutral*, 100 = *extremely dislike the feeling of waiting*).

 After rating all 20 events, participants completed demographics and an attention check (similar to those used in Study 2). Thirty-six participants failed the attention check and were excluded from further analysis, leaving 69 participants for further analysis.

*Results*

 *Time preference*

 We replicated the sign effect in intertemporal choice. Averaging across all 20 events, participants generally preferred to have gains now (*M* = 1.3, *SD* = 0.9) but were neutral as to the timing of losses (*M* = -.1, *SD* = 1.5), a significant difference (reverse scoring the losses), *t*(68) = 6.6, *p* < .001, *d* = 0.8. Focusing on the $50 gain and $50 loss scenarios, participants showed the same pattern, preferring gains now (*M* = 2.4, *SD* = 1.2) and losses later (*M* = -.1, *SD* = 2.5), *t*(68) = 7.3, *p* < .001, *d* = 0.9.

 *Anticipation utility*

 Participants reported a mixture of positive and negative anticipation for positive events, but reported mainly negative anticipation for negative events. Figure 3 shows the results for the matched $50 gain and $50 loss scenarios. When considering receiving $50 in a week, participants felt some positive anticipation (*M* = 42, *SD* = 34) and some negative anticipation (*M* = 33, *SD* = 37). In contrast, when considering losing $50 in a week, participants felt notable negative anticipation (*M* = 54, *SD* = 38), but little positive anticipation (*M* = 16, *SD* = 28). This difference between the anticipation of the positive and negative events was confirmed by swapping the positive and negative anticipation scores for negative events and then examining the interaction term from the 2x2, which was significant, *F*(1,68) = 14.1, *p* < .001, *η*2 = .17.

Figure 3

*Average positive and negative anticipation for a future $50 gain and $50 loss, in Study 4. Error bars show +/- one standard error.*

 This same pattern was seen across the full set of 20 events. Averaging the 10 gain events together, participants felt some positive anticipation (*M* = 51, *SD* = 27) and some negative anticipation (*M* = 27, *SD* = 25). In contrast, when considering the loss events, participants felt notable negative anticipation (*M* = 64, *SD* = 21), but little positive anticipation (*M* = 13, *SD* = 13). This difference between differences was confirmed by swapping the positive and negative anticipation scores for negative events and examining the interaction term, which was significant, *F*(1,68) = 37.7, *p* < .001, *η*2 = .36.

 *Mixed anticipation*

 The results above *suggest* that anticipation of gains is a mixed emotional experience. However, it is possible that some people experience positive anticipation of gains and other people experience negative anticipation of gains, and no one person experiences both at once. Therefore, we developed a measure of "mixed" anticipation: a participant is said to experience mixed anticipation for an event if they report at least 10 (out of 100) positive anticipation and at least 10 (out of 100) negative anticipation for that same event. When considering a future $50 gain, 38% of participants reported mixed anticipation, while when considering a future $50 loss, 20% of participants reported mixed anticipation, a significant difference, *t*(68) = 2.4, *p* = .02. Likewise, averaging across all the gain events, participants reported mixed anticipation 31% of the time, as compared to 19% for the loss events, *t*(68) = 4.1, *p* < .001.

*Discussion*

 Just as people may feel a combination of happiness and sadness when experiencing an event (Williams & Aaker, 2002), so too may the anticipation of future events be a mixed emotional experience. This mixed anticipation happens much more often when considering future gains than when considering future losses. When considering gains, people experience a mixture of savoring and impatience, which makes the net anticipation of gains weakly positive or neutral. In contrast, when considering losses, people experience significant dread but not much "enjoying the moment", which makes the net anticipation of losses decided negative.[[7]](#footnote-7) This may explain the apparent dominance of dread over savoring in Studies 1-3.

**General Discussion**

 The present research is the first to demonstrate that negative anticipation of losses is more pronounced than positive anticipation of gains. It also provides the first process data to support Loewenstein’s (1987) theoretical claims about the role of anticipation utility in time preferences. Taken together, these results offer the first data to explain the "sign effect" in intertemporal choice: people want to accelerate gains more strongly than they want to postpone losses because the psychological cost of dread is far greater than the pleasure of savoring.

Although determinants of heterogeneity in time preference have attracted considerable attention, there has been little inquiry into the role of variation in dread and savoring in producing that variance. We predict, for example, that credit is more attractive to those who feel less dread at the thought of owing money; it is less clear whether the intensity of savoring would foster or corrode fiscal restraint, since people can look forward to near events (a new car) or distant ones (retirement).

Our experimental designs suppressed the effects of uncertainty. In the research presented here, participants were asked to assume that the events would happen for sure. However, it is likely that the uncertainty which accompanies many future events could affect – or could even reverse – the pleasures or pains of anticipated certain consequences: compare, for example, the experience of waiting to receive 10 million dollars at the end of the year *versus* waiting to receive 10 million dollars with a 95% probability. The first would likely be pleasurable, whereas the latter might well be aversive (see Elster and Loewenstein 1992).

A final caveat regarding the current research is that it assessed participants' predictions of anticipation utility. We presume such reports were based on a simulation of how they would feel now. We suspect that such simulations yield poor predictions of how much dread will actually be experienced, because some types of events might be difficult to avoid attending to (e.g., breaking up with someone). Others that we might report intensely dreading (e.g., a visit to the dentist) may not remain top of mind, as attested to by missed appointments to things we'd rather get over. Expectations and violations of expectations yield further complexities. Each of us has experienced savoring the arrival of something we expect in a week, yet impatience if it is delayed an additional week (even though we might well have enjoyed pleasurable anticipation for a full two weeks if that was our expectation). The hedonic dynamics of dread and savoring are beyond the scope of this paper, but remain a completely unstudied area of inquiry pertinent to intertemporal choice.

1. We depart from Loewenstein (1987), who uses the term *savoring* to refer to the pleasurable anticipation of future positive events. In our view, this term is inapt, since it is most commonly used to refer to pleasure arising from concurrent experiences (e.g., savoring a bite of lobster) or reflecting on past experiences (e.g., savoring your team’s lone Super Bowl victory). We could not think of a single word which captured pleasurable anticipation. Nor it seems, could Winnie the Poo. “…*although Eating Honey was a very good thing to do, there was a moment just before you began to eat it which was better than when you were, but he didn't know what it was called*.” [↑](#footnote-ref-1)
2. We suspect that deriving pleasure from anticipating future negative events is extremely rare, and, correspondingly, know of no term for it in the literature. One example of this phenomenon is when a friend or family member will leave soon, and the remaining moments with that person become all the sweeter (due to the knowledge that they will soon be gone). Thus, we will use the term *enjoying the moment* to describe this positive utility from the anticipation of a negative future event. [↑](#footnote-ref-2)
3. Sometimes participants indicated an immediate value of $0, in which case ratios could not be calculated, and those data points were dropped. This occurred for 10% of the $4 gain answers, 9% of the $4 loss answers, 3% of the $1000 loss answers, 17% of the electric shock answers, and 31% of the kiss from a movie star answers. One participant had extremely high ratios (over 100 standard deviations above the mean) and was dropped from the dataset. [↑](#footnote-ref-3)
4. All 27 SS vs. LL items were taken from Kirby, Petry, & Bickel (1999). [↑](#footnote-ref-4)
5. The number of exclusions is higher than Studies 1a and 1b because the attention check was put at the end of the survey (embedded in the demographics), rather than at the beginning. The pattern of results with all participants included is quite similar, and analysis with the full sample of participants is provided in the online supplemental. [↑](#footnote-ref-5)
6. For an additional study reaching the same conclusion using different methods see the online supplemental Study S1. [↑](#footnote-ref-6)
7. We ran another study -- described in the online supplemental as Study S2 -- with a very different methodology, and reached the same conclusion. [↑](#footnote-ref-7)