Kisses vs. shocks: Anticipation asymmetries explain time preferences for gains vs. losses

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| David J. Hardisty | Shane Frederick | Elke U. Weber |
| University of British Columbia | Yale University | Princeton University  |

Author note: Address correspondence to David J. Hardisty, david.hardisty@sauder.ubc.ca, 2053 Main Mall, Vancouver, BC, Canada V6T 1Z2, 604-827-3158. This work was supported by the National Science Foundation grant SES-0820496 and the Social Sciences and Humanities Research Council of Canada.

**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 unidimensionally painful experience (dread). Anticipation is associated with time preference, such that the more people enjoy anticipating an event, the more they prefer to delay it, and the more they dread it, the more they prefer to accelerate it. In combination, these findings explain and mediate the "sign" effect in discounting, i.e., the fact that losses are discounted less than gains.

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

 Kisses vs. shocks: Anticipation asymmetries explain why losses are discounted less than gains

Consumers constantly make choices about what to have now, and what to put off until later. For example, when to have a nice dinner out? When to schedule a dentist appointment? Take income now, or invest it for retirement? Pay a bill now, or put it off until next month?

Many factors affect consumer preferences regarding the timing of outcomes ([Frederick & Loewenstein, 2008](#_ENREF_4); [Frederick, Loewenstein, & O'Donoghue, 2002](#_ENREF_5); [Lynch & Zauberman, 2006](#_ENREF_15)). Some of them should apply equally to gains and losses. For example, the uncertainty that a future event will happen 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, and the more that a consumer is connected to their future self, the more they should care about future outcomes ([Zhang & Aggarwal, 2015](#_ENREF_26)).

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 & Weber, 2009](#_ENREF_8); [Mischel, Grusec, & Masters, 1969](#_ENREF_17); [Thaler, 1981](#_ENREF_22)). Though this "sign" effect is robust, 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](#_ENREF_13); [Scholten & Read, 2010](#_ENREF_19)). This is a major oversight, given that identical outcomes can be framed as gains or losses merely by changing the reference point (e.g., energy savings vs energy costs, time gained vs lost, etc.).

We hypothesize that the desire to postpone losses is weaker than the desire to accelerate gains because the dread of future bad things is more intense than the pleasure of anticipating good ones. Thus, while people have a natural impulse to postpone a negative experience (such as paying a bill), the desire to minimize dread pushes in the opposite direction, leading a moderate time preference (i.e., low discount rates for losses). In contrast, the impulse to receive positive experiences (such as a paycheck) as soon as possible is barely influenced by anticipatory feelings, resulting in a strong time preference (i.e., high discount rates for gains).

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. 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 anticipation1. 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). 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 the remaining moments of an enjoyed experience become even sweeter from the recognition 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 event2.

Comparisons of the relative strength of pleasurable and aversive anticipation are rare ([though see Elster & Loewenstein, 1992](#_ENREF_3)). Indeed, to our knowledge, the only published empirical comparisons are a paper by Loewenstein ([1987](#_ENREF_12)) which compared movie star kisses with electric shocks and a paper by Lovallo and Kahneman ([2000](#_ENREF_14)) 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](#_ENREF_12)) measured willingness-to-pay and found that delaying a kiss from a movie star three days increased its value and delaying an electric shock increased its disvalue. He attributed this to the pleasures (and pains) of anticipation. However, this 3-day kiss result was not a statistically significant increase, and we ran replication studies that similarly found no increase (see the Online Supplement). A subsequent paper by Lovallo and Kahneman ([2000](#_ENREF_14)) measured willingness to delay the resolution of uncertain gambles involving gains and losses. They found that people were generally more willing to delay gambles that were more attractive, and inferred that this is driven by greater anticipatory utility for the more attractive gambles. However, similar to the Loewenstein ([1987](#_ENREF_12)) results, the desire to delay (uncertain) gains was weak (and was never statistically greater than zero). In contrast, the desire to resolve (uncertain) losses sooner was quite strong. Thus, these previous studies on time preferences for gains and losses suggest that pleasurable anticipation may be weaker or less reliable than dread.

However, anticipatory (dis)utility is not the only possible account of the results reported in these studies: as an example, someone might want to delay a kiss from a movie star because he wants to get a haircut and brush his teeth, and not because he wants to expand the period of pleasurable anticipation. Therefore, it is preferable to measure anticipation (and its impact on time preferences) directly, and the efficacy of this method is supported by neuroimaging data. Berns and colleagues ([2006](#_ENREF_2)) assessed the dread for electric shocks using both self-report and fMRI of brain activation during the period preceding them. As expected, those with stronger preferences for immediate shocks exhibited more activity in posterior elements of the cortical pain matrix, and reported greater dread (what they call "anticipatory anxiety"). These results demonstrate the validity of self-report measures of dread, but are silent on comparisons of dread and pleasurable anticipation. More recently, Harris ([2010](#_ENREF_9)) found that this operationalization of dread helps explain temporal preferences of various types of aversive experiences. While these papers show the influence of dread on intertemporal choice, demonstrations of the efficacy of *pleasurable anticipation* are rare, and we are not aware of any studies that directly measure the anticipation of positive events or compare the anticipation ratings of positive and negative events. In the present research, we present five studies that chart these unexplored waters.

 In Study 1, we find that the anticipation of financial losses induces stronger emotions than the anticipation of financial gains, and that this asymmetry mediates the aforementioned sign effect. We extend the investigation beyond financial outcomes in Study 2. Study 3 shows that these asymmetries in anticipation and time preference persist even when gains and losses are matched in subjective value (in other words, even when controlling for loss aversion). Studies 4 and 5 explore the psychological drivers of the anticipation asymmetry, finding that future gains evoke opposing considerations while future losses do not. For example, when thinking about a future paycheck, one may experience both the positive emotions of vicarious consumption (*pleasurable anticipation*) and the negative emotions of deprivation (*impatience*). In contrast, when thinking about a future bill that must be paid, little countervails the negative emotion of *dread* (this is because the mirror of impatience – recognizing the current moment as being better than what will follow – is impotent).

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

*Material and methods*

201 participants recruited from Mechanical Turk, completed an attention check ([similar to Oppenheimer, Meyvis, & Davidenko, 2009](#_ENREF_18)), and then chose between $49 today OR $60 in 89 days. These amounts were gains or losses depending on the condition to which participants had been randomly assigned. They were 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 by clicking on a line 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] (but without any ratings of anticipation) and some demographic questions. All 27 SS vs. LL choices were taken from Kirby, Petry, & Bickel ([1999](#_ENREF_11)).

*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 Supplement.

 *Time preference*

 Overall, participants’ desire for immediate gains was stronger than their desire to postpone losses, replicating the sign effect ([Thaler, 1981](#_ENREF_22)). On the first choice, participants sacrificed value to accelerate reward 70% of the time, whereas particpants in the loss condition sacrificed value to delay penalty only 26% of the time, *z* = 6.82, *p* < .001. The remaining choices (which followed their report of anticipatory pleasure or pain) yielded similar results: SS was preferred 57% of the time in the gain conditions compared to just 26% LL 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*).

 One concern may be that that while the gains and losses were matched in objective value, losses are subjectively valued more than gains ([Kahneman & Tversky, 1979](#_ENREF_10)), and this may have driven the observed differences in time preference. The 27 choice pairs used in this study are often split between small (mean = $26), medium (mean = $47), and large (mean = $68) magnitude outcome items ([Kirby et al., 1999](#_ENREF_11)). Comparing the small losses with the large gains, participants chose to have large gains now 51% of the time, but only chose to delay small losses 27% of the time, *t*(191) = 7.8, *p* < .001. Thus, the difference in time preferences appears robust to differences in magnitude, which would rule out a loss aversion account of the sign effect. We test this more rigorously in Study 3.

*Anticipation utility*

 Respondents were roughly split on whether anticipating a future $60 gain was pleasurable (42%) or aversive (47%), and the mean rating (-5) was not significantly different from zero. By contrast, the anticipation of a future $60 loss was overwhelmingly regarded as negative; 76% rating it as negative, 4% neutral, and 19% rating it as positive, with a significantly negative mean rating of (-36). The positive anticipation ratings for the $60 loss seem strange at first but may have reflected relief that the bill could be put off until later (many MTurk workers are low income and may have other pressing financial concerns). Overall, the expectation of bads were more intense than the positive emotions attending the expectation of goods (*t*(191) = 5.6, *p* < .001, *d* = 0.8). The distribution of anticipation ratings, shown in Figure 1 below, tell a more nuanced story. For gains, there is a mode around 0 anticipation utility, which could indicate either indifference or conflict. The rest of the distribution is more or less uniformly distributed, including ratings of 100 and -100. Therefore, it appears that some people feel pleasurable anticipation at the prospect of a future $60 gain, others feel (aversive) impatience, and still others feel indifference or conflict. For losses, there is a skewed distribution with a mode at -100, tapering off to a small tail at 100. This indicates that most feel dread at the prospect of a future $60 loss, with some feeling indifference or conflict, and only a few reporting strong pleasure. Overall, anticipation of gains is a mixture of pleasure and pain, while anticipation of losses is mostly pain.

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Figure 1 here

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*Mediation*

 As summarized in Figure 2, expected anticipatory emotions mediated the sign effect. The valence of the event in question affected judgments of the associated anticipatory emotions, which in turn predicted preferences between temporally displaced outcomes. Using a bootstrapping test recommended by Shrout & Bolger ([2002](#_ENREF_21)), was *significant* (*p* < .01) but not *complete* mediation – losses were discounted less than gains, even after controlling for the expected (dis) utility of anticipation. Although participants may have selected anticipation ratings merely to justify their choices (due to experimenter demand or a desire for self-consistency), two pieces of evidence weigh against this interpretation: First, another, similar study (Study A3 in the Appendix) manipulated the order of anticipation ratings and intertemporal choices, and found no order effect, contrary to what would be expected if anticipation ratings were chosen merely to justify choices, or vice versa. 2). Secondly, outcome sign was manipulated between subjects (in both this study and Study A3), so it is unlikely that participants gave specific anticipation ratings so as to justify a difference between gains and losses.

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Figure 2 here

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*Discussion*

As predicted, people dreaded a future financial loss more strongly than they enjoyed looking forward to an objectively equivalent gain. Indeed contemplating future monetary rewards was not even positive, suggesting indifference or conflict. We attempt to discriminate among these in Studies 4 and 5.

 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, contemplating future gains is either pallid or bittersweet, and thus preferences for immediate gains remain strong (high discount rates). In another study (Study A3 in the Appendix) we show this same pattern of results in a consumer choice paradigm with air conditioners. Framing future energy usage with a negative frame (energy wasted) rather than a positive frame (energy saved) influences anticipation utility, in turn promoting preferences for the energy efficient option.

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 asymmetry across different time horizons, from delays of 3 days to 5 years.

**Study 2: Anticipation asymmetries across domains**

*Material and 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 a pilot study (asking participants to list real-life examples of gains or losses they would like to delay or accelerate) and from several "classic" examples from prior literature, including "a kiss from the movie star of your choice" and "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 from the Virtual Lab subject pool of a university in the northeast (which draws participants from across the US) for an online study. 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. 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." The delay of the specified interval was manipulated between subjects to be either three days, one week, one month, one year, or five years. (Therefore, all 20 events had the same delay for a given subject.) Participants 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. The number of exclusions is higher than Study 1 because the attention check was put at the end of the survey (embedded in the demographics), rather than at the beginning, and because a different subject pool was used. 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.

 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 pleasurable anticipation of gains (78% vs. 58%; *z*=12.9, *p*<.001). (3) Dread, when it occurred was also *stronger* than pleasurable anticipation, 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, finding a significant difference between the two with a mixed model, F(1,2292)=40.1, *p*<.001. (4) Anticipation utility predicted time preference (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), such that the more a participant indicated enjoying the anticipation of an event, the more likely they were to want to delay it (*F*(1,3377)=138.0, *p*<.001). (Overall, participants preferred to have the event immediately 49% of the time, to delay 23% of the time, and were indifferent 28% of the time.) (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 & Watts, 1975](#_ENREF_25)). We also tested these findings together 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. The analysis 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). It also confirmed a main effect of sign, consistent with typical time preferences: participants were more likely to delay negative events than positive events (*b*=-0.7, F(1,3376)=548.1, p<.001). There was no interaction, *b*=0.000, *F*(1,3376)=0.0, *p*>.5, indicating that anticipation ratings predicted time preferences equally well for gains and losses. (6) Temporal distance diminished the intensity of anticipatory (dis)utility *F*(4,164)=6.0, *p*<.001, *η2*=.13, as suggested by Loewenstein ([1987](#_ENREF_12)).

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Table 1 here

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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 items 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 pleasurable anticipation 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 outweigh the dread of losing it.

 In Studies 1 and 2, we made no attempt to equate the *subjective* magnitude of positive and negative events. Thus, our suggestion that dread is stronger than pleasurable anticipation may simply reflect the fact that the set of negative events we chose had a larger subjective magnitude than the set of positive events. We addressed this in Study 3 by presenting each participant with a pair of positive and negative events 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 — with dread of losses being stronger and more frequent than pleasurable anticipation of gains, gains accelerated more often than losses postponed, and anticipation predicting time preferences — even when the subjective experienced utility of gains and losses were matched.

**Study 3: Controlling for subjective value**

*Material and methods*

 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 Study 1). Twenty-eight participants failed the attention check and were excluded from further analysis. Participants created subjectively matched pairs of positive and negative events, answered demographic questions that primarily served as filler task (reporting gender, age, marital status, income, education, ethnicity, political affiliation, smoking status, and available financial resources). Last, they provided ratings and choices for (individually tailored) 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 from 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 component was made less good or the bad component was made worse until participants were (approximately) indifferent. The next pair was then presented and the procedure repeated. Items for which this procedure could not create indifference for a given participant were excluded from the analysis. (For the five pairs of events, this occurred, respectively 5%, 10%, 2%, 4% and 23% of the time.)

*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 five questions about each of these individual events: (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 similar line labeled with "not at all", "strongly", and "extremely."

*Results*

*Event Pair Titration*

 It took participants an average of 6.4 questions (*SD*=3.5) to reach their indifference point on each pair. Indifference points for each pair were positively skewed, so we report both the means and the medians in Table 2. Notably, the median participant was indifferent about playing a gamble with a 50% chance to lose $25 and 50% chance to gain $55, roughly replicating the 2:1 ratio typically found for loss aversion ([Kahneman & Tversky, 1979](#_ENREF_10)).

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Table 2 here

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*Ratings of Experience Utility*

 For data analysis, we converted the two questions on experience utility (positive or negative and then 0 to 100) into a single -100 to 100 scale, with the means summarized in Table 2. Participants rated the experience utility of positive and negative events to be of similar magnitude, as would be expected because those events were individually titrated and tailored for each participant. The one exception was the fourth pair. Though ostensibly equated by the prior task, participants expected watching the funny TV show as more pleasurable than watching the boring commercials would be displeasurable (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 more pleasurable than the loss was unpleasurable) goes in the opposite direction as a negativity bias, it provides a conservative test of our hypothesis.

 *Ratings of Anticipation Utility*

 On the first question, asking whether anticipation was positive or negative, negative events induced dread more *frequently* (76%) than positive events brought pleasurable anticipation (50%), a significant difference as confirmed with a mixed model test, F(1,958)=75.2, p<.001. Moreover, pairwise proportion tests confirmed that pairs one through four all showed the predicted effect, p < .01 or lower, while the fifth pair showed a non-significant difference in the predicted direction (z=0.9, p=.35). To compare the *intensity* of dread versus pleasurable anticipation, we compared only positive anticipation ratings of gains with negative anticipation ratings of losses, and the average intensity of dread exceed the average intensity of pleasurable anticipation (*M*=-39.6 vs. 34.9; *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.

 For an overall summary, we converted the two questions on anticipation utility (positive or negative and 0 to 100) into a single -100 to 100 scale, with the means summarized in Table 2. The anticipation asymmetry was confirmed for each pair with a series of paired t-tests (reverse scoring the anticipation ratings for losses). In every case, the difference was significant at *p* = .05 or lower.

*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, consistent with Loewenstein ([1987](#_ENREF_12)). This power of anticipation ratings to predict time preferences was equally true for different types of outcomes: there was no interaction with sign or with 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 equated, negative anticipation exceeds positive anticipation. We hypothesize that thinking about losses is a relatively unidimensional negative experience, whereas anticipating gains is bittersweet. The contemplation of future rewards elicits some pleasure while imagining it ("pleasurable anticipation"), but also a feeling of deprivation that we don’t have it yet ("impatience"). Collectively this makes the anticipation of gains a weakly positive experience at best. Conversely, the specter of future penalties is aversive; 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"). We test this account further in Study 4.

**Study 4: Understanding the anticipation asymmetry**

*Material and methods*

 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 and some negative anticipation. In contrast, when considering losing $50 in a week, participants felt notable negative anticipation, but little positive anticipation. 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 for the 2x2, which was significant, *F*(1,68) = 14.1, *p* < .001, *η*2 = .17.

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Figure 3 here

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This same pattern was seen across the full set of 20 events. Averaging the 10 gain events, participants felt some positive anticipation (*M* = 51, *SD* = 27) and some negative anticipation (*M* = 27, *SD* = 25). In contrast, when averaging the 10 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 that elicits 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 20 gain events, participants reported mixed anticipation for 31% of positive experiences, as compared to 19% for the negative experiences, *t*(68) = 4.1, *p* < .001. We conducted a sensitivity analysis and found similar results: when the threshold for "mixed anticipation" is set to 5 (out of 100), 42% report mixed anticipation of gains and 26% report mixed anticipation of losses, *t*(68) = 5.8, *p* < .001. When the threshold is set to 20 (out of 100), 19% report mixed anticipation of gains, and 11% report mixed anticipation of losses, *t*(68) = 3.0, *p* < .01.

*Discussion*

 Just as people may feel a combination of happiness and sadness when experiencing an event ([Williams & Aaker, 2002](#_ENREF_24)), so too may the anticipation of future events be a mixed emotional experience. This mixed anticipation happens significantly more often when considering future gains than when considering future losses. When considering gains, people experience a mixture of pleasurable anticipation 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. (We ran another study -- described in the Appendix as Study A4 -- with a very different methodology, and reached the same conclusion.) This may explain the apparent dominance of dread over pleasurable anticipation in Studies 1-4.

 The hypothetical choice scenarios employed in Studies 1-4 have a number of advantages; they enable studying a wide range of outcomes (which might be unethical to study with real outcomes) and they are logistically easy to administer. However, they also have important drawbacks. One is that participants are asked to make two-level predictions – both imagining an event is on the horizon and then imaging how they would feel about anticipating the event – which may not be accurate. A second drawback is the potential for demand effects or (false) consistency effects: participants may make choices to justify their anticipation ratings, or make anticipation ratings to justify their choices. Therefore, in Study 5, we ask participants to report their actual feelings of anticipation for a real future positive or negative event at a fixed time in the future. Furthermore, all previous studies (1-4) had an attention check and/or brief introduction about anticipation before the main survey, which may have influenced responses. In Study 5, there is no attention check or introduction about anticipation before the main survey questions.

**Study 5: Anticipating real consumption**

*Material and methods*

201 undergraduates (61% female, mean age 20.2) at a large university were recruited for an unrelated study (the "Step Study") in exchange for course credit. The study consisted of two half-hour sessions, one week apart. In each session, they first completed the unrelated study, and then completed the current study.

 When participants entered the lab, they could see jellybeans on the table in clear plastic bags. The jellybeans were a selection of flavors from Bertie Bott's Every Flavour Beans (though this branding was never made known to participants). At time 1, participants read the instruction "This next study involves eating a jelly bean, whose flavor may range from delicious to disgusting. As always, participation is voluntary. Are you willing to eat a jelly bean for this next study?" Nine percent of the sample answered "no" and were exempted from the study, leaving 183 participants. These remaining participants were each randomly assigned to one of two jellybean flavor conditions: toasted marshmallow (*n* = 82) or dirt (*n* = 101). We selected these two flavors based on pre-testing which indicated that students believed the positive flavor would taste equally as good as the negative flavor would taste bad.

 On the next page, participants read "You have been assigned to eat a "dirt" ["toasted marshmallow"] flavored jelly bean one week from today." (Note that, unlike previous studies, participants did not have a choice about when to eat the jellybean.) Participants then answered two questions to measure their predicted experience utility for eating the jellybean, "How **happy** or **pleasurable** do you think the **experience** will be?" and "How **displeasurable** or **unhappy** do you think the **experience** will be?" They answered each question by clicking on a line (of length 100) labeled with "neutral" on the left and "extremely like the experience of eating" (or "extremely dislike the experience of eating") on the right.

Next, participants answered two questions to measure their current (i.e., actual) anticipation utility, "How **pleasurable** or **happy** is the **anticipation**? In other words, how do you feel now, **while waiting** for it?" and "How **displeasurable** or **unhappy** is the **anticipation**? In other words, how do you feel now, **while waiting** for it?" They answered each question by clicking on a line (of length 100) labeled with "neutral" on the left and "extremely like the feeling of waiting" (or "extremely dislike the feeling of waiting") on the right. Finally, participants indicated their gender, age, and ethnicity.

 Twelve participants (7 in the dirt condition and 5 in the marshmallow condition) did not return for the second session. In the second session, participants ate a jellybean of the assigned flavor. Participants then answered two questions to measure their actual experience utility of eating the jellybean, "How **happy** or **pleasurable** is the **experience**?" and "How **displeasurable** or **unhappy** is the **experience**?" They answered each question by clicking on a line (of length 100) labeled with "neutral" on the left and "extremely like the experience of eating" (or "extremely dislike the experience of eating") on the right.

*Results*

 *Predicted experience utility*

 A notable subset of participants had unusual predictions, predicting that they would dislike the toasted marshmallow jellybean (i.e., negative utility equal or greater than positive utility for eating the marshmallow) or enjoy the dirt jellybean (i.e., positive utility equal or greater than negative utility for eating the dirt). Specifically, 21% of those considering the toasted marshmallow flavor indicated they would dislike the experience, and 32% of those considering the dirt flavor indicated they would like it. These ratings could be the result of inattention (not noticing the jelly bean flavor or answering randomly) or unusual tastes (disliking sweet overly sweet things such as marshmallow flavor, or liking novel flavors such as dirt flavor). In either case, our manipulation of positive vs negative flavor did not have the intended effect on these participants. Therefore, we have excluded these participants from further analyses, leaving 65 participants in the positive condition and 69 in the negative condition. However, we did perform a second set of analyses including all participants, which found quite similar results to those reported below and can be found in the supplemental materials.

As summarized in the first row of Table 3, participants predicted that eating the toasted marshmallow flavored jellybean would be an equally good experience as the dirt flavored jellybean would be a bad experience. For each flavor, we subtracted the two ratings (negative and positive) to get a single measure of experience utility for that flavor. As expected (due to pretesting), the predicted experience utility of the dirt (mean = -57.4, *SD* = 28.9) and toasted marshmallow (mean = 50.6, *SD* = 26.5) jellybeans were quite similar. Reverse scoring the dirt scores, the predicted experience utility ratings were not significantly different, *t*(132) = 1.5, *p* = .13, *d* = 0.27.

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Table 3 here

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*Actual anticipation utility*

 The anticipation ratings are summarized in the second row of Table 3. Again, we combined the positive and negative anticipation ratings for each flavor into a single measure of anticipation utility. Replicating the results of previous studies, participants reported dreading the dirt flavored jellybean (mean = -33.4, *SD* = 41.4) more than enjoying anticipation of the toasted marshmallow jellybean (mean = 7.8, *SD* = 27.2). Reverse scoring the ratings for dirt flavor, this was a significant difference, t(132) = 2.6, p < .01, d = 0.40.

 As in Study 4, a participant is said to experience mixed anticipation for an event that elicits at least 10 (out of 100) positive anticipation and at least 10 (out of 100) negative anticipation for that same event. When considering the toasted marshmallow flavor, 88% of participants reported mixed anticipation, while when considering the dirt flavor, 29% of participants reported mixed anticipation, a significant difference, *t*(132) = 8.5, *p* < .001. When the threshold for "mixed anticipation" is set to 5 (out of 100), 79% report mixed anticipation of marshmallow and 41% report mixed anticipation of dirt, *t*(132) = 5.7, *p* < .001. When the threshold is set to 20 (out of 100), 31% report mixed anticipation of marshmallow, and 17% report mixed anticipation of dirt, *t*(132) = 1.8, *p* = .07.

*Actual experience utility*

 Although not relevant to our hypotheses, at T2 we asked participants to rate the actual experience of eating the jellybean, as seen in the third row of Table 3. Again combining the positive and negative ratings for each flavor, we see that participants enjoyed eating the toasted marshmallow flavor (mean = 58.9, *SD* = 27.4) more than they disliked eating the dirt flavor (mean = -43.6, *SD* = 52.4). Reverse scoring the dirt flavor, this was a significant difference, *t*(124) = 2.0, *p* = .04, *d* = 0.38.

**Conclusions**

 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](#_ENREF_12)) 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 outstrips the pleasure of anticipating gains. More precisely, anticipation of losses is a mainly negative experience of dread, whereas anticipation of gains is a mixed emotional experience combining both impatience and pleasurable anticipation. This qualitative difference in anticipation is robust to differences in magnitude, and as such is not explained by loss aversion.

 Given that many consumer outcomes can be framed as either gains or losses, our findings offer useful guidance for managers and policy-makers that wish to encourage future-oriented choices. For example, when consumers are considering an energy efficient upgrade, appeals to look forward to future energy savings are not as effective as promises of avoiding future costs (as demonstrated in Online Supplement Study A3). Similar principles can be applied to long-term investment and health decisions.

Although determinants of heterogeneity in time preference have attracted considerable attention, there has been little inquiry into the role of variation in dread and pleasurable anticipation 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 pleasurable anticipation 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 & Loewenstein, 1992](#_ENREF_3)). Indeed, recent findings suggest that uncertainty in intertemporal choice is aversive for both gains and losses ([Ganguly & Tasoff, 2016](#_ENREF_6); [Hardisty & Pfeffer, 2016](#_ENREF_7)). This would be another contributor to the sign effect. Likewise, other factors such as construal level ([Lynch & Zauberman, 2007](#_ENREF_16); [Trope, Liberman, & Wakslak, 2007](#_ENREF_23)) may partly explain the sign effect. Losses are generally construed at a lower level than gains, which may reduce the impact of delay on subjective value of losses. More broadly, a phenomenon as large and robust as the sign effect likely has multiple contributing causes.

A final caveat regarding the current research is that it assessed participants' predictions of anticipation utility (in Studies 1-4), or current feelings of anticipation (in Study 5). We suspect that such simulations or current feelings may yield poor predictions of how much pleasurable anticipation or dread will actually be experienced over time, 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, for both gains and losses ([Benzion, Rapoport, & Yagil, 1989](#_ENREF_1); [Shelley, 1993](#_ENREF_20)). Each of us has enjoyed anticipating the arrival of something we expect in a week, yet experienced 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 anticipation are beyond the scope of this paper, but remain a completely unstudied area of inquiry pertinent to intertemporal choice.

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Footnotes

1 Nor it seems, could Winnie the Pooh. "…*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*."

2 Another possibility would be *relief* that a problem does not have to be dealt with until later. The term *masochism* is not appropriate because it refers to enjoying the experience of negative things (rather than anticipation) and has no temporal component.

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.*

Table 2.

*Mean and median indifference points, average experience utility (-100 to 100), anticipation utility (-100 to 100), and time preference (1 = immediately, 0 = indifferent, -1 = in one week) for each event in Study 3.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Event** | **Experience Utility** | **Anticipation Utility** | **Now Preference** |
| **Gain** | **Loss** | **Gain** | **Loss** | **Gain** | **Loss** | **Gain** | **Loss** |
| 50% chance of receiving [*M*=$103, *Mdn*=$55] | 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 [*M*=68, *Mdn*=45] minutes | 55 | -55 | 6 | -27 | .33 | -.20 |
| watch really funny TV program for 30 minutes | watch boring, annoying commercials for [*M*=20, *Mdn*=12] minutes | 35 | -27 | -5 | -14 | .73 | .27 |
| 70% chance of receiving [*M*=$83, *Mdn*=$25] | 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 [*M*=67, *Mdn*=10] mild (and harmless) electric shocks | 50 | -47 | 20 | -32 | -.02 | .54 |

Table 3.

*Means (with SDs in parentheses) of utility ratings for eating a toasted marshmallow flavored or dirt flavored jellybean in Study 5.*

|  |  |  |
| --- | --- | --- |
|  | **Marshmallow** | **Dirt** |
|  | **Positive** | **Negative** | **Positive** | **Negative** |
| **T1 Predicted experience utility** | 60.1 (24.4) | 9.6 (11.7) | 7.1 (12.0) | 65.0 (26.2) |
| **T1 Actual anticipation utility** | 32.6 (28.3) | 24.8 (22.9) | 13.7 (21.6) | 47.1 (37.1) |
| **T2 Actual experience utility** | 65.0 (23.8) | 6.1 (12.3) | 12.9 (20.6) | 56.6 (37.5) |

Figure 1. *Distribution of reported anticipation utility for a $60 gain or loss in 89 days in Study 1.*



Figure 2. *Anticipation partially mediates the effect of sign on time preference in Study 1. Direct effects (with standardized betas) are shown in parentheses, while reduced effects (in the full model) are shown without parentheses.*



Figure 3

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