Four Score and Seven Years from now: The "Date/Delay Effect" in temporal discounting

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Abstract

We describe a new anomaly in intertemporal choice: the "date/delay effect:" Future outcomes are discounted more when time is referred to as a delay (e.g., 'in 6 months') than as a calendar date (e.g. on October 17th). The effect is demonstrated in four experiments, using both choice and matching response modes. Moreover, hyperbolic discounting is found only when time is referred to as a delay (discount rates are constant when time is referred to in terms of calendar dates). We conclude by suggesting that Rubinstein's (2003) 'similarity' hypothesis as a potential explanation, and then consider some of its practical implications.

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Lincoln began his Gettysburg Address with a memorable and powerful phrase: "Four-score and seven years ago." His decision to refer in this way to the time since the founding of a Nation was the product of careful deliberation. He would not have been as happy with "About 90 years ago," or "In 1776."

In a more mundane context, researchers investigating intertemporal choices must also decide how to describe time to their respondents. They can refer to a temporal interval using units of delay (e.g., days, weeks, months, or years), combinations of these units (e.g., 'one year and six months'), or calendar dates (On July 5th, 2006). Unlike Lincoln, however, these researchers have not considered how their chosen temporal description will affect the results they obtain.   Yet there is abundant evidence, in other domains of judgment and choice, that the way options are described has a profound effect on preferences. For example, identical outcomes lead to risk seeking when they are described as losses relative to an arbitrary reference point, and risk aversion when they are described as gains (Kahneman & Tversky, 1983); the decision weight put on unitary quantities (such as probability and time) increase when they are decomposed into formally-identical subsidiary components (Read, 2001; Starmer & Sugden, 1993); and choices between gambles can even be influenced by whether the outcomes are listed in columns or rows (Harless, 1992). The finding of description effects across so many domains, suggests they might occur in intertemporal choice as well.

In this paper, we focus explicitly on the effects of describing time using calendar dates or units of delay. We were prompted by the following passage from

Robert Strotz's (1955) seminal paper on intertemporal choice (which we put to a use rather different from that intended by Strotz himself):

> The relative weight which a person may assign to the satisfaction of a future act of consumption (the manner of discounting) may depend on either or both of two things: (1) the *time distance* of the future date from the present moment [what we call the *delay*], or (2) the *calendar date* of the future act of consumption. The weight I assign to my pleasure in drinking champagne next September 26 may depend either on the fact that that date is a certain length of time away from the present or on the fact that it is my birthday. (p. 167-168)

This passage alerts us to two ways of referring to moment at which outcomes will occur: as delays or calendar dates, each corresponding to different ways of conceptualising that future moment and the interval that precedes it. The concluding sentence in the passage above also suggests that the value we place on future outcomes will depend on which conceptualisation is cued. Strotz goes further by speculating about the direction of this effect:

> … To the extent that time-distance is important, I may assign a different (and probably higher) weight to September 26 as it draws nigh; if only the calendar date is important, the weight will not change as that date approaches. (p. 168).

In other words, we will discount the future less if we conceptualise time in date terms, than if we conceptualise it in delay terms[1].

Strotz's explicit purpose when writing the passage above was to summarise a general model of time discounting. Somewhat more formally, the model is as follows:

$$u(x_i, t_i) = \Delta(t_i)u(x_i, t_0)$$

That is, value of an outcome x_i that will be received at time t_i is the value it would have if received immediately (the undiscounted value, $u(x_i, t_0)$), weighted by a discount function ($0 \leq \Delta(t_i) \leq 1$) that reduces the value of the outcome as a function of the time before it occurs. In the above passage, the present value of Strotz's future champagne consumption is determined by its undiscounted future value which may be affected by particulars of the date (e.g. 'the fact that it is my birthday') and the discount function (i.e., 'the fact that that date is a certain length of time away from the present.') Our interpretation of Strotz's passage suggests that if he had focused his attention entirely on his birthday (the calendar date) then $\Delta(t_i)$ would have been 1, and there would be *no* discounting, whereas if he had focused all his attention on the delay, $\Delta(t_i)$ would be less than 1. The *date/delay* hypothesis is that when options are described in terms of dates rather than delays, people will put less decision weight on the 'length of time away from the present', with the consequence that people will appear more patient. If people are choosing between options, date descriptions will make them more likely to choose the larger-later over the smaller-sooner one.

In this paper, we describe four experiments testing the date/delay hypothesis. In Experiment 1, we show that people are more likely to choose the larger-later reward when time is referred to as a date than when it is referred to as a delay; In Experiment 2, this is replicated using a matching procedure; and in Experiment 3 we investigate what happens when both dates and delays are simultaneously available. Experiment 4 shows another difference between date and delay references: hyperbolic discounting occurs only when time is referred to as a delay. We postpone our theoretical discussion to the conclusion.

Experiment 1

In this experiment, participants chose between smaller-sooner (*SS*) and larger-later (*LL*) options. Outcome timing was referred to using either calendar dates or units of delay. There were three temporal-reference conditions, summarised in Table 1. The two delay conditions (*Week* and *Month*) covered the same interval as a *Date* condition. According to the date/delay hypothesis, *LL* should be chosen more often in the Date condition than in either the Week or Month delay conditions.

TABLE 1 ABOUT HERE

Method

Ninety students from the London School of Economics were approached in the library and courtyard, randomly assigned to one of the three conditions described above and asked to check the box of the option they preferred in four questions of the following type:

	Option 1	**Option 2**
You receive	£370	£450
When	Sept 26, 2003	June 25, 2004
Your choice:	❐	❐

Half answered the four questions in the order given in Table 1, and half answered them in the reverse order.

Analysis

Consistent with our hypothesis, *LL* was chosen more often by those in the Date condition than in either the Month or Week conditions (See Table 2). We tested this formally with an ANOVA that included the proportion of choices of *LL* as the dependent variable, and the three question types (Date, Month, Week) as a between-subjects factor. The effect of question type was highly significant (F [3,111]=8.0, p<.0001), and Tukey post-hoc tests confirmed the story told by the means. In short, there was a clear and very strong date/delay effect.

TABLE 2 ABOUT HERE

Experiment 2

In Experiment 1, preferences were elicited using choice. Choice is usually considered the best method for studying preference because it demands the least of the respondent. Another widely used experimental method is *matching*, where the respondent provides a missing attribute value that will make two options subjectively equivalent, as in the following:

- $370 in 17 weeks is equal to $450 in ___ weeks (matching on t_{LL}).
- $370 in ___weeks is equal to $450 in 56 weeks (matching on t_{SS}).
- $370 in 17 weeks is equal to $____ in 56 weeks (matching on x_{LL})
- $____ in 17 weeks is equal to $450 in 56 weeks (matching on x_{SS}).

Where t_{LL} is the time at which the larger-later outcome (x_{LL}) will be received, and t_{SS} is the time when the smaller-sooner outcome (x_{SS}) will be received. Matching tasks

are theoretically important because they correspond to such real-world activities as pricing, bidding and negotiating.

Research has shown that choice and matching draw on different psychological processes, and consequently that trade-off rates can differ dramatically between them (e.g., Tversky, Sattath & Slovic, 1988; Frederick & Shafir, 2004). When matching, respondents may often apply mathematical operations on the numeric attribute values that are sensitive to irrelevant features such as whether the attribute values are exact multiples of one another, and insensitive to relevant features such as whether the numbers refer to hours or minutes of labour (Frederick & Shafir, 2004). Thus, we could not assume from the choice results in Experiment 1, that the date/delay effect would occur in matching.

Method

Participants included professionals and students from the London School of Economics and visitors to a local business centre. One hundred sixty completed the questionnaire, with 135 usable responses.[2] Subjects equated a pair of delayed outcomes where one of the four attribute values (x_{LL}, x_{SS}, t_{LL} or t_{SS}) was missing. For half of the participants, time was referred to as a calendar date, and for half it was referred to as a delay in months. The instructions were as follows: "Imagine that you will receive some **one off** payments, which are guaranteed and that you can choose **how much** you will receive and **when**." Respondents were then shown an example question like the one below:

	Option 1	**Option 2**
You receive:	£____A_____	£500
When:	August 10, 2003	Nov 24, 2003

They were then told "We want you to fill in the blank to make both options equal to you. In the example above you should state what value for A would make getting A on August 10, 2003 **just as good** as getting £500 on Nov 24, 2003."

Questions were constructed based on a 2 (*Temporal reference*: *Date* or *Delay*) $\times$ 2 (*Attribute* left blank: x or t) $\times$ 2 (*Timing* of attribute left blank: $\cdot_{SS}$ or $\cdot_{LL}$) design. For each of the two temporal reference conditions, each participant answered four questions, one for every attribute/timing combination. The values used for each question are given in Table 3.

TABLE 3 ABOUT HERE

Analysis

For each question, a standardized value of the discount function, called a *discount factor*, was obtained using the following formula:

$$d(.) = \left(\frac{x_{SS}}{x_{LL}}\right)^{1/(t_{LL}-t_{SS})}.$$

Where time is measured in units of one year. We use $d(x_{LL})$ to denote values obtained when the larger-later amount was left blank, and so on.

The mean values of d, collapsed across all questions, are depicted in Figure 1. We analysed the data by means of four 2×2×2 ANOVAs, one for each question, and the results of these analyses are given in Table 4. We focus our discussion on the

major results: The main effect of *Temporal reference* (date versus delay), the main effect of the *Timing* of the missing value (whether the subjects were asked to specify an attribute of the more immediate or more delayed reward), and the interaction between *Timing* and *Attribute* (whether respondents were matching on time or amount).

FIGURE 1 ABOUT HERE

TABLE 4 ABOUT HERE

Date/delay effect

Figure 1 shows a strong date/delay effect. For every matching condition, d was higher (that is, there was less discounting) when time was referred to as a calendar date than when it was referred to as a delay. This was confirmed by the ANOVA, which confirmed a strong main effect of temporal reference for every condition.

Additional results

For all conditions there was a main effect of timing and an interaction between attribute and timing. The main effect, as can be seen in Figure 1, reflects the fact that d was lower when matching on time, and the interaction indicates that this effect was entirely due to the very low values of $d(t_{LL})$. We suggest this pattern reflects an *anchoring* effect. Tversky, Sattath, & Slovic (1988) and Delquie (1997) have each suggested that respondents may often generate the requested matching response for the missing attribute by starting with, and then adjusting, the attribute value of the fully specified option (against which the partially specified "matching" option is being

compared and, ostensibly, equated). In our stimuli, for example, a respondent asked to provide x_{SS} may start with x_{LL}, and adjust that downward. To the extent that the final response is "anchored on" or assimilated with the starting value, the adjustment will be "insufficient" in the sense that an attribute will receive more weight when it is the matching dimension than when it is the fully specified dimension (see Delquie, 1997). For our stimuli, this would increase d when matching on amount (by decreasing the difference between two amounts) and decrease d when matching on time (by decreasing the difference between two times). This can account for the main effect of attribute. It does not, however, explain the the interaction (why the imputed d was lower when specifying the time of the later larger reward than when specifying the time of the smaller sooner reward. One explanation, is that when matching on t_{LL} the standard anchoring story applies – people give a time close to t_{SS}, thus decreasing $d(t_{LL})$ -- but that when matching on t_{SS} they anchor on the *present* t_0 rather than on t_{LL}. This will increase the interval between the outcomes, thereby increasing d and producing the pattern observed in this study.

Experiment 3

Experiments 1 and 2 demonstrated the date/delay effect, and showed that whatever distinguishes dates and delays is found in both matching and choice. We now investigate what happens when both the date and delay perspectives are made salient.

Method

Participants were 90 students from the LSE who were approached in the library and courtyard and asked to complete our questionnaire.

The method was similar to that of Experiment 1. Participants chose between pairs of outcomes where the times were referred to as either Delays in months, Dates, or as Dates-plus-Delays, as shown below:

	Option 1	**Option 2**
You receive:	£900	£1200
When:	In 4 months	In 20 months
	Feb 27, 2004	June 24, 2003

The specific questions used in the experiment are summarised in Table 5.

TABLE 5 ABOUT HERE

For each participant, we obtained the proportion of times they chose *LL*. As can be seen in Table 6, the pattern was clear. The Date condition yielded many more choices of *LL* than the Delay condition, and the Date-and-Delay condition was much closer to the Delay condition. An ANOVA on the average proportion choosing LL indicated there were significant differences between the conditions, *F(2,85)=4.29, p<.02*, and Tukey post-hoc tests showed that the Date condition differed from the other two conditions, which did not differ from each other.

TABLE 6 ABOUT HERE

Thus, it appears that when both descriptions are presented concurrently people choose as if they had seen the Delay description only. It leaves open the question of

how alternate temporal references interact when presented sequentially. If a preference is first formed when a period is described by dates, will it be reversed when a delay description is subsequently presented? If not, how durable is a particular perspective? Presumably, not long, since all those people who showed such large date/delay effects in these experiments would have, both frequently and recently, been exposed to both types of descriptions.

Experiment 4

Hyperbolic discounting is the hypothesized tendency for the discount factor d to increase the farther in the future an outcome is expected to occur (Ainslie, 1975; Strotz, 1955). Hyperbolic discounting predicts that for any pair of rewards separated by a fixed interval (i.e., holding $t_{LL} - t_{SS}$ constant), increasing the onset of that interval (t_{SS}) will increase the likelihood of choosing LL. Most tests of this prediction have referred to time as a delay, and many of these have confirmed the prediction (e.g., Bleichrodt & Johannesson, 2001; Kirby & Herrnstein, 1995; Read & Roelofsma, 2003 Exp 1; Keren & Roelofsma, 1995; Van der Pol & Cairns, 2002 – though see Ahlbrecht & Weber, 1997; Baron, 2000; Holcomb & Nelson, 1992; Read, 2001 Exp 2)[3]. On the other hand, in the few experiments describing time in terms of calendar dates hyperbolic discounting has not been observed (Pender, 1996; Read, 2001; Read & Roelofsma, 2003 Experiment 2). This pattern of findings suggests there may be a regularity, in which hyperbolic discounting occurs only (or, at least, primarily) when time is referred to using delays. This hypothesis is tested in Experiment 4.

Method

In this experiment, discounting was measured using a choice titration method, as described in Read (2001). Participants chose between delayed options and, after each choice, either x_{LL} or x_{SS} was adjusted until an indifference point was reached.

Participants were divided into four groups based on whether time was described as a *Date* or *Delay*, and on whether the discounting period was *Long* or *Short*. The stimuli are summarised in Table 6. The periods were divided into 4 intervals that spanned the interval from t_i to t_{i+1}. For example, in the *Short* condition the first interval spanned the dates from August 30, 2002 to Nov 29, 2002 (1 month to 4 months), the second interval spanned the dates from Nov 29, 2002 to Feb 28, 2003 (4 months to 7 months), and so on. Hyperbolic discounting predicts that ***d*** will increase with interval onset.

TABLE 7 ABOUT HERE

Results

The mean values of ***d*** are depicted in Figure 2. As can be seen, ***d*** was always higher when time is referred to as a date than as a delay. Confirming this, there was a significant main effect of time reference, $F(1,55) = 5.6, p<.02$. There was also a main effect of interval, indicating that, consistent with the predictions of hyperbolic discounting, ***d*** increased for later interval onsets, $F(3,165)=8.1, p<.000$. However, as can be seen in Figure 3, this increase was *entirely* due to the Delay condition, an observation that is supported by the highly significant Interval by Time reference interaction $F(3,165)=9.4, p<.0001$.

FIGURE 2 ABOUT HERE

The last point was investigated more closely by conducting separate ANOVAs for the Date and Delay conditions. As suggested by the discussion above, there was a main effect of interval for the Delay condition, *F(3,87)=13.0, p<.000*, but not for the Date condition, *F(3, 78)=2.5, p=.07*. Within-subjects contrasts revealed a strong linear trend for the Delay condition, *F(1,29)=35.1, p<.000*. For the Date condition, on the other hand, there was no significant trend, and in particular no trace of a linear trend, *F(1,26)=0.7*. In short, therefore, the hypothesis that hyperbolic discounting would be observed in the Delay but not the Date condition received very strong support.

Discussion

In these studies, we showed the 'date/delay' effect: time is treated differently when it is referred to as a specific calendar date than when referred to in terms of delay. Specifically, the date description results in less discounting, and also reveals no evidence of the hyperbolic discounting often found in studies using delay descriptions. We will discuss these results in three parts: First, we discuss a theoretical explanation for these findings, and offer some hypotheses for further research; Next, we consider some practical implications of our results; Finally, we draw some lessons from them concerning how we do research.

Theoretical

Our studies were primarily designed to test the date/delay hypothesis, not to give a definitive account of *why* it occurs. However, some guidance can be found in

recent articles suggesting that observed discounting behaviour is *not* determined by an underlying discount function, but rather by similarity comparisons between options on the dimensions of time and amount. Specifically, Leland (2002) and Rubinstein (2000, 2003) propose that discounting over an interval is determined by the similarity of the time-points marking its beginning and its end: the more similar, the less discounting. Both authors stress the implications of their hypothesis for hyperbolic discounting. Rubinstein argues that hyperbolic discounting occurs because the similarity between two time-points separated by a common interval increases with the onset of that interval: 12 months is more similar to 11 months than 2 months is to 1 month. The per-unit discount factor (d), therefore, increases with interval onset. This account easily fits the findings for the *delay* conditions of Experiment 4. If we extend the similarity analysis to non-quantitative comparisons (implied, but not explicitly discussed, by Rubinstein and Leland) it also fits the findings for the date conditions. We suggest the similarity between dates separated by a common interval does not change the later they occur. That is, the similarity of August 13, 2005 to September 22, 2005 is no greater than the similarity of August 13, 2004 to September 22, 2004. Thus, we have hyperbolic discounting for delays, but not for dates.

Can the Rubinstein/Leland hypothesis also enlighten us about the greater patience shown in the date condition? We suggest it can. Take as a single example Question D from Experiment 1 (any question will do equally well): 3 months versus 16 months or August 29, 2003 versus September 24, 2004. If we use a Rubinstein/Leland similarity metric, 3 and 16 months are pretty different, so we should expect lots of discounting. For the date description, however, the story is different. If we used a numerical metric, the dates are quite similar, and certainly more similar than 3 versus 16: 29 is similar to 24; 2003 is similar to 2004. If we look

at the non-numerical months they are also similar -- August is adjacent to September in the calendar. Indeed, most pairs of dates will be reasonably similar to one another, and thus lead to relatively little discounting.

This perspective yields new hypotheses.   For instance, the discounting associated with dates might be influenced by the way in which they are presented. For example, 8/29/03 might be less similar 9/24/04 than 8/29/2003 is to 9/24/2004 (because the ratio 2004/2003 is much less than 04/03); or August 1, 2003 might be less similar to September 24, 2004 than July 24, 2003 is to September 24, 2004.   We leave these speculations, however, for future research, in which judgments of similarity are elicited directly, rather than posited or inferred from responses to intertemporal judgments.

Implications

The date/delay effect has important practical implications. One lesson is that commercial retailers should refer to temporal outcomes in terms of calendar dates when they want their clients to discount future outcomes very little (e.g. if the buyer must incur unavoidable long shipping delays) and in terms of delays when they want to encourage discounting (e.g. when the seller makes money from express shipping).

These implications may be greatest in the domain of investment and credit offerings. When people think of the future in terms of calendar dates, they will be more likely to invest and less likely to borrow, because there will be less discounting over the interval between the present and the moment when future returns will be received, or future payments must be made. For instance, when offering Bonds, Euro Bills Treasury Bills, and other fixed term securities, it would be better to emphasize the specific listed calendar date on which they mature, as this should reduce

discounting and increase willingness to invest at a given rate. Conversely, it may be best to offer loans by referring to the delay until the loan comes due as this should make future payments seem more distant, and therefore less onerous.   In fact, this is how Bonds and loans *are* advertised, although we doubt this is a strategic decision[4]. Another implication is that 'buy now, pay later…' schemes should be more attractive when described in delay terms ('pay nothing for 6 months.') than when described using specific dates ('pay nothing until June 2004'). An informal survey of retailers in the UK making such offers found that the vast majority do, in fact, describe their offerings in this way (though again we doubt that this is strategic).[5]

Governments could employ the date/delay effect to convey the attractiveness of savings, and the unattractiveness of debt. It may be more effective to advertise savings by marketing it as "If you put £1000 in a cash ISA [Individual Savings Account] on the first day of 2004 it will be worth £1500 by Christmas, 2014," than by marketing it as "If you put £1000 in a cash ISA today it will be worth £1500 in less than 11 years." Likewise, to decrease consumer's willingness to incur debt, government regulation could require merchants to specify, in calendar terms, the implications of loans, as in "… on January 28, 2004, February 27, 2004, and the last Friday of every month thereafter until December 29, 2008, you must pay Johnson's Electronics $100." Correspondingly, annuity products might seem more attractive when payments are described as being made on a specific date each year.

Conclusion

Politicians and poets know that the quality and intensity of our responses to acts or events is affected by *how* they are described. It should not surprise us, therefore, that the way in which we refer to a temporal interval affects time

preference. Moreover, this finding is unlikely to be limited to the contrast between

date and delay descriptions, *per se*. For instance, dates that are "special" (e.g. may be

treated differently than other dates, particularly if the specialness is directly specified

(e.g. 'on Christmas 2005,' or 'on your next birthday.') Furthermore, there are still

other ways of referring to time, and each may be characterised by its own way of

discounting the future. For example, temporal events indexed by a person's future

age could be discounted differently than those indexed in other ways: Someone who

is 35, might regard an outcome occurring 15 years away differently than one

occurring when they are 50, or one occurring in 2020. The perspective that

individuals spontaneously adopt think of the future, when no specific perspective is

cued, may even partly explain interindividual differences in discounting.

As a final note, our findings should also serve as a caution to researchers. As

discussed earlier, researchers usually choose temporal descriptions for arbitrary or

pragmatic reasons. Consequently, we, as researchers, often end up proposing as

general truths findings that apply only to the particular descriptions used in their

studies, a possibility given weight by the finding, in Experiment 4, that evidence for

hyperbolic discounting depends on temporal description. Perhaps we should be more

careful to follow the 'operational approach' advocated by Percy Bridgman (1927)

almost 80 years ago

> If we have more than one set of operations [i.e., way of obtaining a result or
>
> measuring a phenomenon], we have more than one concept, and strictly there
>
> should be a separate name to correspond to each different set of operations. (p.
>
> 10).

When we measure effects in intertemporal choice, or in any other area of judgment

and decision making, we should be aware that those effects apply unambiguously only

to the specific set of operations we have chosen. Date-discounting and delay-

discounting are different concepts[6], and the implications we draw from one kind of

discounting do not necessarily apply to the other.

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Endnotes

[1] It must be emphasised that Strotz was not explicitly making a claim about temporal description, but only about the two factors that go into time discounting. Inadvertently, he described a significant phenomenon.

[2] Questionnaires were not used if they were incomplete, or if they had at least one response implying a negative discount rate, or an uninterpretable response. Uninterpretable responses were those in which words were used in place of numbers, times were filled-in when amounts were required, or vice-versa.

[3] Note that this list excludes a large number of studies in which interval length was not held constant.

[4] There are good reasons for the two kinds of presentation that have nothing to do with the date/delay effect. A Euro bill offering is put on the market on one day, and matures on a specific day, and so it is natural – and legally required – to describe the offering in terms of dates. On the other hand, consumer loans are flexible instruments that vary both in the time when they become available, and the repayment term. Again, it is natural to describe the terms in more abstract 'delay' terms.

[5] There was one curious exception. When this passage was first written in December 2003) several retailers were offering 'Buy now, pay nothing until 2005' credit, which is somewhere between date and delay. But 2005 was barely more than 12 months away (and payments are to start in January 2005), and we suspect people will perceive the difference between 2003 and 2005 as greater than 12 months. Within a few weeks, in January 2004, the offer had changed to 'Buy now, pay nothing for 12 months.'

[6] Later, Bridgman asserts about two kinds of measurement: 'The practical justification for retaining the same name is that within our present experimental limits a numerical difference between the results of the two sorts of operations has not been detected. (p. 16)'

Table 1

Amounts and times used in Experiment 1.

	Question							
	A		B		C		D	
	SS	*LL*	*SS*	*LL*	*SS*	*LL*	*SS*	*LL*
Amount(£)	370	450	520	740	770	1480	900	1200
Date	Sept 26, 2003	June 25, 2004	July 25, 2003	Nov 26, 2004	Nov 28, 2003	May 26, 2006	Aug 29, 2003	Sept 24, 2004
Months	4	13	2	18	6	36	3	16
Weeks	17	56	9	78	26	156	13	65

Table 2
Percent choosing the later (LL) amount given different
descriptions of time period in Experiment 1

Question	Description		
	Date	**Month**	**Week**
A	60	29	14
B	63	18	07
C	60	43	32
D	53	18	21
Mean	59^{1}	27^{2}	19^{2}
N	30	28	28

Numbers in a row with a common superscript do not differ
significantly by Tukey HSD test.

Table 3
Amounts and times used in Experiment 2.

	Question							
	A		**B**		**C**		**D**	
	SS	**LL**	**SS**	**LL**	**SS**	**LL**	**SS**	**LL**
Amount in £	370	450	520	740	70	1480	900	1200
Date	Oct 31, 2003	July 7, 2004	Aug 29, 2003	Dec 31, 2004	Dec 26, 2003	June 30, 2006	Sept 26, 2003	Oct 29, 2004
Delay (months)	4	13	2	18	6	36	3	16

Table 4
Analyses of variance for all Questions in Experiment 2. All df = (1, 127)

	Question							
	A		**B**		**C**		**D**	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Reference: Date versus delay	18.66	.00	41.65	.00	23.58	.00	29.74	.00
Timing: $\cdot$SS or $\cdot$LL	6.96	.01	9.67	.00	25.04	.00	3.45	.07
Attribute: *x* or *t*	0.27	.61	8.50	.00	20.71	.00	0.00	.96
R´A	0.34	.56	0.34	.56	6.95	.01	6.80	.01
R´T	0.27	.60	2.31	.13	0.35	.56	0.03	.86
T´A	5.72	.02	4.99	.03	11.12	.00	6.19	.01
R´A´T	0.22	.64	4.89	.03	0.44	.51	1.07	.30

Table 5
Amounts and times used in Experiment 3.

	Question							
	A		**B**		**C**		**D**	
	SS	*LL*	*SS*	*LL*	*SS*	*LL*	*SS*	*LL*
Amount (£)	900	1200	750	2000	520	780	465	870
Date	Feb 27, 2004	June 24, 2005	April 30, 2004	Oct 31, 2008	Dec 26, 2003	Oct 28, 2005	Mar 26, 2004	Feb 23, 2007
Delay (month)	4	20	6	60	2	24	5	40

Table 6
Percent choosing the later (LL) amount given different
descriptions of time period in Experiment 3

Question	Description		
	Date	**Month**	**Date-plus-month**
A	47	18	23
B	50	25	33
C	33	21	13
D	30	11	13
Mean	40^1	19^2	21^2
N	28	30	30

Numbers with a common superscript do not differ
significantly by Tukey HSD test.

Table 7
Dates, delays and interval lengths in all conditions of Experiment 4

Interval	Reference	t_1	t_2	t_3	t_4	t_5
				Time points		
Short	Date	Aug 30, 2002	Nov 29, 2002	Feb 28, 2003	May 30, 2003	Aug 29, 2003
	Delay	In 1 month	In 4 months	In 7 months	In 10 months	In 13 months
Long	Date	Oct 25, 2002	Aug 29, 2003	April 30, 2004	Jan 28, 2005	Oct 28, 2005
	Delay	In 3 months	In 12 months	In 21 months	In 30 months	In 39 months

Figure 1
Results of Experiment 2, showing effect of Date and Delay when matching on both amount (x_S and x_L) and time (t_S and t_L).
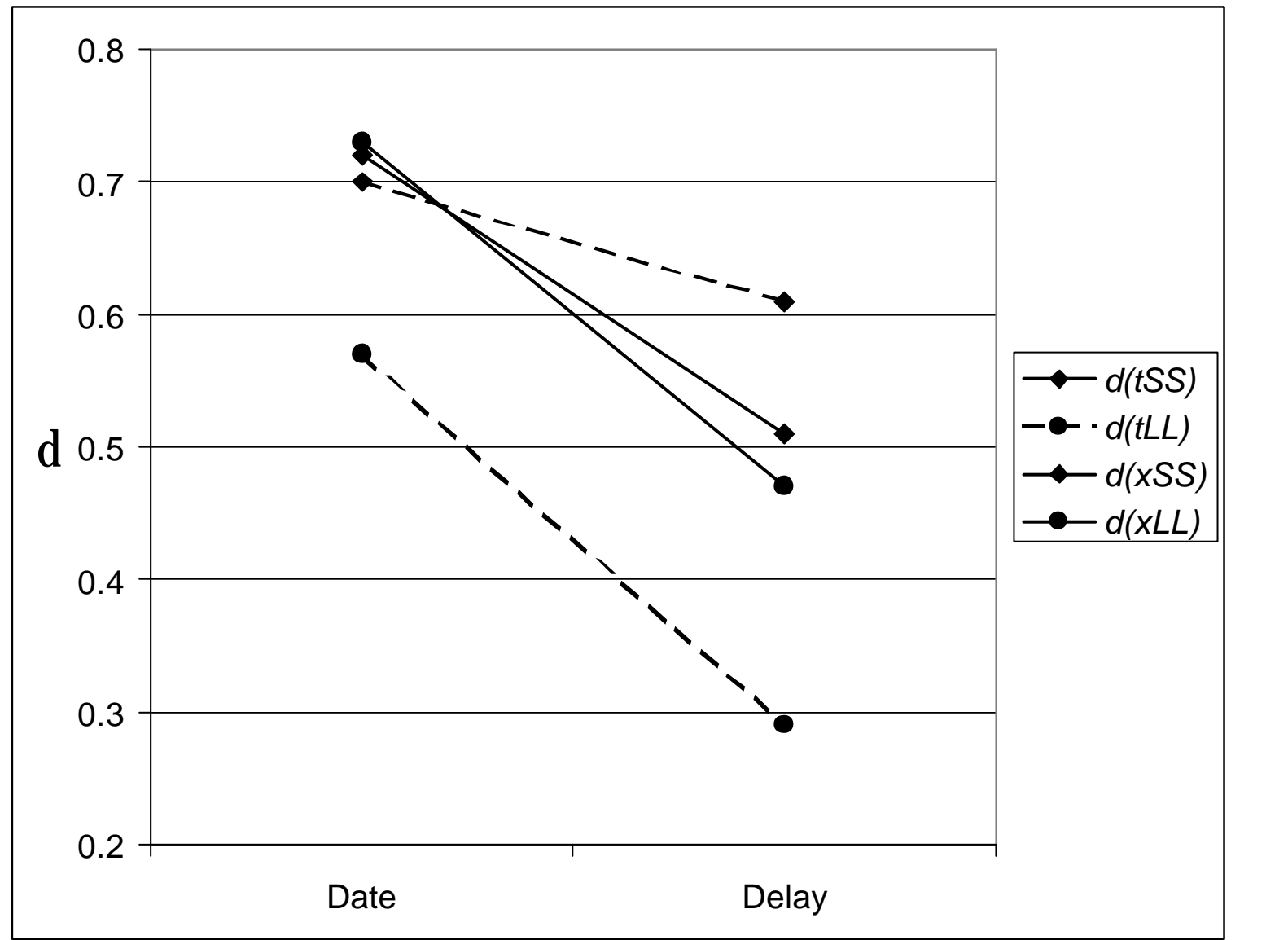
Figure 2: Results of Experiment 4, showing effect of Date and Delay.