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Contrast effects on sequence assessments

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

This thesis benefits from discussions with colleagues, my supervisor and the two examiners. However, where their contributions are noted, all views remain my own.

Contrast effects on sequence assessments

Abstract

Loewenstein and his colleagues found divergent preferences for outcomes assessed in isolation versus those embedded in a sequence, i.e. discounting isolated future outcomes versus preferences for increasing and constant sequences. They also found long intervals (i.e. the difference between time delays) rather than long time delays (i.e. the temporal distance from the present) had a detrimental effect on preference for improvement. This thesis proposes a descriptive model of sequence preferences, namely the contrasts model, which acknowledges the difference between interval and delay. The idea is that delay and interval are two different kinds of variables. Delay is non-relational and describes characteristics of individual outcomes, whereas interval is relational and describes characteristics of outcomes in relation to one another. Built on this idea, the contrasts model assumes that the value of a sequence consists of a non-relational part (the endowment value), which is a function of delay and nominal value of the component outcomes and a relational part (the contrast value), which is a function of the signed value difference between the outcomes, their interval and domain relatedness (i.e. whether or not the outcomes share the same domain). Delay and interval influence the endowment and the contrast respectively. Empirical investigations provide evidence for the contrasts model. Decision makers are capable of distinguishing between influences of delay and interval even when the two coincide and exert conflicting influences. Experiments using both money and non-monetary outcomes also show that preferences for improvement can be made more pronounced by shortening intervals and/or enhancing relatedness between the outcomes.

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Notation	Description
r	discount rate
δ	discount factor or discount parameter in the contrasts model
β	parameter of the improvement predictor in LP and the contrasts model
σ	parameter of the spreading predictor in LP
σ'	parameter of the spreading predictor in the contrast model
{}	brackets of choice, e.g. { puddings for Monday, puddings for Saturday}
$(e_1, e_2, \ldots e_n)$	a temporal sequence that consists of *n* events/outcomes
CLT	the Construal Level Theory
CV	the contrast value of a sequence
DU	the Discounted Utility model
EV	the endowment value of a sequence
IEM	the Inclusion/Exclusion model
LP	Loewenstein and Prelec's (1993) model of sequence preferences
NV	the nominal value of a sequence
TG	Tversky and Griffin's (1991) endowment and contrast effects framework

Chapter 1 INTRODUCTION

A sequence is a series of outcomes spaced over time (Loewenstein & Prelec, 1993). Sequences are ubiquitous. Almost all decisions have costs and benefits extended into the future. These include important life-time decisions, e.g. schooling and marriage, as well as seemingly trivial ones, e.g. whether to snack on an apple or a chocolate bar. Chocolate bars may bring higher immediate pleasure; apples however offer greater long-term benefits to health.

Sequence preferences, i.e. how people would like to experience multiple outcomes, are central to our well-being. In economic analysis, sequence preferences are traditionally handled within the framework of normative discounting models, e.g. the discounted utility model (or DU; Koopmans, 1960; Samuelson, 1937). These models assume "outcome independence", or that the value assessments of outcomes are independent of each other. Thus the value of a sequence can be expressed as an additive combination of the values of its component outcomes. The impact of *time delay*, i.e. the time distance of an outcome to the present, is embodied in *discount parameters*, e.g. *discount rate*, which is the percentage by which the value is reduced for each time period or *discount factor*, which is the remaining proportion of value after one period of delay. For single outcomes, delayed outcomes are valued less than immediate ones. That is, discount rates are mostly positive; so we say that *positive time preference* prevails (Frederick, Loewenstein, & O'Donoghue, 2002). Treating a sequence as a collection of isolated outcomes leads to the prediction that a falling series of utility levels (a *decreasing sequence*) is more attractive than a rising series (an *increasing sequence*) because the former allows the more desirable (or less undesirable) outcomes to be experienced sooner rather than later.

Such predictions contradict a large body of empirical evidence. While it is true that people prefer gains earlier rather than later, they also prefer increasing sequences to decreasing ones. The so-called *preference for improvement* has been observed in a variety of domains for both positive and negative outcomes, monetary and non-monetary outcomes (Chapman, 1996; Guyse, Keller, & Eppel, 2002; Hsee & Abelson, 1991; Loewenstein & Prelec, 1991, 1993; Loewenstein & Sicherman, 1991; Read & Powell, 2002; Ross & Simonson, 1991; Stevenson, 1993); it even applies to retrospective assessments of aversive experiences, such as pains and discomfort (Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993; Varey & Kahneman, 1992). In addition to this, people sometime prefer to spread outcomes evenly across time. Loewenstein and Prelec (1993) called these two kinds of preferences, i.e. preference for improvement and preference for spreading, the two *modal* sequence preferences. Modal sequence preferences imply time preferences that are non-positive.

The divergent time preferences result in part from how one makes decisions, or the level of *choice bracketing* (Read, Loewenstein & Rabin, 1999). Under narrow bracketing, the decisions are made in isolation, whereas under broad bracketing, the decisions are made at the same time, taking into account effects of one decision exerts on other decisions. Outcomes presented in isolation versus in a sequence foster narrow and broad bracketing respectively. That people tend to bracket choices narrowly exacerbates positive time preference for isolated outcomes.

The co-existence of positive and negative time preferences does not represent the only challenge faced by DU. A more fundamental problem is that features important for sequence assessments do not exist for isolated outcomes. These include the so-called “Gestalt characteristics” or sequence-level characteristics such as the *trend* (Loewenstein & Prelec, 1991), the *velocity* of the trend (Hsee & Abelson, 1991;

Hsee, Salovey, & Abelson, 1994), the *peak* and *end* values (Fredrickson & Kahneman, 1993; Kahneman, et al., 1993; Ross & Simonson, 1991). Also important are factors that operate on people's perceptions about sequences, which include the length of *interval* (Loewenstein & Prelec, 1991, 1993), i.e. the difference between the two delays, as well as the ways in which sequences are *partitioned* (Ariely & Zauberman, 2000, 2003). Notably, influences of interval and delay diverge systematically. Interval rather than delay determines outcome *integrity*, or the degree to which outcomes are perceived as a whole (Loewenstein & Prelec, 1993), which in turn affects preference for improvement.

As an alternative to DU, Loewenstein and Prelec (1993) proposed a model (henceforth LP) that described sequence preferences based on the idea that people derive utility not only from direct experiences, but also from *memory* and *anticipation* (Loewenstein, 1987; Loewenstein & Elster, 1992). A desirable event, once experienced, no longer provides a source for anticipatory utility. Worse, it may serve as a comparison standard and in so doing, decrease the perceived attractiveness of later, related experiences. The opposite holds for negative experiences. This kind of "triple-counting" of utility, i.e. before, during and after the actual experience, explains why people may choose to delay a positive experience while at the same time expedite a negative one.

Compared to DU, Loewenstein and Prelec's model achieves great improvement in descriptive validity. However, their model has no place for interval, as it does not differentiate between interval and delay. In this thesis, I propose a model, namely "the contrasts mode", which acknowledges this difference. To do so, I define two types of variables. I assume delay is a *non-relational* variable and interval is a *relational* variable, so called because interval rather than delay captures the relationship between the outcomes. Delay measures *psychological distance* of an isolated outcome and determines outcome representation and assessments. I discuss impact of delay using Trope and Liberman's (2000, 2003) *Construal Level Theory*. By contrast, interval reflects how *similar* outcomes are perceived in terms of *time*. Similarity determines grouping and categorization (Higgins & Brendl, 1995; Kahneman & Tversky, 1982; Tversky, 1977). This provides an account for the interval effect on outcome integrity (Kahneman & Tversky, 1979), with implications for how people perceive a set of outcomes, how these outcomes interact with each other (Schwarz & Bless, 1992) as well as the strength of such interactions (Higgins & Brendl, 1995). None of these are applicable to delay.

To incorporate these ideas into describing sequence preferences, I elaborate on Tversky and Griffin's (1991) *endowment and contrast effects* framework (or TG). It assumes that the way temporal outcomes interact with each other conforms to the so-called *context effects,* i.e. influences of the decision context on judgments. The idea is that each sequence outcome, except for the very last, exerts dual influences on the assessment of the entire sequence – a direct endowment effect that reflects its true worth and an indirect contrast effect that affects the assessment of later, related outcomes. The difference between endowments and contrasts parallel the one between delay and interval. Endowments are specific to individual outcomes whereas contrasts arise between outcomes. In other words, endowments and contrasts are *non-relational* and *relational* effects respectively. It is therefore logical to assume that delay affects the endowment but not the contrast and interval affects the contrast but not the endowment. The "contrasts model" of sequence preferences thus distinguishes between the influences of the two temporal variables. The same logic predicts that *domain relatedness*, a relational variable that captures the degree to which outcomes are perceived as of the same kind, exerts similar influences as interval rather than delay.

Exactly how interval and relatedness affect contrast effects can be understood from research on context effects. Based on this research, contrast effects are more pronounced between more related outcomes and/or outcomes with shorter time intervals. Delay, on the other hand, fosters discounting; the longer the delay, the greater the discounting, the smaller the endowment value will be. A sequence is more attractive if it has a large endowment and/or a large contrast. Intervals exert dual influences on sequence preferences because for a series of future outcomes, shorter intervals imply shorter time delays. Thus shorter intervals not only enhance contrast effect but also entail less discounting.

The rest of the thesis illustrates these ideas. The first four chapters, from Chapter 2 to 5, lay the theoretical foundation of the contrasts model. Chapter 2 reviews empirical findings of time preferences, i.e. preferences for isolated outcomes and preferences for sequences, highlights the difference between the two, and examines psychological mechanisms underlying sequence preferences. Chapter 3 explores the difference between interval and delay, derived from the Construal Level Theory and research on similarity. Chapter 4 discusses context effects and show influences of interval and delay. Chapter 5 discusses influences of choice bracketing on perceptions and assessments of sequences.

Chapter 6 consolidates these ideas and presents the contrasts model in formal terms. The main hypothesis is that sequence preferences depend on both the endowment effects and the contrast effects. The endowment effects in turn depend on the nominal values of the outcomes and their respective time delays; the contrast effects depend on the signed value difference between the (adjacent) outcomes, their lengths of interval and degree of relatedness.

Chapter 7 to 10 report experiments that test these predictions. *The ranking task* in Chapter 7 tests trend effect, i.e. the magnitude of improvement (deterioration) as captured in the signed value difference. *The sequence judgment task* in Chapter 8 examines the influences of relatedness and interval on contrast effects. That is, as the outcomes become related or temporally nearer, whether the value discrepancy between increasing and decreasing sequences (endowment) would become larger. One implication of the contrast effects is that interpersonal contrasts (i.e. contrasts between outcomes received by different individuals) parallel intrapersonal ones (i.e. contrasts between outcomes embedded in a sequence). *The interpersonal judgment task,* also reported in Chapter 8, adopts the same design as the sequence (intrapersonal) judgment task. The difference is that the "context" is now a gain received by another individual rather than by the same individual at a different time. Comparing and contrasting the results of these two studies provide insights into contrast effects in the two different types of judgment tasks. A parallel between the two, if found, would provide support for the approach of describing sequence preferences by borrowing insights from research into context effects.

The experiments so far assume delay has no impact on sequence assessments. Chapter 9 tests whether this assumption holds empirically. *The scheduling task* re-examines the classic "abrasive aunt" experiment (see Example 2.3), under six different combinations of interval and delay (two levels of delay x three levels of interval). The results provide a base for answering two questions: 1) how outcomes embedded in a sequence are discounted and 2) whether and how discounting (which depends on delays) interferes with preference for improvement (which depends on intervals).

Finally, Chapter 10 reports the *happiness task* that explores the notion of dual influences. The assessment of sequences occurs when multiple variables as hypothesized in the contrasts model vary, thus affecting simultaneously the endowment values and the contrast values of a sequences. By presenting sequences with different nominal values (endowment), this study also tests the robustness of the contrast model and obtains further evidence that the value of a sequence depends on comparisons between the outcomes rather than the value of one single outcome, e.g. the last or the first outcome in the sequence. I conclude in Chapter 11 by summarizing findings, discussing implications, and identifying areas for future research.

Chapter 2 SEQUENCE PREFERENCES

2.0 Introduction

Over the years the question of how value changes over time has stimulated fruitful research in a wide range of disciplines, including psychology (Read & Loewenstein, 2000), behavioural economics (Thaler, 1981), political sciences (Schelling, 1984), and neuroeconomics (Camerer, Loewenstein, & Prelec, 2005). This investigation employed a diverse range of methods and techniques, including real choices, laboratory experiments, econometrics and even medical test such as functional Magnetic Resonance Imaging. Loewenstein, Read and Baumeister's book (2003) surveys recent developments in the field. This body of research lends insight into people's divergent time preferences for isolated outcomes versus for sequences, as well as the difference between interval and delay. This chapter examines this topic.

My plan is this. I start by discussing the Discounted Utility model (DU, Koopmans, 1960; Samuelson, 1937), which remains the framework of choice for predicting preferences for future outcomes. I show how preferences for isolated outcomes differ systematically from preferences for sequences. Differences between interval and delay emerge. I then examine psychological mechanisms underlying the two modal sequence preferences, i.e. preferences for improvement and spreading. In the end of the chapter, I introduce the notion of *choice bracketing* to show how the way people make choices affects decisions.

2.1 The discounted utility model (DU)

The discounted utility model (DU) is the traditional approach and remains the framework of choice for handling time preferences. In a general form, the value of a stream of future consequences is a function of utility pertaining to individual outcomes. That is, $V=f(u_0, u_1, \ldots u_t)$, where u_t denotes the consumption utility at time t. As a particular instantiation of this general model, DU assumes outcome independence, meaning that the value of an outcome is independent of other outcomes in the same sequence. This assumption, in combination with a series of technical axioms collectively known as "completeness", implies the *General Additively Separable* representation (Loewenstein, 1992):

$$V= \sum d(t)u_t, \qquad \text{--- (2.1)}$$

In Eq.2.1, $d(t)$ is a discount function that reflects the impact of time delay t on the value of an outcome received at time t. Two common representations of discount function are *discount factor*, denoted as δ_t, and *discount rate*, denoted as r_t. Discount factor captures the proportion of value remained after an outcome has been delayed by a standard time unit (t), e.g. a year; discount rate is the percentage by which the value is reduced for each time period. The relationship between the two discount parameters is straightforward, i.e. δ_t=1-r_t. For instance, a yearly discount factor of 0.9 implies that £100 to be received a year from now is worth £90 now; and a yearly discount rate of 10% implies that in a year's time £100 now will be worth 90% (=1-10%) of its original worth, or £90. An individual is said to have *positive* (*negative*) *time preference* if her discount rates are positive (negative), or if her discount factors are less (greater) than 1. For such individuals, we say that value decays (accrues) over time.

DU has a distinctive feature. Time preferences are condensed into one single parameter. The task of finding the *right* one is however far from straightforward – with the exception of money. Fisher (1930) showed early on that the choice of discount rates *should* be equal to the prevailing market interest rate (x) irrespective of an individual's idiosyncratic time preferences. The idea is that the existence of capital markets allows individuals to make intertemporal trade-offs – one can speed up a future consumption or delay an immediate one to the extent that his or her marginal rate of time preference would always equal the interest rate for money (Loewenstein & Thaler, 1989). This implies a fixed relationship between discount factor and market interest rates, i.e. $\delta_t = 1/(1+x)$, where x is the prevailing market interest rate. Inserting this into Eq.2.1 produces $V = \sum_{t=0}^{n} \frac{u_t}{(1+x)^t}$, which is the well-known expression for computing the *net present value* (NPV) of a sequence of future incomes.

2.1.1 Preferences for isolated outcomes

Theoretically, the NPV expression is applicable to monetary outcomes or non-monetary outcomes measurable by money. It makes two predictions: people *discount* future outcomes and have *consistent* time preferences. Discounting is based on the fact that market interest rates are almost universally positive. Since any unspent money can be saved or invested to earn interests, future money *should* be valued less than immediate money. Time consistency means one's later preferences "confirm" rather than contradict his earlier preferences (Frederick, et al., 2002). This stems from the use of a constant discount parameter regardless of time delay. In the NPV formulation, this discount rate is the prevailing market interest rate for all time periods, no matter how distant or near the outcomes are.

Empirical investigations provide strong support for positive time preference (Benzion, Rapoport, & Yagil, 1989; Frederick, Loewenstein, & O'Donoghue, 2002; Read & Loewenstein, 2000; Thaler, 1981) but not for time consistency. For instance, Thaler (1981) showed that when the acquisition of money or consumer commodities was delayed, people demanded a premium to offset the disutility caused by the delay.

Loewenstein and Prelec (1993) showed that 82% of their participants who enjoyed French food preferred to have a French dinner in one month rather than in two months.

On the other hand, "inconsistent" behaviours are abundant in real life – we *plan* to work on a paper/go on a diet/start exercising only change our mind in the presence of more tempting alternatives, e.g. surfing internet/having desserts/dozing off. *Hyperbolic discounting* (Ainslie, 1992) refers to the empirical finding that discounting is slower (i.e. a larger discount factor or a smaller discount rate) when the delay is longer. For instance, Thaler (1981) asked people to state the future value of amounts of money available now, if they were delayed by times varying from 3 months to 10 years. Given a present amount of $15, people's implicit discount rate decreased from 277% when the delay was three months to 19% when the delay was ten years. Dozens of follow-up studies found similar results (Read, 2004). Hyperbolic discounting predicts *time inconsistency*, i.e. preference reversals between a smaller sooner option (*SS*), e.g. having desserts, and a larger later option (*LL*), e.g. exercising, when both options are delayed. The idea is that the shorter the delay, the faster the discounting. Thus, compared to *LL*, *SS* loses value at a faster rate when both options are delayed. People who prefer *SS* to *LL* when both options are near may prefer *LL* to *SS* instead when both are distant (Ainslie, 1992; but see Read, 2001b).

Unlike DU, hyperbolic discounting relaxes the assumption of time consistency. In so doing, it provides a more accurate account of how people actually assess future outcomes. As DU, however, hyperbolic discounting assumes positive time preference. This assumption works for isolated outcomes but becomes problematic for outcomes embedded in sequences, as we see next.

2.2 Sequence preferences

In sharp contrast to the "impatience" people exhibit towards isolated outcomes is their patience when facing a set of temporally distributed outcomes – people sometimes want to save the best till last, rather than to have them as soon as possible, or they want to spread outcomes evenly across time. Loewenstein and Prelec (1993) refer to *preference for improvement* and *preference for spreading* as the two *modal* sequence preferences. In what follows, I review each in turn and examine their underlying mechanisms.

2.2.1 Improvement

Preference for improvement is illustrated in Example 2.1 (Loewenstein & Prelec, 1991). All the respondents to Choice 1 and Choice 2 preferred French food to Greek food. The response pattern to Choice 1 reveals positive time preference – an overwhelming majority (80%) preferred to have the French dinner this month rather than next month. But when the French dinner was presented along with the less preferred Greek dinner, only 43% chose to do so. Loewenstein and Prelec replicated the results by replacing the Greek dinner with *a dinner at home* (Example 5.2, Chapter 5).

Example 2.1 (n=82)

Choice 1			Choice
A.	French dinner in this month		[80%]
B.	French dinner in next month		[20%]

Choice 2	This month	Next month	Choice
C.	French dinner	Greek dinner	[43%]
D.	Greek dinner	French dinner	[57%]

Ross and Simonson (1991) reported similar findings. Their participants strongly preferred sequences of gambles that ended with a gain (lose $15, then win $85) to those that ended with a loss (e.g. win $85, then lose $15), despite the same expected payoffs of the gambles. They subsequently referred to this finding as a preference for "happy endings". Hsee and Abelson (1991) further showed that their undergraduate participants preferred a fast rise in salary and academic performance to a slow rise, as well as a slow fall to a fast fall. That is, preference for improvement is moderated by the *velocity* in which the value changes over time (Hsee & Abelson, 1991). Later investigation by Hsee, Salovey and Abelson (1994) found that the impact of velocity was particularly salient towards the end of a sequence. That is, satisfaction was higher if the rate of change increased for increasing sequences and decreased for decreasing sequences.

Preference for improvement receives strong support from literature – it has been observed in a diverse range of domains, including monetary incomes (Loewenstein & Sicherman, 1991), weekend activities (Loewenstein & Prelec, 1993), dinners (Loewenstein & Prelec, 1991), gambling (Ross & Simonson, 1991), academic performances (Hsee & Abelson, 1991), health states (Chapman, 1996; Read & Powell, 2002), environmental goods (Guyse, et al., 2002). It holds even when people search for an ordered set (Diehl & Zauberman, 2005) and make retrospective assessments of aversive experiences, such as pains and discomfort (Kahneman, et al., 1993; Varey & Kahneman, 1992).

Why is preference for improvement so prevalent? It seems that this preference is overdetermined, motivated by multiple psychological mechanisms including *savouring* and *dread* (Loewenstein, 1987; Loewenstein & Elster, 1992), adaptation (Helson, 1964), loss aversion (Kahneman & Tversky, 1979), and the closely related *contrast effects* (Loewenstein & Elster, 1992; Mussweiler & Strack, 2000; Schwarz & Bless, 1992a; Tversky & Griffin, 1991).

First, Loewenstein (1987) argued that people derive utility from anticipatory savouring and dread. His participants preferred to delay a kiss from their favourite movie star for a few days while to receive unpleasant electric shocks as soon as possible. Loewenstein (1987) explained that these actions enhanced one's satisfaction by permitting the accumulation of utility and avoiding that of disutility. This implies that people will perceive the improving sequence of events (immediate shock, delayed kiss)[1] to be more attractive than the deteriorating sequence of events (immediate kiss, delayed shock).

Second, adaptation-level theory posits that people tend to adapt to on-going stimuli over time and to evaluate new stimuli relative to their adaptation-level. Kahneman and Tversky's (1979) notion of loss-aversion refers to the observation that a loss is more painful than a gain of the same magnitude. For sequences, if people

[1] In this thesis, I denote a sequence composed of *n* outcomes as (*Outcome 1, … Outcome n*) in the order of their occurrence.

adapt to the most recent level of stimuli they experience, then sequences that strictly improve afford a continuous series of upward shift, perceived as gains. By contrast, decreasing sequences provide a series of losses. Since losses loom larger than gains, increasing sequences are particularly attractive compared to decreasing sequences.

Third, Tversky and Griffin (1991) argue that a hedonic event may contrast with a later event and change its perceived attractiveness. The direction of these contrasts is predominantly *backward* (Bruine de Bruin & Keren, 2003; Loewenstein & Elster, 1992; Prelec & Loewenstein, 1991); that is, an earlier event serves as a comparison standard for a later event, rather than *forward*, or the other way around. Backward contrast effects predict that having inferior experiences earlier enhances the attractiveness of later, superior experiences (Heyman, Mellers, Tishcenko, & Schwartz, 2004), and consequently the attractiveness of the entire sequence. I review contrast effects and their implications in Chapter 4, to provide a basis for extending the idea into the contrasts model that describes sequence preferences.

Notably, savouring and dread is unique among these accounts in that it does not require decision makers to make comparisons between the outcomes – people preferred immediate shocks and delayed kisses even when they encountered each outcome *in isolation*[2]. Nevertheless, the response pattern in Example 2.1 shows that presenting outcomes in pairs may exacerbate this preference by means of other mechanisms reviewed in this section, for which comparisons between temporally distributed outcomes are instrumental.

[2] In making this claim, I assume that people do not contrast shocks and kisses with events that are not directly presented to them, such as events retrieved from memory. This assumption is holds due to a strong tendency of narrow bracketing (Read et al 1999). However, it could be that shocks and kisses are contrasted with "mundane" life events retrieved from memory. This thesis only considers contrasts between outcomes presented to a decision maker.

2.2.2 Spreading

In addition to improvement, people sometimes prefer to spread outcomes evenly across time. This is illustrated in Example 2.2 (Loewenstein & Prelec, 1991).

Example 2.2 (n=37)

Choice 1	This weekend	Next weekend	Two weekends from now	Choice
A.	Fancy French	Eat at home	Eat at home	[14%]
B.	Eat at home	Fancy French	Eat at home	[86%]

Choice 2	This weekend	Next weekend	Two weekends from now	Choice
C.	Fancy French	Eat at home	Fancy lobster	[54%]
D.	Eat at home	Fancy French	Fancy lobster	[46%]

Among the three outcomes that constituted the four sequences in Example 2.2, the fancy lobster is the most desirable while eating at home the least, relatively speaking. The preference for Option B over A and the indifference between Option C and D each violates positive time preference, which would predict a preference for A over B, and one for C over D; the response pattern in Choice 2 did not conform to improvement either – despite having a consistent increasing trend over three weeks, D is not more desirable than C. What makes Option B and C more attractive than implied by improvement alone is the spreading of the global satisfaction. In comparison, Option A exposes the decision maker to the least desirable outcome for two weeks in a row and Option D concentrates the two desirable outcomes together.

Stevenson (1993) also reported a preference for spreading when her undergraduate participants assessed college loans and work-study scenarios.

What makes spreading desirable? One explanation is that spreading offers decision makers “convenience” in resource allocation. Read and Powell (2002) collected verbal protocols from participants before asking them to make choices of health and income sequences that increased, remained constant and decreased over time. Their participants who preferred constant sequences argued that constant sequences made “managing [one’s] budget so much easier”.

Spreading also allows people to replenish their “limited coping capacities” in time (Linville & Fisher, 1991), and therefore avoid the prospect of being overwhelmed by positive or negative hedonic experiences. Since losses loom larger than gains (Kahneman & Tversky, 1979), this account would predict a stronger tendency for spreading losses than gains. Consistent with this, Linville and Fisher found that while people preferred to spread large gains ($250 or $200) but not small gains ($5), they preferred to spread both large and small losses of the same amount.

A concave value function may contribute to spreading as well (Kahneman & Tversky, 1979; Thaler & Johnson, 1990). If we assume that decision makers form global assessments by first assessing each individual outcome and then combining these assessments, then they can maximize the global satisfaction by spreading, such as by splitting a lump sum gain of 200 pounds into two gains of 100 pounds. Note that this account cannot explain the preference for spreading losses because the value function for losses is convex rather than concave.

It is worth noting that preference for spreading is not restricted to time. Just as college students choose to distribute loans over four academic years (Stevenson, 1993), employees choose to invest the same share of their retirement funds in equities and bonds, or however many investment options (e.g. *n*) they are provided, a finding known as "*1/n* heuristic" in resource allocation (Benartzi & Thaler, 1998, 2001). Linville and Fisher (1991) found that people were less inclined to spread across time outcomes of different kinds (e.g. a large monetary refund and an excellent academic grade) than outcomes of the same kind (e.g. two excellent academic grades). This might happen because outcomes of different kinds were less likely to be assessed as a whole, and therefore less likely to pose a threat to one's limited coping capacities.

These examples show that spreading takes place across time periods as well as across domains. Underlying both is the idea that similar outcomes tend to be grouped together and assessed together and the similarity depends on the interval between the outcomes and/or their contents, i.e. what the outcomes are. Preference for spreading is manifested as the desire to distribute outcomes across groups, regardless of on which attribute(s) these groups are defined.

The parallel between temporal and non-temporal attributes in spreading highlights a difference between the two modal sequence preferences. Temporal grouping is not inherent in any of the factors underlying preference for improvement. This provides an explanation that preference for spreading is pronounced when the task is to allocate a fixed sum (e.g. Stevenson, 1993). Another implication is that each of the two modal sequence preferences can arise on its own. On the other hand, it is possible that preference for spreading reflects a compromise between the conflicting positive and negative time preferences, when decision makers discount the future but at the same time want to experience improvement over time. Consistent with this, outcomes embedded in sequences might also be discounted, as we see next.

2.3 Perceptions of sequences

Loewenstein and Prelec (1993) presented Example 2.3 to forty-eight museum-visitors.

Example 2.3 (n=48)

Imagine you must schedule two weekend outings to a city where you once lived. You must spend one weekend with an irritating, abrasive aunt who is a horrendous cook and the other weekend with former work associates whom you like a lot. Which of the following two outings do you prefer?

	Option	This weekend	Next weekend	Choices
1.	A.	Friends	abrasive aunt	[10%]
	B.	abrasive aunt	Friends	[90%]

	Option	This weekend	26th weekend	Choices
2.	A.	Friends	abrasive aunt	[48%]
	B.	abrasive aunt	Friends	[52%]

	Option	26th weekend	27th weekend	Choices
3.	A.	Friends	Abrasive aunt	[17%]
	B.	abrasive aunt	Friends	[83%]

Visiting friends was presented as a pleasant event, and visiting aunt an unpleasant one; Schedule A was therefore a decreasing sequence whereas Schedule B an increasing one. The three choices differed in either the delay of the first visit or the interval between the visits. Using the response to Choice 1 as the benchmark, discounting (positive time preference) became slightly more pronounced when the sequences were delayed by 26 weeks (7% more choosing Sequence A in Choice 3 than in Choice 1), and *much* more pronounced when the *interval* increased by the same magnitude (38% more choosing A in Choice 2).

Loewenstein and Prelec argued that their results provide evidence for the detrimental effect a long interval exerts on *outcome integrity*, or the degree to which outcomes are perceived as an integral whole. Without integrity, outcomes are perceived as isolated, bearing no relationships. As a result, these outcomes will be evaluated independently of each other. Since positive time preference dominates the assessment of isolated outcomes, long intervals enhance positive time preference at the cost of preference for improvement typical for sequences.

This "interval effect" is even observed in assessments of continuous, unpleasant experiences. Ariely and Zauberman (2000, Experiment 1) exposed participants to episodes of noise, either continuous or segmented by intervals. They found preference for improvement in both conditions, i.e. decreasing levels of intensity were rated higher than increasing ones. Importantly, this preference was more extreme, i.e. the rating difference between the noises of an increasing and decreasing magnitude was larger, in the continuous condition than in the segmented condition, providing evidence for an interval effect that mediates the preference for improvement. The authors found similar results with assessment mode: the preference for improvement was more extreme when people made a single retrospective assessment at the end of each episode than when they made on-line assessments as well as the retrospective assessment. Ariely and Zauberman (also see 2003) explained that both interval and on-line assessments disrupted the *cohesiveness* of the experience, and therefore undermined preference for improvement.

The notion of cohesiveness is essentially the same as integrity, except that while integrity is used for *discrete* outcomes, cohesiveness is specific to *continuous* experiences. Under the guise of "sequence preferences", two types of sequence, i.e. discrete and continuous, are often discussed at the same time due to their shared findings of preference for improvement, the peak-end rule and the interval effect. In what follows, I first take a closer look at continuous experiences and then examine the relationship between the two.

2.3.1 Continuous sequences

Different from discrete sequences, continuous sequences are *extended experiences* or *episodes* (Dhar & Simonson, 1999) that consist of outcomes that do not have clearly defined time boundaries that segregate one another. Continuous sequences are important because they characterize how people store *autobiography memories,* i.e. memory about things that occur in place and time. According to Barsalou (1988), people do not store in memory a stream of isolated events; rather they store temporal-causal sequences, such as a trip, a stay in the hospital or working at a job. Retrospective assessments of such experiences provide a basis for people to make future decisions.

Kahneman and his co-workers pioneered the research into the correspondence between patterns of extended experiences and their global assessments. The afore-mentioned finding of the "peak-end" rule of sequence assessments was first reported in Frederickson and Kahneman (1993), who showed participants either short or long film clips that contain either pleasant (e.g. puppy playing) or unpleasant images (e.g. an amputation) and elicited respondents' real-time ratings of their affective states and also an overall retrospective rating that summarized the entire experience at the end of the film. They found that the summary assessment was well-predicted by a weighted average of the most extreme state (peak) and the final state (end), whereas film duration had almost no influence.

The "peak-end" rule and consequently the "duration neglect" receive support from a large body of experiments (Fredrickson & Kahneman, 1993; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993; Redelmeier & Kahneman, 1996; Schreiber & Kahneman, 2000; Varey & Kahneman, 1992). In a non-experimental study, Redelmeier and Kahneman (1996) asked real patients who underwent colonoscopy to report the momentary pain they experienced every 60 seconds, as well as the total pain after the procedure was over. The procedure lasted from 4 to 69 minutes. They found a significant correlation between the total pain and a weighted average of the most intense pain and the pains recorded during the last three minutes of the procedure. The variations of duration had virtually no effect on the total pain. For a series of gains, the peak-end rule predicts preference for improvement because the latest gain is also the gain that has the highest or peak intensity.

Consistent with Barsalou (1988), Frederickson and Kahneman (2003) attribute the peak-end rule to the way experiences are stored in memories. Rather than recording all the details, memories take "snapshots", composed of the defining moments of an experience – these typically include its peak and its end, but not its duration. The disparity between the memory of an experience and the "real" experience highlights the difference between *retrospective (remembered) utility* and *experienced utility*. Since people rely on memory of past decisions to assess *predicted utility* of outcomes for making future decisions (Kahneman & Snell, 1990; Kahneman & Varey, 1991; Kahneman, Wakker, & Sarin, 1997), it is not surprising that preference for improvement, as implied by the peak-end rule, prevails in predicted as well as retrospective assessments, but not in real-time assessments (Novemsky &

Ratner, 2003). In other words, the perceived hedonic advantage of improvement over deterioration may never be experienced.

For instance, in one of Novemsky and Ratner's experiments, each of their participants selected three jelly beans from a list of eight that were respectively one they liked a lot (flavour 1), one they liked less (flavour 2) and one they liked less than the other two (flavour 3). The task was to rate the satisfaction from consuming flavour 2 when it was embedded in two sequences, either following the consumption of flavour 1 or that of flavour 3. Participants made the assessments in one of three conditions, when they *predicted* how much they would enjoy flavour 2 in each sequence, when they rated how much they enjoyed flavour 2 while tasting it in each sequence, or when they *retrospectively* rated how much they had enjoyed flavour 2, after having tasted it in the two sequences. Contrast effects would predict higher ratings assigned to flavour 2 when its tasting occurred after the tasting of the less desirable flavour 3 than after the tasting of the more desirable flavour 1. Novemsky and Ratner found evidence for contrast effects only in the *predictive* condition where the participants forecasted their satisfaction before the consumption, but not in the concurrent or the retrospective conditions.

2.3.2 Continuous versus discrete sequences

The difference between continuous experiences and discrete sequences is likely to be quantitative rather than qualitative, reflecting different degrees of cohesiveness (integrity), which might be the result of different levels of observation adopted by the decision maker. For instance, a restaurant meal is a discrete event viewed from distance but it becomes a continuous sequence of acts including ordering, waiting, drinking, eating, paying and leaving when one is having the meal. On the other hand, a biographical life[3] is continuous from birth to death, which however contains many discrete landmark events, such as entering puberty, going to university, starting one's first job, retirement, etc. That is, depending on one's perspective and level of abstraction, a discrete outcome can become continuous at a "micro-level", when the details of the outcomes are "unpacked", whereas a continuous outcome may in fact be an overview of a series of discrete outcomes.

Even at a given level, a continuous experience can still be converted to a discrete sequence. Sequence partitioning occurs when intervals are inserted within, or when we make on-line assessments instead of one overall assessment at the end of the sequence. Ariely and Zauberman's (2000) research demonstrates that partitioning decreases the impact of global characteristics (e.g. the overall pattern) but enhances the impact of local characteristics (e.g. value of individual outcomes). That is, partitioning decreases the value gap between the improving experience and the deteriorating experience. This parallels the interval effect on preference for improvement (Loewenstein & Prelec, 1993).

Since outcome cohesiveness (integrity) exerts impact on the desirability of an experience, this discussion suggests the possibility of maximizing one's satisfaction by assessing discrete experiences as continuous ones or vice versa. For instance, if a meeting is getting increasingly boring, we might focus on individual speakers or topics to mentally segment the downward pattern. On the other hand, if a movie is becoming increasingly more interesting, we might switch off our mobile phones to avoid unwanted interruptions. Why don't these manipulations happen often enough? It seems we tend to make decisions and assess outcomes the way they come. The idea

[3] This example was suggested by Peter Ayton.

is captured by Read, Loewenstein and Rabin's (1999) notion of choice bracketing, as we see next.

2.4 Influences of choice bracketing

Choices bracketed together are made together. The brackets can be narrow or broad. Under *narrow* bracketing, people make few decisions at a time; under *broad* bracketing, they make many decisions at the same time, relatively speaking. Choice bracketing has implications for time preferences. This happens because multiple outcomes are more like to be considered together under broad bracketing than under narrow bracketing. Since positive time preference prevails for isolated outcomes, narrow bracketing fosters positive time preference.

Levels of bracketing itself may depend on completely arbitrary factors. This is illustrated in Example 2.4, which Read et al presented to two groups of visitors to an International Airport in the US:

Example 2.4

> You are attending a conference at a hotel for a week (Monday morning through Monday morning). You eat all your meals at the conference hotel. The specialty of the hotel dining room is New Orleans Bread Pudding, which is delicious, but heavy on the fat and calories. However, you can have the bread pudding with dinner at no extra cost.

One group (broad bracketing) was asked to think of the entire week as a whole. They were asked: "On which day(s), if any, would you like to eat a bread pudding?" The other group (narrow bracketing) was asked the same question, only this time they had to think about their choices separately for weekends and weekdays. Both groups then checked off their decision for each day. Read et al found that the narrow bracketing group chose to eat significantly more puddings (.57 per day) than the broad bracketing group does (.35 per day). In this case, narrow and broad bracketing directly follows from the way in which the outcomes are presented. Chapter 5 illustrates choice bracketing in detail and explains why this happens.

2.5 Summary

Chapter 2 presents findings of time preferences and highlights the difference between preferences for isolated outcomes versus those for sequences. While positive time preference prevails for isolated outcomes, preferences for improvement and spreading are the two modal sequence preferences. This difference highlights the need of considering alternatives to DU in order to capture sequence preferences. Preference for improvement and spreading are motivated by different factors and each may arise on its own. Sequences can be discrete or continuous, reflecting different degrees of cohesiveness or integrity between the outcomes. Choice bracketing influences time preferences because a narrow or broad decision perspective determines whether outcomes are assessed in isolation or as a whole. Difference between delay and interval emerges: long intervals but not long delays disrupt outcome integrity and undermine preference for improvement. In Chapter 3, we take a closer look at this difference.

Chapter 3 DELAY AND INTERVAL

3.0 Introduction

Despite that interval is the simple difference between time delays, Chapter 2 demonstrates a difference in terms of their impact on time preferences. Outcome integrity depends on interval rather than on delay. Discounting is a function of delay rather than interval. Generally speaking, regardless of how distant outcomes are, an outcome will only be discounted if it is removed from the present, the extent of which is measured by time delay. I define *relational* and *non-relational* variables to capture the difference between delay and interval. Delay is non-relational as it is specific to individual outcomes, independent of the relationship between the outcomes. In other words, delay reflects the *psychological distance* of an outcome, i.e. how distant it is perceived by the decision maker. By contrast, interval is relational as it captures the temporal similarity between outcomes.

To gain further insights into the difference between these two types of variables, in what follows, I examine properties of delay and interval respectively within the framework of the *Construal Level Theory* (CLT) and *similarity*. I show how time preferences can be informed by the findings in these two lines of research.

3.1 Delay as psychological distance

Ebbinghaus proposed the notion of psychological distance, which he used to explain observed individual differences in their ways of handling a task (Ebbinghaus, 1885/1914). Sigel later used the term to capture individuals' emerging ability to understand that an object can be represented by something other than the concrete object itself (Sigel, 1970, 1982). Mischel and his colleagues were among the first who associated psychological distance with time preferences (Mischel, Shoda, & Rodriguez, 1989), by associating it with the immediacy of the moment, in which the stimulus in the *here and now* dominates. Recently, Trope and Liberman (2000, 2003) define time as a dimension of psychological distance, and time delay as a measurement of this distance. That is, the longer the delay, the more distant the outcome is from the decision maker. Their *Construal Level Theory* (CLT) posits that psychological distance determines representation of the outcome. A long delay fosters a high-level construal, when representation consists of a few abstract features that convey the essence of the outcome whereas a short delay fosters a low-level construal when representation consists of more concrete and incidental details. That is, high/low-level features, or features that are compatible with high/low-level construals, gain more weight in judgments of outcomes that are distant/near. This has direct implications for time preferences.

For instance, one of their experiments elicited monetary bids for gambles under two conditions: either played immediately or two months later (Sagristano, Trope, & Liberman, 2002). A set of 20 bets varied in probability of winning (.1, .3, .5, .7, and .9) within each of four levels of expected value ($4, $6, $8, and $10). Participants provided the amount of money they were willing to bid to play each gamble. The researchers found that for immediate gambles, the highest bids were for bets with high probability and low payoff, whereas for distant future gambles, the highest bids were for bets with low probability and high payoff. The researchers explained that the respondents based their decisions on different attributes of the gambles depending on time delays. Probabilities of winning were more important for immediate gambles but winning amount was more important for distant gambles.

Consistent with CLT, as delay increased, the effect of payoffs increased and, independently, the effect of probabilities decreased with temporal distance. This account assumes that winning amount is a high-level feature that is more central to playing the gambles whereas probability is a low-level feature that is more peripheral.

When the choice is between a smaller sooner option (*SS*) and a larger later option (*LL*), CLT predicts a preference reversal when both options are delayed. This is because *SS* is more desirable in terms of the low-level feature (i.e. the shorter time delay), whereas *LL* is more desirable in terms of the high-level feature (i.e. the larger amount). Recall in Chapter 2 this reversal is predicted by hyperbolic discounting that posits slower discounting for longer time delays. CLT therefore offers an alternative account in terms of the change in the representation of the outcomes.

It is worth noting that time is synonymous to delay within CLT. The reason is that the representation of an outcome depends on how it is perceived by the decision maker, as a function of how distant the outcomes is from his/her, who is often at the present. This representation does not directly depend upon how distant an outcome is from *other* outcomes in the same decision. Perceived length of interval however measures the latter kind of *between-outcome distance*, which I capture by the notion of *similarity*. The perceived length of interval is equivalent to the perceived *temporal similarity* between the outcomes. To gain insights into influences of interval, I discuss properties of similarity next.

3.2 Similarity

Similarity is arguably the most important theoretical construct in cognitive psychology – it underlies critical mental processes including inference, categorization, and generalization concerning learning, memory and transfer (Medin, Goldstone, & Gentner, 1993). Its properties that are most relevant to our discussion include its role in grouping and categorization, the context-dependent nature of its judgments and its influences on the perceived importance of attributes.

3.2.1 Grouping

Similarity determines grouping and categorization (Goldstone, 1994; Nosofsky, 1986) – similar objects are grouped together whereas dissimilar ones are not. Modern models of categorization offer different explanations for this. An object is categorized as an A and not a B because it is more similar to A's best representation than it is to B's (*prototype* theories), or because it is more similar to the individual items that belong in A than it is to those that belong in B (*exemplar* theories). Despite the difference, both theories assume that categorization depends on the similarity between the item to be categorized and the categories' representations.

The similarity judgment may however go beyond apparent resemblance. For instance, people judge snake and raccoon to be similar when the context of *pets* is provided (Barsalou, 1982). This happens presumably because their common features such as providing the owner with pleasure and companionship become salient in such a context. Barsolou (1982) define *ad hoc* categories (e.g. things in a room) as those categories that collect apparently dissimilar members together in response to *situational goals*, as different from natural categories (e.g. birds).

3.2.2 Context-dependency

The existence of *ad hoc* categories is evidence that similarity judgments are not fixed but flexible and context-dependent (Medin, Goldstone, & Markman, 1995; Tversky, 1977). In addition to goals, Parducci's *range-frequency* theory (1965, 1995) shows how rating scales *per se* influence similarity judgments. His *range principle* asserts that numerical ratings are linearly related to the underlying psychological impressions. A judge assigns the lowest (highest) category rating to the lowest (highest) stimulus and differences among the ratings of the remaining stimuli are proportional to the differences between their respective psychological impressions. His *frequency principle* holds that the rating is proportional to the ordinal position (i.e. the rank) of a stimulus in the set of psychological impressions. The higher this position, the higher the frequency value and vice versa. Similarity is captured by the difference in subjective values, the smaller this difference, the higher the similarity and vice versa (Parducci, 1995; Dhar & Glazer, 1996; Medin et al. 1995).

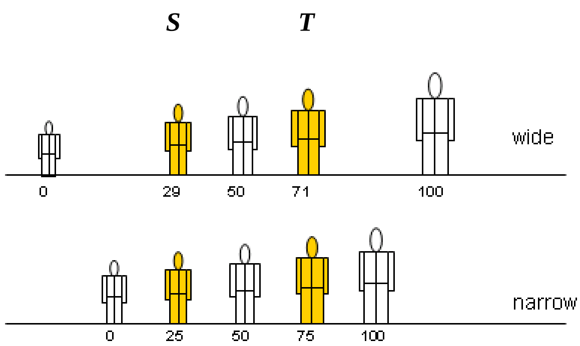

Figure 3.1. Judgments of similarity vary with the "range"

Vertically aligned figures in the two contexts have the same height. The number underneath each figure indicates the predicted rating (subjective value) based on a simple average of the range value and the frequency value. Source: Parducci, 1995.

Fig.3.1 illustrates the range principle. The task is to assess the heights of a *short* person (*S*) and a *tall* person (*T*), when they are embedded in either a *wide* context or a *narrow* context. The wide context has a more extensive range of heights compared to the *narrow* context. The two "end-persons" are assigned fixed ratings of 0 and 100. *S* (*T*) has a higher (lower) range value in the wide context than in the narrow context. This is because *S* is proportionally more different from the shortest person with respect to the entire range (positioned at 2/6 in the wide-context with a range value of 33.33=2/6×100 versus positioned at 1/4 in the narrow-context with a range value of 25=1/4×100); the reverse however holds for *T* (positioned at 4/6 in the wide-context with a range value of 66.67=4/6×100 versus positioned at 3/4 in the narrow-context with a range value of 75=3/4×100). The frequency values of both *S* and *T* however remain constant across the contexts as *T* always ranks the 2nd tallest and *S* the 4th.

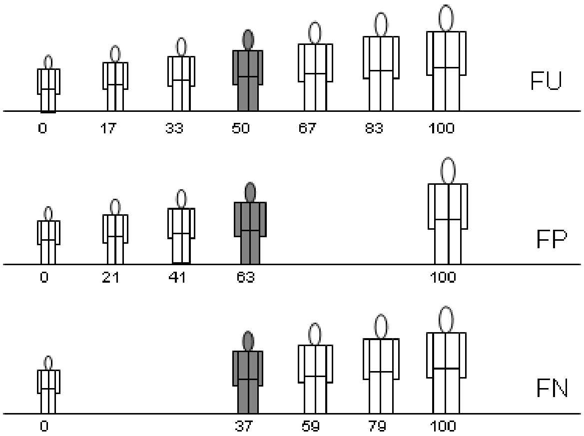

Figure 3.2.

Judgments of similarity vary with the "frequency" (ordinal position).

Vertically aligned figures in the two contexts have the same height. The number underneath each figure indicates the predicted rating (subjective value) based on a simple average of the range value and the frequency value. Source: Parducci, 1995.

What happens when the range remains constant but the ordinal position varies across the contexts? Fig.3.2 illustrates such a case. The target (shaded) is embedded in the centre of the three contexts, FU, FP and FN, and therefore has the same range value across the contexts (50=1/2×100). Its ordinal position however varies, from the highest in FP (the 2nd tallest with a frequency value of 75=3/4×100), to the middle in FU (a frequency value of 50), to the lowest in FN (the 4th tallest with a frequency value of 25=1/4×100). The higher the ordinal position, the larger the size of the frequency value and vice versa.

Parducci posits that judgments depend on both range and frequency. The subjective value is a weighted sum of the range value and the frequency value. In our example, an equal weighting (0.5) is assumed, implying that range and frequency are equally important. The dimension of interest is height; thus a higher subjective value corresponds to a greater perceived height and vice versa. The predictions appear underneath the "figuremen" in Fig.3.1 and 3.2. For instance, Fig.3.1 shows that *S* has a higher value in the wide context than in the narrow context (29 versus 25), indicating that *S* is perceived as taller in the wide context. The reverse holds for *T*, which scores 71 and 75 in the wide and narrow context respectively.

What do these tell us about similarity judgments? The hypothesis is the less similar the stimuli, the larger the difference between their subjective values, and vice versa. For instance, in Fig.3.1, the value difference between *S* and *T* is smaller in the wide context than in the narrow context (42 versus 50), indicating that the two have more similar heights in the wide context. This illustrates the *range effect* on similarity. That is, the more extensive the range, the higher the similarity and vice versa.

The frequency effect can be shown likewise. The target person in Fig. 3.2 has a larger subjective value in FP than in FN, suggesting that the target is less similar to the shortest person (always rated 0) in FP than in FN but more similar to the tallest person (always rated 100) in FP than in FN. That is, the larger the subjective value, the more similar the target is to the high-end person and the less similar it is to the low-end person and vice versa. Subsequent investigations provide support for both the range effect and the frequency effect (Mellers & Cooke, 1994; Wedell, 1998).

The range effect is consistent with the finding known as the *extension effect* (Tversky, 1977). Tversky found that participants judged Italy and Switzerland to be more similar in a context that contained both European and non-European countries, e.g. China and the U.S., than in a context that contained exclusively European countries. This is because the attribute of being a European country became more *diagnostic,* i.e. more useful in grouping the countries, when the decision context was extended to include *non*-European countries (Medin et al., 1995). Diagnosticity is embodied in decision weights. Tversky's featural model of similarity therefore predicts that Italy and Switzerland, both being European countries, are more similar in the extended context.

3.2.3 Decision weights

While the extensiveness of the decision context changes the salience of the attributes and thereby the perceived similarity, how similar multi-attribute options are on a given attribute affects how important that attribute is and consequently the preference for the options. An attribute is weighted more heavily if the options have more divergent, i.e. less similar, levels on that attribute (Payne, 1982; Tversky, 1977). This idea has made its way into decision analysis under the guise of *swing weights* (Winterfeldt & Edwards, 1986). A swing refers to the difference in the most and the least desirable levels on that attribute. The idea is that decision weights should be proportional to the swings, rather than to the absolute importance of the attributes. For instance, the number of lives saved is crucial to the assessment of any medical treatment regime. However, this attribute is useless if we are selecting from a set of alternatives that save more or less the same number of lives.

Wedell (1998) provided empirical evidence for the relationship between range and weights. As shown in Table 3.1, his participants assessed two hypothetical persons, *A* and *B*, on two attributes, *X* and *Y* (Wedell, 1998). He manipulated the ranges of the values along *X* and *Y* in two different ways. In the “wide-narrow” case, dimension *X* had a wide range of values and dimension *Y* had a narrow range; in the “narrow-wide” case, the opposite was true. Wedell measured the decision weights by subjective ratings of importance. He showed that these ratings were always greater for the dimension with the wider range, i.e. *X* in the wide-narrow condition and *Y* in the narrow-wide condition.

Table 3.1. A choice between two non-dominant options in two range conditions.

Options	*Wide* Attribute X	*Narrow* Attribute Y	*Narrow* Attribute X	*Wide* Attribute Y
A	3	4	3	4
B	4	3	4	3

Evidence that assessments depend on both dimensional similarity (which determines the subjective values of *A* and *B* on each attribute) *and* range similarity (which determines the decision weights of the attributes) comes from the observation that the global assessments were consistent with the prediction of the dimensional similarity but contradicted those of the range similarity. That is, in both narrow-wide and wide-narrow contexts, participants preferred the options that performed *worse* on the attribute they had rated as more important, i.e. *A* in the wide-range context and *B* in the narrow-wide context; also see Mellers & Cooke, 1994). Consistent with the range effect, the wider range enhanced the similarity between the options, which in this case translated into the smaller perceived disadvantages of the preferred options (Option *A* on dimension *X* and Option *B* on dimension *Y*).

3.3 Implications for time preferences

Viewing interval as reflecting perceived temporal similarity between the outcomes provides insights into findings including the interval effect on outcome integrity, the notion of time contraction, and the "similarity effect" on time preferences, as we see next.

3.3.1 Integrity

Chapter 2 introduces the notion of integrity, which refers to the degree to which (discrete) outcomes are perceived as a whole (Loewenstein & Prelec, 1993)[4]. Example 2.3 shows that as the interval increases from one week to 26 weeks, the fraction of participants preferring the increasing (Aunt, Friends) is reduced by 38% (from 90% to 52%). That is, long intervals undermine integrity. From the current perspective, integrity implies the grouping of outcomes. Integrity is therefore a function of the perceived similarity between the outcomes. Long intervals signal lack of similarity and foster a shift in one's perceptions of the outcomes from being part of a group (sequence) to being isolated. Positive time preference dominates the assessments of isolated outcomes. Therefore, long intervals undermine preference for improvement.

While the visits are of the same kind, similar findings exist for outcomes that, on the face value, share little in common. For instance, Dhar and Simonson's (1999) *consumption episode effects* refer to the finding that decision makers apply specific decision strategies to diverse outcomes, e.g. watching an opera and having a meal, that is, as long as these outcomes are perceived as constituting a *consumption episode*, e.g. an evening out. For instance, consumers facing tradeoffs between goal attributes

[4] This discussion applies to both integrity (for discrete sequences) and cohesiveness (for continuous experiences).

and mean attributes would choose to *highlight* goal achievements by sacrificing means. In one of their experiments, participants preferred an *expensive* meal to a moderately priced one when the meal took place *immediately after* an opera but not after a relatively cheap movie. They did this presumably to maximize the pleasure of the evening out. However, the highlighting strategy was not observed when the meal took place *one week* after the opera. From the current perspective, despite that watching an opera and having a meal shares little in common, they form an *ad hoc* category that is specific to the decision context and the goals. Similar to what happens in *natural* categories, however, long intervals disrupt integrity in *ad hoc* categories as well.

Since delay does not reflect temporal similarity, it is no surprise that delay has little impact on outcome integrity. In Example 2.3, as the schedules were delayed by 26 weeks, the percentage of participants preferring (Aunt, Friends) was reduced only by 7% (from 90% to 83%). However, why did sequence preferences change with delay at all? Loewenstein and Prelec (1993) explained that longer delay fostered greater discounting, which reduced the attractiveness of the improving schedule that placed the more desirable event (visiting friends) later rather than earlier.

An alternative account is that delay actually enhances integrity and as a result, outcomes are more likely viewed and assessed as one single composite outcome. Trend becomes meaningless when the outcomes are merged, such as when receiving £10 in the morning and £20 in the afternoon are assessed as “receiving £30” on the same day. There are two reasons this merge could actually have taken place. First, delay fosters high-level construals (Trope & Liberman, 2003), which makes time, a peripheral attribute, less salient. Second, a long delay entails a wider range of time, thus fostering *time contraction* (see below), meaning that the interval is perceived shorter than it actually is (Parducci, 1965, 1995). In either case, the role of intervals in separating outcomes from each other might be suspended.

A non-linear relationship between integrity and the perception of sequences, as well as between integrity and preference for improvement, emerges from this discussion. Outcomes that form a sequence need to be perceived as a whole and also as individuals. That is, they can neither be too integral nor too separate. Preference for improvement is undermined whether the integrity is too high or too low.

3.3.2 Time contraction

Time contraction means decision makers compress time and treat long intervals as if they were short (Read & Loewenstein, 1995). The range effect (Parducci, 1965, 1995) predicts that delay fosters time contraction. This is because delaying outcomes entails a larger range of time. This enhances perceived similarity in terms of time and decreases the perceived length of interval.

Read and Loewenstein argue that time contraction underlies the *diversification bias*, or the tendency for people to choose more variety when making combined choices of quantities of goods for future consumption than making separate choices immediately preceding the consumption. Participants who choose simultaneously for a series of future consumption are exposed to a larger range of delays than participants who choose sequentially one at a time. Diversity is made more appealing by time contraction because shorter interval between the consumption exacerbates the perceived satiation by repeated consumption (Kahneman & Snell, 1990, 1992).

3.3.3 The "similarity effect"

Rubinstein obtained a finding, the similarity effect, which illustrates how time preferences depend on the range of attributes under consideration. Rubinstein (2003, Experiment III) showed participants the following two options:

A. In 60 days you are supposed to receive a new stereo system. Upon receipt of the system, you must pay $960. Are you willing to delay the transaction by one day for a discount of $2?

B. Tomorrow you are supposed to receive a new stereo system. Upon receipt of the system, you must pay $1,080. Are you willing to delay the delivery and the payment by 60 days for a discount of $120?

Hyperbolic discounting entails a discount rate that decreases with delay length. It predicts a preference for Option A over Option B because outcomes that offer a fixed rate of trade-off between money and time (i.e. $2 per day) are more attractive if the trade-off is more distant. In reality, most participants responded positively to B but not to A. One reason might be that the $2 saving in A was made trivial by the wider range of money ($120) in B (Parducci, 1965, 1995). However if $2 was perceived trivial even without the extended range (Gourville, 1998), then as Rubinstein argued, it was the similarity between the two payments in A that made the waiting of an additional day less worthwhile, a finding he called the *similarity effect* (2003). This second account is consistent with the impact of similarity on decision weights. The small dollar difference in Option A compared to the one in Option B (a saving of $2 versus no saving versus a saving of $120 versus no saving) makes the monetary attribute less important in A than it is in B. By contrast, the range of time is the same, i.e. 60 days, in both options. Time may also be normalized to provide the basis for assessments (Ariely & Loewenstein, 2000).

3.3.4 Assessment mode

Given a set of outcomes, the global attractiveness can be derived from two modes of assessment or *outcome editing* (Kahneman & Tversky, 1979; Thaler, 1985). Under the *integrated mode*, the outcomes are combined first and then assessed, whereas under the *segregated mode*, the outcomes are assessed first and these individual assessments are then combined. As discussed earlier, delay fosters time contraction and thereby the chance that outcomes are assessed as one single composite outcome. This follows from the hypothesis that the more integral the outcomes, the more likely the integrated mode of assessments and vice versa (Thaler, 1999). People routinely use calendar day, week, month, etc. to determine editing mode (cf. Bradburn, 2000) or the level of *mental accounting* (Thaler, 1985, 1999). For instance, we balance our household accounts monthly and real life gamblers track gains and losses on a daily basis (Thaler & Johnson, 1990). Decision makers intuitively distribute gains and losses over different days, especially when the magnitude of these outcomes is large (Linville & Fischer, 1991). Consumers sometime choose to pay well in advance, using the interval to decouple the “painful” payment and the consumption, thus deriving greater satisfaction from the consumption (Prelec & Loewenstein, 1998). Similarly, experiencing gains and losses close in time allows the gains to cushion the negative impact of the losses. One explanation for the relationship between integrity and assessment mode is that high integrity enhances evaluability (Hsee, Loewenstein, Blount, & Bazerman, 1999), making global assessments of related and temporally close outcomes easier.

It is worth noting that the integrated and segregated modes represent two extreme ways of assessment. They can be viewed as defining the end-points of a continuous scale of assessment modes – the higher the integrity, the more likely the integrated mode, whereas the lower the integrity, the more likely the segregated mode. Sequence assessments represent an intermediate case, where both the values of the individual outcomes and their interactions exert influences. This is consistent with the view that sequence outcomes are both integral as a group and separate as individuals.

3.4 Relatedness

Apart from time delay, temporally distributed outcomes may also differ in what they are. I use *domain relatedness* to capture the similarity in kind – higher domain relatedness signals higher similarity and vice versa. Since interval and relatedness both signal similarity, they have similar influences on sequence assessments. First of all, relatedness affects integrity, the more related the outcomes, the higher their integrity and vice versa. To illustrate, consider two sequences: (receiving 10 pounds today, receiving 20 pounds tomorrow) versus (cleaning the flat today, reading one's favourite novel tomorrow). The first pair of outcomes have a higher relatedness than the second pair. Preference for improvement, a modal sequence preference, is therefore more likely to emerge in the first sequence than in the second. Supporting this view, Ariely and Zauberman (2000) commented that the "cohesiveness can be based on segments proximity in time, their contextual relationship, or the mere fact that they are evaluated together" (p.230). This comment is in response to their observation that the influence of sequence-level features persisted even in the most segmented condition, as opposed to segment-level features. Similarly in Example 2.3, the fraction of participants preferring (Aunt, Friends) remained over half (54%) even when the interval was as long as 26 weeks (or 6 months). Without relatedness, this result would have seemed odd as the interval is so long that the participants should have exhibited an overwhelming preference for the decreasing (Friends, Aunt). From the current perspective, the integrity is retained because the outcomes happen in the same domain and assessed at the same time

This highlights the malleability of relatedness judgments. That is, as similarity, relatedness could arise naturally or in response to the decision context. It follows that two apparently unrelated outcomes can become related given appropriate contexts. For instance, making plans for “things to do during the weekends” encompasses both “cleaning the flat” and “reading one’s favourite novel”. As a result, decision makers are more likely to choose to read the novel after the cleaning than the other way around. Likewise, an opera and a meal seem unrelated. However, endowed with episode-specific relatedness, one’s decisions about the two are bounded by the desire to maximize the enjoyment of the episode (Dhar & Simonson, 1999).

That integrity depends on interval as well as relatedness provides another reason why delay might enhance integrity, especially for outcomes that are dissimilar at the face value. Compared to interval, judgments of relatedness take place on more central and therefore higher-level attributes, which become more salient as a result delay. Consistent with this, (Liberman, Sagristano, & Trope, 2002) asked individuals to imagine a set of scenarios (e.g., a camping trip, a friend’s visit) to occur in either the near or distant future. For each scenario, participants grouped related objects (e.g., tent, ball, snorkel) into as many groups as they deemed appropriate. They observed that fewer groups were created for the distant future scenarios than for the near future scenarios.

3.5 Summary

In Chapter 3, I distinguish between relational and non-relational variables and discuss delay and interval respectively within the frameworks of the Construal level theory and similarity. The non-relational delay reflects psychological distance of an outcome and determines level of construals. Delay fosters time contraction and influences how attractive individual outcomes are. By contrast, the relational interval reflects temporal similarity between the outcomes. Properties of similarity provide an account for findings such as time contraction, the interval effect on integrity and the similarity effect on time preferences. Domain relatedness also reflects similarity, and exerts similar influences as time interval. Delay may undermine preference for improvement because of enhanced discounting or because the outcomes become more integral. Chapter 4 explains this from the perspective of contrast effects.

Chapter 4 CONTEXT EFFECTS

4.0 Introduction

Tversky and Griffin (1991) posit that a past event exerts *dual influences* on one's present well-being – an *endowment effect* that represents its direct contribution to one's happiness and a *contrast effect* that represents its indirect contribution, through which it changes the attractiveness of a later related event. Two things are worth noting. First, if the assessment is about a sequence, then the global satisfaction reflects the attractiveness of the sequence. Second, the difference between endowment and contrast effects parallels the one between interval and delay. Endowments are non-relational because it depends only on individual outcomes; contrasts are relational because it depends on how outcomes relate to each other. Contrast effects lead to preference for improvement because having inferior events earlier makes later superior events more desirable and thereby enhances the global satisfaction. Thus, Tversky and Griffin's framework can be modified to capture sequence preferences as a function of delay and interval.

Endowment and contrast effects are two different kinds of context effects, or the influence of the decision context on judgments. The decision context in this case narrowly refers to the outcomes under consideration. The judgment refers to the global assessment of the outcomes. To understand sequence preferences, and the influence of delay and interval, I discuss the topic of context effects in this chapter. In what follows, I first present the *accessibility-applicability hypothesis* that explains how the magnitude of context effects depends on relatedness and interval between the context and the target. I then present the *Inclusion/Exclusion model* that predicts how the valence of context effects depends on interval and relatedness. That is, whether context effects take the form of assimilations or contrasts. I discuss influences of interval in further detail. I then demonstrate applications of context effects to sequence assessments using two intertemporal judgment models, namely Tversky and Griffin's (1991) *endowment and contrasts model* and Loewenstein and Elster's (1992) *consumption and contrasts model*.

4.1 Context effects

It is well known that judgments depend on decision contexts. Three empirical findings illustrate this: (a) a heavy context weight leads to underestimation of the target weight, whereas a light context weight leads to overestimation of the same target weight (D. R. Brown, 1953); (b) reminding people of a scandal-ridden politician decreases the credibility of his party while enhances the credibility of other politicians in the same party (Schwarz & Bless, 1992b); and (c) making sequential choices between non-dominant options, people's preferences in the second choice are shaped by the options they encounter in the first (Simonson & Tversky, 1992), a concept known as the "trade-off contrasts". That is, the more important an attribute is perceived in the first choice (e.g. Attribute Y when the trade-off is between one unit of Attribute Y and three units of Attribute X), the less important it is in the subsequent choice, and vice versa. Consequently, the alternative superior on this attribute (Y) is less likely to be chosen in the second choice than in the first.

These examples show that context effects can take two opposing forms, known as *assimilation effects* and *contrast effects*, which reflect respectively a *positive* and *negative* (inverse) relationship between judgments and implications of contextual information. Context effects are ubiquitous – the three examples are in the domains of psychophysics, social judgments and consumer choice. Contrast effects influence the assessment of weight, the reputation of *individual* politicians, as well as the attractiveness of consumer goods, whereas an assimilation effect influences the assessment of the reputation of a political party.

Example (c) also illustrates how context effects can take the form of temporal effects – people's preferences in a later choice depended on the options they encountered earlier. Thus, the questions of when context effects arise, how pronounced they are, and which form they take are important for our understanding of sequence preferences. While the *accessibility-applicability hypothesis* provides an answer to the first two questions, the *Inclusion/Exclusion model* (or IEM) sheds light on the third, as we see next.

4.1.1 Accessibility-applicability

The *accessibility-applicability hypothesis* (Higgins & Brendl, 1995) states that only accessible and applicable information influence judgments; the more applicable the information, the greater its influences are and vice versa.

Contextual information is accessible by definition. According to the *accessibility principle* (Higgins & King, 1981), this is the fundamental reason underlying context effects, as it means that instead of retrieving all the knowledge that may potentially be relevant, people rely on a subset of information that comes to mind most easily at the time of the judgment (Higgins & Bargh, 1987). As a result, the temporary representation of a target stimulus, as well as the construction of a standard, includes not only information that is chronically accessible and context-invariant, but also information that is only temporarily accessible due to the salience of decision context.

Applicability, on the other hand, depends on similarity between contextual information and judgment targets – the more similar the two, the more applicable the information, the greater its influences will be and vice versa. For information to exert influences at all, it has to be related to the target on the dimension of interest (Strack & Mussweiler, 1997). For instance, the assessment of my current badminton skills depends on the knowledge of my past badminton skills but not on the knowledge of my cooking skills, even when both pieces of information are equally accessible at the time of the judgment (Mussweiler & Strack, 2000).

Interval between the target and the context also influences applicability (Mussweiler & Strack, 2000), the shorter it is, the greater the applicability, and the more pronounced the context effects become. For instance, in terms of my present badminton skills, the knowledge of my badminton skills *a month ago* is more applicable than that of *a year ago*. Taken together, the more relevant the information, the more recent it is, the greater its influences and vice versa.

4.1.2 The Inclusion/Exclusion Model (IEM)

Given a piece of information that is both accessible and applicable, what determines whether its influence is positive (assimilation) or negative (contrast)? Schwarz and Bless's (1992) *Inclusion/Exclusion model* (or IEM) posits that this depends on how the contextual information is *categorized* at the representation stage of the target. If the information is *included* in the representation, it is assimilated into the judgment, but if the information is *excluded* from the representation, it is contrasted with the judgment. Two things are worth noting. First, the same piece of information cannot be simultaneously excluded from and included in the representation of the same target. That is, assimilation and contrast effects do not co-exist. Second, for the contextual information to serve as a judgment standard, it has to be first excluded from the representation and then used to construct the standard, or, in Kahneman and Miller's (1986) words, an "alternative state of reality". An implication is that assimilation effects arise more readily than contrast effects (Schwarz & Bless, 1992; Mussweiler & Strack, 2000).

Example (b) illustrates how IEM works. The information of the scandal-ridden politician provides the context for the assessment of the reputation of both the party and other politicians in the same party. Since the party is superordinate to its members, the logic of including the information in the representation of the party is compelling. By contrast, two individual politicians are at the same level of abstraction. IEM thus predicts an assimilation effect in the assessment of the party but a contrast effect in the assessment of individual politicians, which is what Schwarz and Bless (1992b) found. Note that in this case, the same context fosters both an assimilation effect and a contrast effect. This however does not contradict IEM because the two effects have different targets, i.e. the party versus individual politicians. As we see later, the same logic underlies the *dual influences* of a past outcome on one's assessments of present well-being (Tversky & Griffin, 1991).

In addition to the hierarchical relationship between the target and the context, or the lack of, inclusion and exclusion also depend on their interval and relatedness, when applicable. Mussweiler and Strack (2000) commented: "To the extent that accessible knowledge is similar to the judgmental target or pertains to the same overall category or time period, it is likely to be seen as representative for the judgment" (p.256). This idea is embodied in Strack's (1992) notion of *representativeness-check*. Decision makers check how representative information is in order to determine whether it is appropriate for reaching an accurate judgment. Representative information is assimilated whereas non-representative information is contrasted (Strack, 1992). This logically follows from our postulate in Chapter 3 that relatedness and interval reflect perceived similarity between the target and context, and this similarity also determines how representative the contextual information is perceived with respect to the target (Kahneman & Frederick, 2002; Kahneman & Tversky, 1972). In what follows, I discuss influences of interval in detail.

4.1.3 Interval

As we see in Chapter 3, time contraction demonstrates how the perceived length of interval may differ from its actual length. It is however the perception and the resulting grouping of the outcomes that determines whether the contextual influences are assimilations or contrasts. For instance, Strack (1992) asked first-year college students to recall a positive or negative past event before assessing their current life satisfaction. The first group was asked to "think about a life event that occurred about two years ago", while the second group was asked to "think about a life event that occurred about two years ago, that is, *before you entered the college*". An assimilation effect was observed in the first group – participants reported higher or lower life satisfaction following a recall of a positive or negative past event; a contrast effect was observed in the second group – participants reported higher satisfaction after recalling a negative past event but lower satisfaction after recalling a positive one.

Strack attributed his findings to *extendures*, or periods of life stored in memory (N. R. Brown, Shevell, & Rips, 1986). We may view each extendure as an *ad hoc* category, defined by landmark events such as "entering the college". Events within the same extendure are perceived as representative of each other, which fosters inclusion and assimilations. The opposite can be said of events occurring in different extendures. The lack of representativeness fosters exclusion and contrasts between them. Strack's example therefore demonstrates how sensitive outcome grouping is to the presence or absence of landmark events. On the other hand, it is conceivable that grouping may arise spontaneously, such as when the decision maker recalls landmark events on their own, which is more likely to happen when the interval is long than short. This provides an account for the finding that recalled past events were contrasted with the assessment of one's current well-being whereas recalled present events were assimilated (Strack, Schwarz & Geschneidinger, 1985).

This interval effect may contribute to the disparity between sequential and simultaneous judgments, when options are assessed one at a time or several at the same time. In Example (c), consumers contrast a later trade-off with an earlier one. Wedell, Parducci and Geiselman (1987) found that their participants assigned higher (lower) ratings to the same faces in the sequential condition when the context contained less (more) attractive faces; the opposite occurred in the simultaneous condition. Martin and Seta (1983) found evidence for a contrast effect when participants made the assessment after seeing information of *each* individual, but assimilation effects when participants assessed the attractiveness of two individuals after seeing information of *both* individuals.

In these experiments, the valence of the context effects depends on whether or not an interval exists between the presentations of the contextual information *or* between the assessments of the target. Which is more important in terms of context effects, the presentation of the outcomes or their assessments? Bruine de Bruin and Keren's (2003) experiments provide a clue. Their participants assessed the attractiveness of dorm rooms and blind dates. Each option was described by nine features, among which five were common and four were unique. Common and unique features always had *opposite* valences. For instance, two dorm rooms in the "unique negative" condition both offered own phone-line, were close to supermarket, student-recommended, had safe neighbourhood and shared balcony but one were difficult to park bike, had old carpet, high security deposit, and dirty kitchen, whereas the other was thin-walled, overdue in maintenance, required two months' notice, and had unfriendly landlord.

They posited that if participants contrasted a later assessment with an earlier one, the ratings should exhibit a trend that was dictated by the valence of the unique features, rather than by the valence of the common features. That is, an improving sequence of ratings would characterize the assessments of the unique positive condition whereas a deteriorating sequence would characterize that of the unique negative condition. They investigated the so-called "order effects" in five experiments – four of these were the factorial combinations of simultaneous and sequential presentation and assessment modes; the fifth condition entailed rating an option after viewing the descriptions of both this option and the one(s) that had already been rated. They observed that the order effects were the weakest, that is, the improvement or the deterioration in ratings was the least obvious, when judgments and presentation were both simultaneous (Experiment 5). Overall, the effect was most pronounced in tasks that promoted sequential judgment. These results suggest that while both presentation and judgments are important, the judgment mode is perhaps more influential.

4.2 Implications for time preferences

I use context effects to conceptualize interactions between temporal outcomes and to gain insights into sequence preferences. The idea is that facing a set of outcomes, decision makers assess one outcome at a time, with the rest of the outcomes serving as the "decision context". They form the global assessment by combining the assessments of individual outcomes. With this assumption, research on context effects provides an account for the non-linear relationship between integrity and preference for improvement hypothesized in Chapter 3. The reason is that higher relatedness and shorter intervals between the outcomes exert multiple influences. First, they imply greater integrity; second, they signal greater applicability and therefore more pronounced context effects and third, they imply greater representativeness of the contextual information. Since preference for improvement is motivated by contrast effects, higher integrity only accompanies more pronounced preference for improvement if contrast effects arise. This happens when the contextual (non-focal) outcome is perceived as non-representative and therefore excluded from the representation of the target (the focal) outcome.

Research on intertemporal choice explicitly or implicitly incorporates the idea of context effects and with it, the influences of interval and relatedness. For instance, Hsee and Ableson (1991) show that the faster the improvement/ deterioration, the more/less satisfactory a sequence becomes (see Chapter 2). Tversky and Griffin (1991) proposed the *endowment and contrast effects* model to describe one's global wellbeing after a past and a present related experience. Loewenstein and Elster's (1992) *consumption and contrast effects* model is a similar model that also addresses influences of both past and future events.

Although not a model of sequence preferences *per se*, I show in Chapter 6 how Tversky and Griffin's idea can be generalized and developed towards this end. Loewenstein and Elster's model has exerted profound influences on time preferences. In what follows, I discuss these two in detail.

4.2.1 The endowment-contrast effects model

In their work on assessment of global wellbeing, Tversky and Griffin (1991) hypothesize that a past event exerts *dual influences* on one's present well-being – an *endowment effect* that represents its direct contribution to one's happiness or satisfaction, and a contrast effect that represents its indirect contribution. That is, "[a] positive experience makes us happy, but it also renders similar experiences less exciting. A negative event makes us unhappy, but it also helps us appreciate experiences that are less negative" (p.709). To test their idea, Tversky and Griffin devised hypothetical scenarios about high-school students, who encountered two events, one past and the other "present"; the events were either related (e.g. two term papers or two parties) or unrelated (one term paper followed by a party or vice versa). The earlier event was either positive or negative; the later event was always neutral. This arrangement gave rise to a 2x2 between-subjects design in which a neutral event was preceded by either a positive or a negative event, which could be either related or unrelated. Their participants (college students) viewed these scripts and rated the satisfaction of the high-school students on a "1-10" scale, with higher ratings indicating higher satisfaction.

Tversky and Griffin made the following predictions. First, consistent with the endowment (assimilation) effect, satisfaction ratings reflected the quality of the first event, regardless of the relatedness, i.e. greater satisfaction when the first event was positive than negative. Second, consistent with the applicability principle, the contrasts occurred between the related events. Since the second event was neutral, a positive (negative) first event entailed a negative (positive) impact on the satisfaction. In other words, the contrast effects and endowment effects always worked against each other.

Their results supported these predictions. As shown in Figure 4.1, satisfaction ratings were significantly higher in the positive condition (the solid line) than the negative condition (the dashed line), for both the related events (mean rating: 6.8 versus 5.5) and the unrelated events (7.1 versus 4.9). However, the difference was much smaller for the related events (1.3=6.8-5.5) than for the unrelated (2.2=7.1-4.9). Tversky and Griffin obtained further support for their framework from an experiment in which participants played computer games for real money.

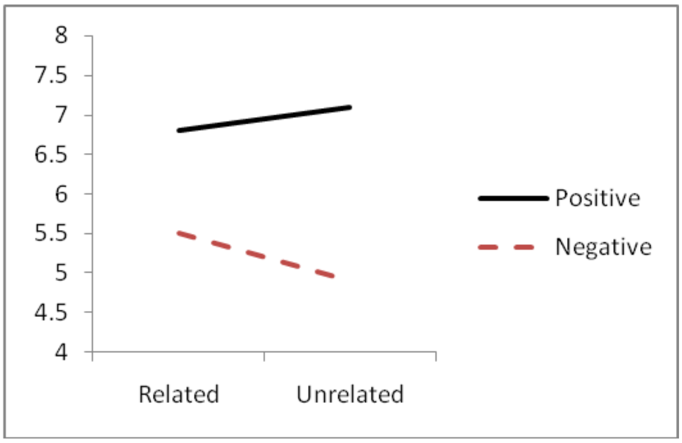

Figure 4.1. The mean satisfaction ratings observed in Tversky & Griffin (1991).

4.2.2 The consumption-contrast effects model

Loewenstein and Elster (1992) posit that memory and anticipation turn judgments of one's present well-being into a type of "triple counting". Instead of one direct impact, individual events influence utility before as well as after the experience – first through anticipation, then through direct experience and finally through memory. Loewenstein and Elster labelled the effects attributable to past events as *backward* effects and those attributable to future ones as *forward* effects. They referred to the positive and negative effects as *consumption effects* and *contrast effects* respectively.

One insight of this framework is the asymmetry between the influences exerted by past and future events. Consumption effects are predominantly forward, whereas contrast effects are predominantly backward (Prelec & Loewenstein, 1991) – an assumption implicitly incorporated in Tversky and Griffin (1991). This explains why we rejoice at an improvement over our past consumption but lament the same improvement over our future. In the latter case, "contrast effect is completely eclipsed by the consumption effect" (Loewenstein & Elster, 1992, p.233).

Loewenstein's (1987) notion of anticipatory savouring and dread are two representative forward consumption effects. The idea is that anticipating a future positive/negative event yields positive/negative utility. Pronounced anticipatory effects explain why people who are otherwise impatient with isolated outcomes would prefer to delay a kiss from their favourite movie star for a few days but at the same time choose to receive non-lethal electronic shocks as soon as possible – both violate the notion of positive time preference. Loewenstein and Elster attributed discounting to forward effects, commenting that "were it not for the forward contrast effect that makes us envy our future selves, perhaps people may not discount future satisfaction at all" (1992, p.233).

4.2.3 Discussion

Two things are worth noting from the two models presented in this section. First, they both embody the notion of applicability. Applicability implies relatedness. While Tversky and Griffin posited and found more pronounced contrast effects for events of the same domain than for those of different domains, Loewenstein and Elster argued that information must be similar to judgment target in "some relevant respect" to exert intertemporal effects.

Second, the dual or triple influences as hypothesized in the models are consistent with the prediction of IEM. The value of an event is assimilated into the assessment of one's global well-being, a superordinate target, as well as contrasted with the assessment of other, related events that are on the same level of abstraction. In addition to these two, Loewenstein and Elster's notion of triple-counting of utility also takes into account the satisfaction derived from *direct* experience, in addition to the one derived from memory or anticipation.

Since IEM is a general framework of context effects, we would expect the endowment-contrast model to explain intertemporal as well as non-intertemporal judgments. For instance, recalled present/past events were assimilated into/contrasted with the assessment of current satisfaction (Strack, et al., 1985). And the experience of an extremely pleasant (unpleasant) room was assimilated into the assessment of life satisfaction but contrasted with the assessment of own living conditions (Schwarz, Strack, Kommer, & Wagner, 1987). It is not surprising these findings are compatible with the endowment-contrast model. It is however important to note that how the two context effects arise diverges depending on the context. While Strack et al demonstrated the influence of the *interval* between the context and target, Schwarz et al, as Tversky and Griffin, demonstrated the influence of the level of abstraction, i.e. whether or not the target was superordinate to the context.

Does a similar parallel between intertemporal and interpersonal judgments exist? Just as assessments of present events depend on attractiveness of related past events, assessments of one's own experiences depend on attractiveness of experiences of related others. As Hume (1739/1969) observed almost three centuries ago, "a direct survey of another's pleasure … gives us pleasure and … produces pain when compared with our own". Taken together, our present well-being depends not only on our own experiences, whether these experiences take place in the past, present or future, but also on experiences of related others.

That people tend to *consume* rather than contrast future events and the reverse holds for past events illustrates one unique aspect of intertemporal judgments – the influence of our asymmetric time orientations. An explanation for this, as offered by Loewenstein and Elster, relies on the parallel between intertemporal and interpersonal judgments. They note that our future is in the hands of our present selves, and therefore in a sense “disadvantaged” compared to the present. Forward contrasts are almost as rare as making comparisons against the disabled.

4.3 Summary

Chapter 4 shows two things. First, why and how context effects can be used to model sequence preferences and second, how relatedness and interval might influence time (sequence) preferences. According to the applicability principle, the contextual information has to be related to the target to exert any influence. If the outcomes are temporally distributed, then the higher the relatedness, the shorter the interval, the more pronounced the influences one outcome exerts on another are and vice versa. Such influences can take two forms, a positive assimilation (endowment or consumption) and a negative (inverse) contrast. IEM predicts that the valence of the context effect depends on how the information is categorized with respect to the target. Higher domain relatedness and shorter intervals signal higher representativeness, which entails a higher chance of assimilation. IEM thus predicts the dual influences of an outcome on the assessment of global satisfaction – the information of this outcome is assimilated into the superordinate target but contrasted with the assessment of another related outcome that is probably later in time. The idea is embodied in Tversky and Griffin’s endowment and contrast effects framework and Loewenstein and Elster’s consumption and contrast effects framework. In Chapter 6, I consolidate these ideas into a model that describes sequence preferences as a function of interval, delay and relatedness. Before that, I deal with the topic of choice bracketing in Chapter 5. That is, how decision perspectives may affect time preferences.

Chapter 5 CHOICE BRACKETING

5.0 Introduction

Read, Loewenstein and Rabin (1999) propose the notion of *choice bracketing*. Choices bracketed together are made together, by taking into account effects that one choice exerts on other choices in the same bracket. A bracket can be *narrow* or *broad*, depending on whether it contains *a few* or *many* choices. The more choices a bracket contains, the broader it is. Example 2.4 (Chapter 2) demonstrate how bracketing depends on arbitrary factors and how people's preferences vary with the level of bracketing. If this happens, we say that *bracketing effects* emerge. Levels of bracketing affect time preferences in at least two ways. First, narrow bracketing exacerbates the perception that outcomes are in isolation and therefore fosters positive time preference. Second, modal sequence preferences depend on level of bracketing. In what follows, I discuss the topic of choice bracketing in detail.

After introducing the idea, I discuss the prevalence of narrow bracketing, and examine the reason behind this. I then demonstrate the importance of decision heuristics – how they facilitate broad bracketing and how they may lead to biases such as in the case of the so-called *overbracketing*. In conclusion, I discuss the influence bracketing on sequence judgments, including when people perceive a sequence and what makes a sequence attractive.

5.1 Bracketing

Denoting a bracket by "{}" allows us to represent the decisions in Example 2.4 as follows. The group who chose bread puddings separately for weekends and weekdays encountered {bread puddings for *weekends*} and {bread puddings for *weekdays*}; the group who made one combined choice encountered {bread puddings for this week}, which is essentially {bread puddings for *weekends*, bread puddings for *weekdays*}. In the latter case, the bracket contains two choices and is therefore *broader* than in the former case where each of the two brackets contains just one choice. The bracketing effect is expressed as people choosing fewer bread puddings under broad bracketing than under narrow bracketing.

Making many decisions at the same time, or *simultaneous* choice (Simonson, 1990) allows the decision maker to detect interactions among the outcomes that are not possible when the decisions are made in isolation, i.e. under narrow bracketing, or *sequential choice*. It follows that broad bracketing facilitates the maximization of global satisfaction. Despite this, narrow bracketing prevails. One implication of this is the tendency for decision makers to adopt a narrow frame when assessing outcomes, known as the *minimal account* (Kahneman & Tversky 1984; Thaler, 1985, 1999; Tversky & Kahneman, 1981). Under this account, decision makers assess only the differences between the alternatives and disregarding all their common features. By contrast, under the broadest *comprehensive account*, the decision maker takes into account all other factors including current wealth, future earnings, possible outcomes of other probabilistic holdings, and so on. The comprehensive account is the gold-standard of economic analysis but is rarely used.

Kahneman and Tversky (1984) offer several reasons for this. Compared to a broad decision frame, a narrow one alleviates cognitive strain, facilitates evaluation and justification, and offers a better match with the properties of hedonic experiences. These advantages of a narrow frame can be attributed to decision makers' cognitive limitations, i.e. cognitive inertia and limited cognitive capacities. For the same reason, narrow bracketing prevails, as we see next.

5.1.1 Narrow bracketing prevails

Cognitive inertia means people use information the way it comes (Read et al, 1999; Slovic, 1972). The reason might be that doing anything otherwise will consume more cognitive resources, which are however limited (Simon, 1955). Cognitive inertia exacerbates narrow bracketing because we perceive most decisions to come one at a time in isolation rather than many at the same time. Example 2.4 illustrates its influences. Participants made separate choices of bread pudding for weekends and weekdays or one combined choice for the entire week, depending on whether the choices were presented that way.

Cognitive inertia is also observed in decisions with uncertain outcomes. An example is Samuelson's gamble. Paul Samuelson offered one of his colleagues an equal chance to win $200 and to lose $100 (Samuelson, 1937). This colleague turned down the offer, but volunteered to play 100 such bets. Aggregating risky prospects with positive expected values leads to an upward shift in the distribution of payoffs, making the risk more attractive. In this case, while a player stands a 50% chance of losing money by playing one single bet, this chance is quickly diminished as he plays more bets – a fact that most people seem to know intuitively. For instance, most of Redelmeier and Tversky's (1992) participants took on the offer of six identical bets but turned down the offer of a single-bet. Strikingly, the single bet was rejected even when it was presented immediately after an offer of five identical bets, which most of the participants willingly accepted. Cognitive inertia prevents decision makers from thinking beyond the way the choices are presented.

On the other hand, not all simultaneously presented decisions are made together, suggesting other factors at play. Tversky and Kahneman (1981) presented the "twin-gamble problem" to two separate groups of participants.

Problem 1 (n=150):

Imagine that you face the following pair of concurrent decisions. First examine both decisions, then indicate the options you prefer.

Decision (i). Choose between:

A. A sure gain of $240 [84%]

B. 25% chance to gain $1000 and 75% chance to gain nothing [16%]

Decision (ii). Choose between:

C. A sure loss of $750 [13%]

D. 75% chance to lose $1000 and 25% chance to lose nothing [87%]

Problem 2 (n=86):

Choose between:

A & D 25% chance to win $240 and 75% chance to lose $760 [0%]

B & C 25% chance to win $250 and 75% chance to lose $750 [100%]

People’s responses to Problem 1 and 2 diverged. The options A and D were preferred in Problem 1 but the combination B&C, as the dominant option, was chosen by *all* participants in Problem 2. This dominance however only became obvious in Problem 2, when the outcomes had already been combined in terms of probability and monetary value. By contrast, the response pattern in Problem 1 demonstrated an *isolation effect* (Tversky & Kahneman, 1981), which is the tendency of making decisions in isolation, i.e. narrowly bracketing one’s choices. Consequently, people were risk-averse for gains in Decision (i), preferring the sure thing to the gamble, and at the same time, risk-seeking for losses in Decision (ii), preferring the gamble to the sure thing (Kahneman & Tversky, 1979).

This response pattern is inconsistent with the prediction of cognitive inertia. Respondents to Problem 1 were presented with both decisions and instructed to consider their joint consequences. The failure of broad bracketing occurred at the stage of outcome editing (Kahneman & Tversky, 1979), when outcomes had to be combined on each attribute for assessment. This is an effortful task, whereas people have only limited cognitive capacities (Simon, 1955). This makes narrow bracketing more attractive and sometimes more realistic than broad bracketing (Payne, Bettman, & Johnson, 1992). Generally speaking, as the number of decisions increases, the task of constructing the composite options and choosing among these options becomes increasingly complex. To illustrate, consider two hypothetical binary choices, e.g. {*a*, *b*} and {*c*, *d*}. Under narrow bracketing, the decision maker makes two independent binary comparisons, one within each set. Under broad bracketing, there are four composite outcomes, i.e. {*ac*, *ad*, *bc*, *bd*}, and as many as six (=Combination (2,6)) binary comparisons.

If broad bracketing is more effortful than narrow bracketing, why does broad bracketing arise spontaneously in the choices of bread puddings and Samuelson's gambles? This is because in these cases the so-called *pre-existing heuristics* (Read et al., 1999) exist, which allow us to make simultaneous decisions without the effortful and often lengthy acts of outcome editing or comparisons. As another example, suppose at lunch we are offered a choice between two side dishes, e.g., chips and mixed vegetables, and one between three main dishes, e.g., fried fish, Shepherd's pie and pasta. The heuristic of "choose the complements" immediately identifies "fish and chips" as the best option. We do not need to list all the six possible combinations and go through the pair-wise comparisons to make the choice. From this perspective, the twin-gamble example demonstrates what happens when decisions are not facilitated by heuristics – participants *underbracketed* their choices; that is, they adopted narrow bracketing even when they were presented with multiple choices and were capable of broad racketing.

Despite great savings in time and mental effort, heuristics are mental shortcuts that lead to *satisficing* rather than optimal decisions. Decisions made using heuristics can be fraught with biases. Mixed vegetables and Shepherd's pie might actually be more satisfactory than fish and chips under careful consideration (Gigerenzer & Selten, 2001; Kahneman, Slovic, & Tversky, 1982; Payne, Bettman, & Johnson, 1993). Another type of decision error, as opposed to underbracketing, is the so-called *overbracketing*, which happens when broad bracketing is adopted by mistake, as we see next.

5.1.2 Overbracketing

Daniel Read and I presented Example 5.1 to forty-seven students at the London School of Economics:

Example 5.1

Imagine that you are offered a choice between the following two options based on the toss of a coin: (N=47)

A	heads: the left shoe (boot) of a pair of shoes (boots)
36, 77%	tails: the right shoe (boot) of a pair of shoes (boots)
B	heads: the left shoe (boot) of a pair of shoes (boots)
11, 23%	tails: the left boot (shoe) of a pair of boots (shoes)

Each option is a gamble that offers either a pair of complements (A) or a pair of substitutes (B). There is no reason to prefer A to B or vice versa because a decision maker can only receive *one* of the four outcomes by making the decision only once.

Nevertheless, after counterbalancing the goods, we observed a preference for Gamble A to Gamble B, $\chi^2(1)=14.696$, $p<.001$, suggesting a preference for the gamble with *complementary outcomes*. We obtained similar results when participants encountered restaurant meals and books, as well as when they were asked to choose between two *choices* that offer either complementary or substitutable alternatives.

At face value the response pattern is consistent with the prediction of broad bracketing, suggestion that participants assumed they would encounter the decision more than once. By consistently choosing Gamble A, they would eventually receive the complements (a pair of shoes or boots), and therefore derive greater global satisfaction. The tendency of narrow bracketing however suggests a different account. It is more likely that participants had overbracketed their choices, as a result of the joint influences of cognitive inertia and pre-existing heuristics. Due to cognitive inertia, the *outcomes* were assessed together, for which the heuristic of "choosing complements over substitutes" was falsely applied to outcomes that cannot be received at the same time.

Another example of overbracketing is the finding of *diversification effect* (Read & Loewenstein, 1995; Simonson, 1990), or that people choose more varieties when making simultaneous choices for future consumption than making sequential choices at the time of the consumption. In a real life experiment, Read and Loewenstein (1995) presented young trick-or-treaters two trays of Halloween candies. One group of children (the simultaneous group) were asked to pick two candies at the same time; a different group (the sequential group) was asked to pick two candies in two different houses, one at a time. Cognitive inertia dictates that the simultaneous group encountered one decision as {(Candy 1, Candy 2), (Candy 1, Candy 2)}, whereas the sequential group encountered two decisions as {(Candy 1, Candy 2)} and

{(Candy 1, Candy 2)}. The simultaneous group picked many more varieties than the sequential group. This happened despite the fact that all the candies were deposited in the same bag. The desirability of diversification might be misleading. Read, Antonides, van den Ouden, and Trienekens (2001) found that office workers were actually *less* satisfied with their snaking decisions made from the simultaneous choice than from a series of sequential ones at the time of the consumption.

5.1.3 Decision versus experienced utility

The examples of overbracketing provide evidence for the disparity between *perceived* and *experienced* bracketing effects. Due to cognitive inertia, people may perceive bracketing effects from outcomes that are presented together, which however do not exist when the experiences unfold. This applies to both the *perceived* advantage of choosing more varieties of candies and the *perceived* complementarity between the outcomes that cannot take place at the same time.

This demonstrates the disparity between *decision* utility and *experienced* utility (Kahneman & Snell, 1990, 1992; Kahneman & Varey, 1991; Kahneman, et al., 1997), or the utility people perceive at the time of the decision versus the utility people receive from the actual experience of the same outcome. Time interval between the decisions and the experiences exacerbates this disparity. People have difficulty forecasting preferences even for familiar goods (e.g. ice cream), let alone preferences for novel experiences (Kahneman & Snell, 1990, 1992); their decisions are also biased towards how they feel at the time of decision making, which can be quite different from how they actually feel at the time of the experiences (Kahneman & Snell, 1990; Loewenstein, 2005; Read & van Leeuwen, 1998).

It is important to note that this discussion shows how easily overbracketing may arise; it however does not provide evidence for the superiority of narrow bracketing over broad bracketing. The reason is that only by adopting a broad decision frame can the decision maker have the freedom of comparing decisions made under different levels of brackets and of course select the best, narrow or broad, to maximize his/her global satisfaction.

5.2 Bracketing influences sequence judgments

Levels of bracketing affect time preferences in at least two ways. First, the prevalence of narrow bracketing exacerbates the perception that outcomes are isolated, fostering positive time preference. Second, modal sequence preferences depend on level of bracketing. Example 5.2 and 5.3 illustrate this idea. Example 5.2 is a slightly revised version of Example 2.1 (Chapter 2) – the Greek dinner is replaced by a dinner at home. This change however has little effect on people's preferences. Most respondents to Choice 1 preferred to have the French dinner this month, whereas most respondents to Choice 2 became much more patient, preferring to delay the French dinner till next month.

Example 5.2

Choice 1		
A.	French dinner in this month	
B.	French dinner in next month	
Choice 2	<u>This month</u>	<u>Next month</u>
C.	French dinner	Dinner at home
D.	Dinner at home	French dinner

From the perspective of choice bracketing, this preference reversal is a bracketing effect. Choice 1 is between two isolated outcomes; Choice 2 is between two sequences or *composite outcomes* derived from two separate choices – one between whether to have the French dinner this or next month (Choice 1) and one between whether to have *dinner at home* this or next month. Participants adopted narrow and broad bracketing in Choice 1 and Choice 2, respectively. A preference for improvement was only observed in Choice 2, that is, when the sequences emerge under broad bracketing.

While Example 5.2 illustrates the impact of bracketing on the perception of sequences, Example 5.3 demonstrates its impact on the preference for sequences. Read et al. (1999) presented the problem to two groups of respondents. One group (narrow bracketing) made the two choices separately and the other group (broad bracketing) made one combined decision for both.

Example 5.3

Choice 1

	This Saturday	Next Saturday
A	Cleaning the garden	Planting flower bulbs
B	Planting flower bulbs	Cleaning the garden

Choice 2

	This Saturday	Next Saturday
A	Reading the driving manual	Reading a novel
B	Reading a novel	Reading the driving manual

Each choice was between two alternative sequences. Cleaning the garden and reading the manual were relatively boring compared to planting flower bulbs and reading a novel. Option A (B) was therefore increasing (decreasing). The first group adopted narrow bracketing and made separate decisions in each choice. Preference for improvement dominated the responses. That is, most participants preferred the increasing sequence (Option A) in both Choice 1 and 2 and ended up having an extremely boring weekend followed by an extremely enjoyable weekend. The second, broad bracketing group behaved differently. Most participants now exhibited a preference for spreading; they paired sequences with different trends together, i.e. A (B) in Choice 1 and then B (A) in Choice 2.

5.2.1 Discussion

The results obtained in Example 5.2 and 5.3 are consistent with cognitive inertia. The decision frame participants adopted was always consistent with the way in which the choices were presented: narrow when outcomes/choices came one at a time, broad when many came at the same time, relatively speaking. Improvement and spreading are bracketing effects that emerge under broad bracketing. The strategies of "choosing improving or constant sequences" are decision heuristics that facilitate simultaneous decisions. Just as those consumers who choose diversity are not more satisfied with their choices at the time of the consumption, improvement might be an overrated property that people believe in as well as recall its desirability but never experience (Novemsky & Ratner, 2003; also see Chapter 2). In both cases, the interval between the outcomes might be so long that people fail to detect either the improvement over time or the diversity of the consumption, which were made salient by the fact that these outcomes were presented together at the time of the decision. That is, people may have overbracketed their choices by preferring sequences with an increasing trend.

The two modal sequence preferences parallel the two consumption episode effects (Dhar & Simonson, 1999), which, broadly speaking, are bracketing effects well, i.e. when the choices within the same episode form a broad bracketing and are made together. Chapter 3 presented the so-called *highlighting* strategy. Consumers sacrifice means to achieve goals when facing a trade-off between the two. For example, they chose to eat at an expensive restaurant rather than a moderate one after having enjoyed an opera. Another consumption episode effect is called *balancing*, which consumers adopt when facing conflicting goals, e.g. to eat healthy as well as tasty food. Dhar and Simonson showed that restaurant-goers more likely went for a dessert that was delicious but high in fat (e.g. chocolate cake) rather than one that was low in fat but less-tasty (e.g. fruit salad), after they had chosen a main dish that was healthy but less tasty.

Preference for spreading is in effect a balancing strategy between the near future and the distant future – decision makers distribute utility evenly across time and in so doing, they achieve a compromise between the consumption in different time periods. From this perspective, spreading implies that each time period is considered to be of equal importance. By contrast, decision makers who exhibit a preference for improvement highlight more distant consumption by sacrificing more recent consumption, implying that the more distant period is considered to be more important. The same perception is embodied in the notion of backward contrast effects (Prelec & Loewenstein, 1991), where earlier experiences serve as an assessment standard for later experiences. Compared to the assessment of outcomes embedded in a sequence, the assessment of isolated outcomes presents a decision situation that requires no *obvious* intertemporal tradeoffs, either between two goals or between one goal and one means.

One thing worth noting about Example 5.2 is that for most of us, having dinner at home is the most likely alternative to the French dinner. It follows that Choice 1 and Choice 2 are in fact *identical* and one should always consider the implications for dinner at home even if it is not presented as an alternative. Example 5.2 therefore illustrates the power of cognitive inertia, and the extent to which our preferences depend on the way outcomes are presented to us.

5.3 Summary

This chapter discusses the topic of choice bracketing and its implications. Due to cognitive inertia and limited cognitive capacities, we typically perceive decisions to come one at a time; making isolated decisions is also less effortful than making many decisions at the same time. As a result, narrow bracketing prevails despite the normative appeal of broad bracketing. The exception to this is when decision heuristics exist to facilitate simultaneous decisions. In terms of time preferences, the tendency of narrow bracketing and cognitive inertia provide an account for the dominant positive time preference for isolated outcomes, in contrast to preferences for improvement and spreading for outcomes embedded in a sequence. Preferring increasing versus constant sequence can be viewed as decision heuristics that “highlight” future consumption at the cost of present one versus “balance” between earlier and later consumption. Improvement and balancing are more likely under broad than narrow bracketing, when outcomes (sequences) are considered together. However, as illustrated in the case of overbracketing, heuristics-based decisions are satisficing rather than maximizing. The desirability of improvement may never be experienced.

Chapter 6 THE CONTRASTS MODEL

6.0 Introduction

In this chapter, I develop a descriptive model of sequence preferences based on the idea presented so far. I refer to this model as “the contrasts model”, as it is an extension of Tversky and Griffin’s (1991) endowment and contrast effects framework. The idea is that the value of a sequence comes from two sources, *non-relational*, which includes the value derived from endowment effects and influences of delay, and *relational*, which includes the value derived from contrast effects and influences of interval.

In what follows, I start by presenting Tversky and Griffin’s (1991) endowment and contrast effects framework (TG), followed by a discussion on Loewenstein and Prelec’s (1993) model (LP). I then present the contrasts model, which adopts the structure of LP but the individual components of TG. I then discuss conceptual differences between the contrasts model and TG and LP, before presenting an example that examines the predictive validity of the contrasts model, using data reported in Loewenstein and Prelec (2003, Study 1). I concluded by discussing assumptions that are important for the empirical investigation in the second half of this thesis.

6.1 Tversky and Griffin (1991)

Tversky and Griffin (1991) posits that the global satisfaction after having received two temporally distributed outcomes (e.g. a past outcome e_1 and a present outcome e_2) is the additive sum of the values derived from the endowment of each outcome and the contrast between the two. The endowment effects capture the inherent worth of the outcomes as in $v(e_1)+v(e_2)$; the contrast effects capture the influence of the earlier outcome on the assessment of the later present outcome as in $v(e_2-e_1)$. Since the earlier and the later outcomes constitute a sequence, the global satisfaction at the present is also the desirability of the sequence (e_1, e_2). Therefore,

$$SV = EV+CV=v(e_1)+v(e_2)+ v(e_2-e_1) \quad \text{--- (6.1)}$$

, where SV, EV and CV denote respectively the value of a sequence, its *endowment value*, or the value derived from the endowment effects, and its *contrast value*, or the value derived from the contrast effects. The difference between EV and NV will emerge later in this chapter when we consider time discounting. As for now, the two are identical.

This model, or TG, predicts that the more attractive the outcomes *per se*, the more attractive the later outcome compared to the earlier one, the more attractive the sequence is and vice versa. Eq. 6.1 incorporates the idea of *backward* contrast effects and predicts preference for improvement. The model however does not describe preference for spreading. This is because increasing, decreasing and constant sequences have positive, negative and zero CVs. It follows that holding EV constant, constant sequences will always be less attractive than increasing sequences. However, preference for spreading is an independent term in the model proposed by Loewenstein and Prelec (1993), as we see next.

6.2 Loewenstein and Prelec (1993)

Loewenstein and Prelec (1993) describe negative time preferences by assuming that people assess sequences by comparing cumulative *anticipatory utility* they are going to receive in the future periods with cumulative *recollected* utility they have received in the past periods. Holding constant the total nominal value (endowment) of a sequence, the more one receives in the past, the less one can expect to receive in the future. This gives rise to the idea of capturing sequence preferences by the so-called *deviation index,* expressed as

$$d_t = \frac{t}{n}\sum_{i=1}^{n} u_i - \sum_{i=1}^{t} u_i$$

, where d_t is the deviation index at period t, is the difference between the utility accumulated till t in the hypothetical constant sequence that has the same total nominal value as the target sequence and the same utility in the target sequence.

This deviation index is negative (positive) when the utility accumulates faster (more slowly) in the target sequence than in the constant sequence, which occurs when the target sequence is declining (improving). That is, the more positive the deviation indices, the more "improving" the sequences are and vice versa. Preference for spreading, on the other hand, is captured by the absolute value of the deviation index – they are zero when the target sequence is constant itself and the smaller the indices, the more "spread" the sequence, regardless of whether the values are improving or declining. For instance, deviation indices d_1 and d_2 for (1,2) are respectively 0.5 (=1.5-1) and 0 (=3-3), whereas these for (2,1) are -0.5 (=1.5-2) and 0 (3-3). While the sums of d_is are 0.5 and -0.5 for (1,2) and (2,1), the sums of their absolute values are 0.5 in both the increasing and the decreasing sequences.

Loewenstein and Prelec express the value of a sequence as a weighted average of three values that capture respectively the nominal value (*NV*) of a sequence, the magnitude of improvement and the magnitude of spreading:

$$SV = \sum_{t=1}^{n} u_t + \beta\sum_{t=1}^{n} d_t + \sigma\sum_{t=1}^{n} |d_t| \qquad \text{--- (6.2)}$$

Bounded between 1 and -1, the improvement and spreading parameters, β and σ, reflect the direction as well as the importance of improvement and spreading in sequence assessments. While a positive β implies a preference for improvement, a negative σ implies a preference for spreading. That is, the modal sequence preferences are embodied in positive βs and negative σs.

6.2.1 An example

Consider two sequences: A (1,0,2,0,1) and B (2,1,1,0,0), where the numbers indicate the amount of satisfaction derived from five continuous weekends. These numbers conform to interval scales[5], meaning that preferences are captured by the difference between two measurements with an arbitrary zero. According to the discounted utility model, A is less attractive than B because more desirable outcomes are experienced later in A than in B. However, the two modal sequence preferences, i.e. preferences for improvement and spreading, both predict the opposite.

Table 6.1 shows how LP makes such a prediction. The global nominal values of A and B are both 4 as we are only concerned with the order of the activities rather than what they are. The hypothetical constant sequence therefore has values of 0.8 in all periods. As shown, A outperforms B in improvement, because it has a more positive $\sum d_i$ (0 versus -5); A also outperforms B in spreading, because it has a smaller $\sum|d_i|$ (1.6 versus 5.0). Under the assumption of modal sequence preferences, i.e. positive β and negative σ, schedule (1,0,2,0,1) is more appealing than schedule (2,1,1,0,0).

[5] Loewenstein and Prelec (1993) showed their model (Eq.6.2) conforms to an interval scale.

Table 6.1. Computations of LP for Schedule A and B (Eq. 6.2).

	t_1	t_2	t_3	t_4	t_5	**Sum**
The constant sequence	0.8	0.8	0.8	0.8	0.8	**4**
$\sum u_i$	0.8	1.6	2.4	3.2	4	
Schedule A	1	0	2	0	1	
$\sum u_i$	1	1	3	3	4	
d_i	-0.2	0.6	-0.6	0.2	0	**0**
$\|d_i\|$	0.2	0.6	0.6	0.2	0	**1.6**
Schedule B	2	1	1	0	0	
$\sum u_i$	2	3	4	4	4	
d_i	-1.2	-1.4	-1.6	-0.8	0	**-5.0**
$\|d_i\|$	1.2	1.4	1.6	0.8	0	**5.0**

Consistent with this, participants in Loewenstein and Prelec (1993, Study 1) rated the two schedules, among a total of 30 schedules, which were all permutations of the same set of events (for full results see *Appendix A*). The mean ratings assigned to A and B were 3.79 and 1.95 respectively. The overall predictive validity of LP was high (Pearson correlation coefficient = .835). Loewenstein and Prelec also derived parameter values for each participant. The modal pattern was consistent with modal sequence preferences, i.e. positive βs and negative σs, with the mean values of β=.28 and σ=-.13. These results provide support for LP. In what follows, I present the contrasts model, which combines insights from LP and TG.

6.3 The contrasts model

One aim of the contrasts model is to distinguish between influences exerted by the two temporal variables, i.e. delay (*d*) and interval (*I*). As discussed in the previous chapters, contrast effects, interval and relatedness (*R*) all contribute to the relational value of a sequence, whereas nominal values and time delays both contribute to the non-relational value of a sequence. As Tversky and Griffin (Eq.6.1b), I express sequence preferences as an additive sum of the non-relational value (EV) and the relational value (CV). Relatedness and interval both reflect perceived similarity between the outcomes, and therefore affecting CV rather than EV. Since the more related the outcomes, shorter the interval, the more pronounced the contrast effects, CV depends on the *relatedness-interval ratio*, or *R/I*. I rewrite Eq.6.1 as:

$$SV = EV + CV = v(e_1) + v(e_2) + \frac{R}{I} v(e_2 - e_1) \qquad \text{--- (6.3a)}$$

Eq.6.3a describes preferences for sequences containing just two outcomes, e_1 and e_2. To generalize to sequences containing *n* outcomes, I assume that contrasts always happen between an earlier outcome and its *immediate* successor, which has the shortest interval with the earlier outcome and therefore enjoys the highest applicability of the contrast with the earlier outcome. With this assumption, in a sequence (e_1, e_2, e_3), the global contrast consists of two between-event contrasts, one between e_3 and e_2 and one between e_2 and e_1. That is,

$$SV = EV + CV = v(e_1) + v(e_2) + \frac{R}{I} v(e_2 - e_1) \qquad \text{--- (6.3b).}$$

$$cv_i = \frac{R_{i-1,i}}{I_{i-1,i}} v(e_i - e_{i-1})$$

As Eq.6.1b, Eq.6.3a predicts improvement but not spreading –contrast effects do not exist between outcomes of the same value. A solution inspired by LP is to employ the *absolute value* of *CV*, or |*CV*|, which is only zero when the target sequence is constant and the larger it is, the more the values vary from one period to the next. Eq.6.3b becomes:

$$SV = EV + CV + |CV| = \sum_{i=1}^{n} v(e_i) + \beta \sum_{i=2}^{n} cv_i + \sigma' \sum_{i=2}^{n} |cv_i| \quad \text{--- (6.3c)}$$

Note that Eq.6.3c has an identical structure as LP (Eq.6.2). The reason I denote the spreading parameter by σ' rather than by σ, as in LP, is due to a difference in how the two models handle preference for spreading. I discuss this in the next section.

In application, we often encounter situations in which the outcomes have the same level of relatedness (i.e. a constant *R*) and are evenly spaced across time (i.e. constant *I*). When this happens, Eq.6.3c can be simplified as:

$$SV = \sum_{i=1}^{n} v(e_i) + \beta \frac{R}{I} \sum_{i=2}^{n} cv_i + \sigma' \frac{R}{I} \sum_{i=2}^{n} |cv_i| \quad \text{--- (6.4)}$$

Sequence preferences now become a function of the ratio of between-event value differences and intervals. This ratio is in fact the *velocity* in which the value changes over time within a sequence. In other words, Eq.6.4 formalizes and generalizes Hsee and Abelson's (1991) velocity hypothesis that holding constant the amount of improvement/deterioration, the faster the value improves (deteriorates), the more (less) attractive the sequence becomes.

6.4 Model comparisons

Derived from LP (Eq.6.2) and TG (Eq.6.1a), the contrasts model (Eq.6.4) share with the other two models the assumption that the value of a sequence is an additive sum of two values, the true, inherent value of individual events (sequence) independent of other events in the same sequence and the value derived from the shape of the sequence. Nevertheless, the contrasts model differs from its two parent models conceptually and practically. As a start, I decompose the model expressions according to the type of value captured in the individual terms (Table 6.2):

Table 6.2. A comparison of the contrasts model, TG and LP.

	Events	Improve-ment	Spread-ing	Influential factors
The contrasts model (6.4)	$\sum v(e_i)$	$\sum cv_i$	$\sum \lvert cv_i \rvert$	*R, I*
Tversky and Griffin (6.1b)	$\sum v(e_i)$	$\sum cv_i$	*n/a*	*n/a*
Loewenstein and Prelec (6.2)	$\sum u_i$	$\sum d_i$	$\sum \lvert d_i \rvert$	*n/a*

n/a: not available

As shown, the terms describing the global value of the "events" are identical in all three models, which is the additive sum of the values (or utility) of the individual sequence events. The models differ in how they represent the shape of a sequence. Firstly, in the contrasts model, as in Tversky and Griffin, the shape is captured by the value differences between events – the more positive/negative this difference, the larger the magnitude of improvement/deterioration, whereas the smaller this difference, positive or negative, the more constant the sequence. By contrast in LP, the shape results in different speeds in which the values accumulate over time. The slower the accumulation, the more positive the deviation index d_i, the more “improving” the sequence is and vice versa, whereas the closer the speed is to a constant, the smaller the $|d_i|$s, and the more “spread” the outcomes are. The contrasts model further hypothesizes that the shape matters more when the outcomes are more related or have a shorter interval. No such assumptions are made in TG or LP.

In practice, these conceptual differences are translated into differences in predictions and applications. Firstly, the contrasts model and LP, but not TG, are capable of describing preference for spreading. Neither can TG, in its original form, deal with sequences containing more than two events. Secondly, the contrasts model, but not TG and LP, are applicable to sequences that contain events with different intervals or different levels of relatedness. However, the predictions made by the contrasts model and LP may vary even for the same sequence due to their differences in the approach of describing modal sequence preferences, in particular preference for spreading.

To illustrate, imagine Alice is making plans for the two upcoming weekends. Her options, valued at 3, 2, 1 and 0 respectively on an interval scale, are having Dim Sum at her favourite Chinese restaurant, visiting a friend she misses, dining at a local Indian restaurant and cleaning her flat. Suppose Alice prefers to do just one thing a day. What kind of arrangements would maximize her global satisfaction?

Since the events are fixed, our task is to select the best ordering of the events from 24 (=4!) possible permutations, all having the same total nominal value. First of all, both the contrasts model and LP would predict (0,1,2,3) to be the most “improving” schedule. Any other ordering would result in faster value accumulation and negative between-event contrasts. The same prediction would also be made by TG were it applicable to four-event sequences. The contrasts model and LP however diverge in their judgments of how constant sequences are. As shown in Table 6.3a, (2,1,0,3) deviates less from the uniform sequence than (0,1,2,3) ($\sum|d_i|$=2 versus 5) whereas as shown in Table 6.3b, (0,1,2,3) not only maximizes improvement but also minimises between-event contrasts ($\sum|cv_i|$=3).

Table 6.3a. Computation details of (0,1,2,3) and (2,1,3,0): LP.

	t_1	t_2	t_3	t_4	**Sum**
The constant sequence	1.5	1.5	1.5	1.5	**6**
$\sum u_i$	1.5	3	4.5	6	
Schedule	0	1	2	3	**6**
$\sum u_i$	0	1	3	6	
d_i	1.5	2	1.5	0	**5**
$\|d_i\|$	1.5	2	1.5	0	**5**
Schedule	2	1	0	3	**6**
$\sum u_i$	2	3	3	6	
d_i	-0.5	0	1.5	0	**1**
$\|d_i\|$	0.5	0	1.5	0	**2**

Table 6.3b. Computation details of (0,1,2,3) and (2,1,3,0): the contrasts model.

	t_1	t_2	t_3	t_4	**Sum**
Schedule	0	1	2	3	**6**
cv_i		1	1	1	**3**
$\|cv_i\|$		1	1	1	**3**
Schedule	2	1	0	3	**6**
cv_i		-1	-1	3	**1**
$\|cv_i\|$		1	1	3	**5**

Which approach is better, deviation from the uniform sequence or contrasts between the events? It might seem easier to imagine why (0,1,2,3) is predicted to be more constant than (2,1,0,3) (as predicted by the contrasts model) rather than less constant (as predicted by LP); but again this would depend on one's *decision perspective*. Decision makers depicted in the contrasts model focus on just two outcomes at a time. By contrast, decision makers depicted in LP make global assessments of past and future utility. Read et al's work on choice bracketing supports the narrow focus, which supports the approach adopted by the contrasts model.

The simplicity of using between-event contrasts to model improvement however comes at a cost, i.e. the capacity of the contrasts model to capture complex patterns. Under the assumption of a linear value function, the sum of the between-event contrast values is reduced to the difference between the values of the last and the first events ($\sum cv=v(e_n)-v(e_1)$). In other words, preference for sequences with the same total nominal value, and the same first and last events, e.g. (1,2,0,4) and (1,0,2,4), would rely entirely on spreading[6].

The contrasts model compensates this drawback by accommodating other types of complexity in sequence assessments. For instance, the events in Alice's scheduling decision are not evenly distributed – four events take place over the two weekends, hence having a one-week interval in between two one-day intervals. The contrasts model captures this by positing that the global assessment relies more heavily on the within-weekend contrasts than on the between-weekend contrast. It follows that (1,2,0,3), despite not strictly improving, might be just as desirable as (0,1,2,3), as the large improvement (from 0 to 3) in the second week may more than

[6] LP has similar problems when describing spreading. For instance consider (2,1,3,1) and (2,3,1,1). Based on the contrasts model, the two sequences are equally improving but (2,1,3,1) is worse in spreading. By contrast, LP would predict (2,1,3,1) to be better in both improvement and in spreading. While the prediction of improvement made by LP makes sense, the one of spreading is not. The possibility of combining the better predictors of the two models is discussed later in the chapter.

compensate for the negative contrast between the two weeks (from 2 to 0). Furthermore, the events may even have different levels of relatedness – the Chinese Dim Sum might be perceived as more related to the Indian dinner than to the cleaning. The contrasts model handling these by adjusting up or down decision weights assigned to various contrasts.

Built from between-event contrast, the contrasts model can also be easily applied when sequence partitioning occurs. By contrasts, deviation indices have to be re-constructed for each segment based on the new hypothetical uniform sequences. Ariely and Zauberman's (2000) find that sub-sequences (segments) are assessed similarly as is the "super-sequence", to which preference for improvement applies (see Chapter 2). Segmentation however causes the global assessment to rely less on the global pattern while more on the intensity of the segments. Once an experience is over, its representation no longer contains the shape of the experiences' pattern but only an overall summary measure. In practice, this implies a step-wise approach of sequence assessment. Consider (1,2,3,1,2,3), which might be assessed as ((1,2,3), (1,2,3)). If this happens, each sub-sequence is first assessed on its own before the outcomes are assessed as if they constituted a new sequence, as in (*SV*(1,2,3), *SV*(1,2,3)).

6.4.1 A validation of the contrasts model

How valid is the contrast model as a descriptive account of sequence preferences? To provide some preliminary evidence, I apply the contrasts model to the sequences reported in Study 1, Loewenstein and Prelec (1993).

The task was to rate thirty weekend schedules, among which were the aforementioned two schedules, A and B. All sequences are permutations of five weekend activities, including one highly enjoyable event with utility of 2, two mediocre events with utility of 1, and two boring events with utility of 0. Participants were not given specific events but asked to imagine from their own experiences events that might fit these utility levels.

Table 6.4 presents the computation details of the contrasts model for Schedule A and B. Since the outcomes are all weekend activities and evenly spaced, relatedness-interval ratio is constant and Eq.6.4 is applicable. As LP, the model assumes a linear value function and no discounting.

Table 6.4. Computations of the contrasts model (Eq.6.4)

	t_1	t_2	t_3	t_4	t_5	**Sum**
Schedule A	1	0	2	0	1	**4**
cv_i		-1	2	-2	1	**0**
$\lvert cv_i \rvert$		1	2	2	1	**6**
Schedule B	2	1	1	0	0	**4**
cv_i		-1	0	-1	0	**-2**
$\lvert cv_i \rvert$		1	0	1	0	**2**

As shown in Table 6.4, the two sequences have the same endowment value (EV=4). Schedule A has a more positive contrast value than Schedule B (0 versus -2), consistent with the observation that A performs better than B in terms of improvement. A also scores higher than B in terms of |CV| (6 versus 2). Thus, to reflect the observation that A is in fact more constant than B, the spreading parameter σ' needs to be positive, different from the spreading parameter σ in LP. This echoes the difference in the approach adopted in the two models discussed earlier. The contrasts model captures spreading by the value difference between the events such that the smaller this difference the more constant the sequence. Thus, a positive rather than negative spreading parameter σ' would indicate preference for spreading.

To make predictions using the contrasts model, I adopt the mean parameter values reported in Loewenstein and Prelec (1993), but reverse the valence of the spreading parameter. Using β=.28 and σ'=.13, the contrasts model predict estimated subjective values for the 30 sequences. As shown in *Appendix A*, the contrasts model has a smaller mean squared error than LP[7] (0.99 versus 3.0) and similar overall validity as LP (Pearson correlation coefficient is 0.840 versus 0.835, Table 6.5).

Table 6.5. Performance of LP and the contrasts model (Eq.6.4)

	LP	The contrasts model
Improvement predictor	0.808**	0.730**
Spreading predictor	-0.241	0.440*
The model	0.835**	0.840**

* significant at .05 level; ** significant at .01 level

Consistent with this discussion, the correlation between the spreading predictor and the mean ratings is *positive* for the contrasts model but *negative* for LP. In other words, the larger the size of the contrast effects, the more the value spreads across over time and vice versa. However, the performance of the individual terms in the two models diverges. LP outperforms the contrasts model in terms of improvement (*R*=0.808 versus 0.73); the contrasts model outperforms LP in terms of spreading (*R*= -0.241 versus 0.44). Combining the superior predictor in each model

[7] Loewenstein and Prelec (1993) reported slightly different results. The reason is that they made predictions using parameter values fitted for individual participants. Since such data were not available, for the sake of comparison reasons, I made predictions for both the contrasts model and LP using the mean estimates of β and σ (σ').

creates a "hybrid" model that has the improvement predictor of LP (($\sum d$), the spreading predictor of the contrasts model ($\sum|cv|$) and the common expression of *EV*. This model achieves the highest predictive validity (*R*=0.87).

This investigation also reveals a common weakness shared by LP and the contrasts model. Neither model accurately predicts the sequence that participants found the most attractive, i.e. (1,0,1,0,2). The choice of the contrast model is (0,1,0,1,2), whereas the choice of LP is (0,0,1,1,2). It is easy to see why. Compared to these two, (1,0,1,0,2) arranges a mediocre experience to take place before a boring one. Its preference implies impatience, or positive time preference, which incurs penalties in both models. To provide a remedy for the contrasts model, I incorporate discounting in Eq.6.1, as we see next.

6.4.2 Incorporating time discounting

First of all, discounting is fostered by time delay. As a non-relational variable, delay affects EV but not CV or |CV|. Bounded between zero and 1, the discount parameter δ_i captures the proportion of value remained of for event e_i as a result of its time delay[8]. The discount parameter embodies the idea of positive time preference for isolated outcomes. It is 1 for the immediate outcomes with a delay of 0; it is less than 1 but greater than 0 if the outcomes are removed from the present. We revise Eq.6.4 as

$$SV = \sum_{i=1}^{n} \delta_i v(e_i) + \beta \frac{R}{I} \sum_{i=2}^{n} cv_i + \sigma \frac{R}{I} \sum_{i=2}^{n} |cv_i| \qquad \text{--- (6.5)}$$

[8] The discount parameter in the contrasts model differs from the one in DU. In the contrasts model, each discount parameter can only describe the value decay of the event to which it is attached. By contrasts, the discount parameter in DU is used to determine the value decay of *any* future outcome by means of some fixed expression, such as the one for computing NPV (see Chapter 2).

At this stage, it is important to distinguish between endowment value (EV) and nominal value (NV) – EV is the *discounting-adjusted* NV. In other words, these two are only identical if we do not consider time discounting.

To see how Eq. 6.5 works, consider (1,0,1,0,2), the most attractive schedule in Study 1. Assume δ to be 1 for the first week and 0.8 for all the rest, which means outcomes that take place in the future weeks are valued 80% of their original worth. Table 6.6 shows the computation details of the model (Eq.6.5). As shown, Schedule (1,0,1,0,2) now has a slightly higher *EV* than either (0,1,0,1,2) or (0,0,1,1,2) (3.4 versus 3.2). This *EV*, combined with *CV* and |*CV*|, along with parameter β=.28 and σ'=.13, predicts a preference for (1,0,1,0,2) over the other two schedules (4.33 versus 4.28 and 4.02).

Table 6.6. Computations of the discounting-adjusted contrasts model (Eq.6.5)

	t1	*t2*	*t3*	*t4*	*t5*	**EV**	***SV***
δi	*1*	*0.8*	*0.8*	*0.8*	*0.8*		
(1,0,1,0,2)	1	0	1	0	2		
discounted	1	0	0.8	0	1.6	3.4	4.33
cvi		-1	1	-1	2	1	
|*cvi*|		1	1	1	2	5	
(0,1,0,1,2)	0	1	0	1	2		
discounted	0	0.8	0	0.8	1.6	3.2	4.28
		1	-1	1	1	2	
		1	1	1	1	4	
(0,0,1,1,2)	0	0	1	1	2		
discounted	0	0	0.8	0.8	1.6	3.2	4.02
		0	1	0	1	2	
		0	1	0	1	2	

Since the contrasts model does not place constraints on how a sequence outcome *should* be discounted, it can make divergent predictions in terms of how sequence preferences might change with delay. To illustrate, consider two two-event sequences (0, 2) and (2, 0), when they are either "near" or "distant" in the following three scenarios: *A*, *B* and *C* (the bottom part of Table 6.7).

Table 6.7. Influences of delay on preference for improvement

	δ_1	δ_2	***EV***	δ_1	δ_2	***EV***	δ_1	δ_2	***EV***	δ_1	δ_2	***EV***
	1	1		1	0.9		0.9	0.8		0.9	0.85	
(2,0)	2	0	***2***	2	0	***2***	1.8	0	***1.8***	1.8	0	***1.8***
(0,2)	0	2	***2***	0	1.8	***1.8***	0	1.6	***1.6***	0	1.7	***1.7***
A	Near			Distant								
B				Near			Distant					
C				Near						Distant		

Scenario A, B and C have different combinations of discount parameters, δ_1 for the first outcome and δ_2 for the second outcome. δ_1 is at least as large as δ_2, indicating a positive time preference, that is, longer delays result in greater discounting. As can be seen in the bottom half of Table 6.7, the discount parameters for the first and second outcomes in Scenario A are both 1 in the near condition, but 1 and 0.9 in the distant condition. In other words, delay exacerbates the discounting of the more distant outcome. In Scenario B, δ_1 and δ_2 are 1 and 0.9 when the outcomes are near, but 0.9 and 0.8 (or approximately 0.9*0.9) when distant. That is, delay has roughly the same impact on the two outcomes. In Scenario C, δ_1 and δ_2 are 1 and 0.9, and 0.9 and 0.85 in the near and distant conditions, indicating that delay has a larger impact on the first outcome than on the second[9].

[9] The pattern of discounting in Scenario B and Scenario C exemplifies classic exponential discounting and hyperbolic discounting respectively.

Regardless of how distant the sequences are, the degree of improvement remains the same (the signed value difference is either 2 or -2). Therefore the contrast model predicts that the preference between (0,2) and (2,0) is determined by their respective endowment values (EV), which in this case depends on how the outcomes are delayed. Scenario A B and C represent three cases in which delay might *reduce*, *have no impact on* and actually *enhance* preference for improvement. In Scenario A, The EV difference is larger in the distant condition than in the near condition (0=2-2 versus 0.2=2-1.8), making (2,0) more attractive relative to (0,2) when the sequences are delayed. In Scenario B, this difference remains the same over time (0.2 in both). In Scenario C, this difference is however smaller in the distant condition (0.2 versus 0.1=1.8-1.7), making (0,2) even more attractive. In summary, for sequence (time) preferences as simple as the ones we postulate here, delay weakens/enhances/has no impact on preference for improvement if the later outcome suffers from a larger/a smaller/the same amount of value decay compared to the earlier outcome.

6.5 Looking ahead

The remaining chapters of this thesis (Chapter 7, 8, 9, 10) report experiments that test the validity of the contrasts model. The following things are worth noting:

Two-event sequences I employ two-event sequences to investigate influences of delay, interval and relatedness. This is to maximize the salience and therefore the impact of relatedness and interval, which is the focus of this investigation.

Constant parameter I assume that the improvement and spreading parameters, β and σ', as well as the discount paramter δ, all remain constant in a given experiment. This essentially means that people's sequence (time) preferences remain stable in a given decision context.

Linear value function I adopt a linear value function for simplicity. This is a reasonable assumption as most often the experiments investigate only small range of values. When such assumption is questionable, their consequences are discussed.

No interactions between delay, interval and relatedness I consider only first-order effects in the contrasts model. That is, delay does not influence *perceived* interval or relatedness. In other words, I do no consider more complex effects such as time contraction, which implies that delay can affect perceptions of interval, and thereby contrast effects and discounting of the later outcomes.

The main prediction of the contrasts model is that sequence preferences depend on both the endowment and the contrast effects. Endowment effects in turn depend on the nominal values of the individual outcomes and their respective time delays; contrast effects depend on the signed value difference between the adjacent outcomes, their interval and relatedness. Under the assumption of the modal sequence preferences, a larger relatedness-interval ratio makes increasing sequences more attractive and decreasing sequences less attractive. That is, preference for improvement is enhanced. An overview of the experiments is shown in Table 6.8:

Table 6.8. Overview of the experiments.

Task	**To provide evidence for the hypothesis that**
The ranking task (**Chapter 7**)	The trend (signed value difference) matters
The sequence judgment task (**Chapter 8**)	Interval (I) and relatedness (R) affect trend preferences
The interpersonal (social) judgment (**Chapter 9**)	Interpersonal and intrapersonal contrasts are similar
The scheduling task (**Chapter 9**)	Delay and interval can affect sequence preferences simultaneously
The happiness task (**Chapter 10**)	Endowment (EV) and contrast effects (CV) coexist

Chapter 7 THE RANKING TASK

7.0 Introduction

The contrasts model posits that the value of a sequence consists of the endowment value and the contrast value. The endowment value is a function of the nominal value and delay; the contrast value depends on the signed value difference, interval and relatedness. As a start, this chapter investigates influences of the *signed value difference* between outcomes, that is, when the outcomes are embedded in two-outcome sequences. Positive, zero and negative value differences correspond to increasing, constant and decreasing sequences. Existing research shows that preference for improvement (i.e. positive β) holds for sequences containing only two outcomes. For instance, a preference for "happy endings" (Ross & Simonson, 1991) refers to the finding that participants strongly preferred those sequences ended with a gain to those ended with a loss, despite the same total nominal value (NV). Lowenstein and Prelec (1993) reported similar results. Under the assumption of positive β, I hypothesize:

H1.1 Effects of positive contrast value

The more positive the signed value difference, the more attractive the sequence is perceived and vice versa.

I test H1.1 using a ranking task of two-event monetary sequences.

7.1 The ranking task

Methods

Subjects. Fifty-six students studying at the London School of Economics were randomly approached on the campus. They were unpaid.

Methods. Each sequence consisted of two unexpected monetary outcomes that occurred over a period of two days, i.e. one event on each day. Two groups of sequences were created. The "positive" group consisted of five sequences, each composed of two gains with a constant nominal value of £500. As an example, the positive sequence (250, 250) was described as:

> One day, you experience an unexpected gain of £250.
>
> The next day, you experience another unexpected gain of £250.

The "mixed" group consisted of six sequences, each composed of one gain and one loss, with a constant nominal value of zero, e.g. (-200, 200). Table 7.1 lists all the sequences in the two groups, in the order they were presented to the participants[10] and also the signed value difference of each sequence.

Table 7.1. Stimulus sequences in the ranking task

Positive	$v(e_2-e_1)$	Mixed	$v(e_2-e_1)$
(100, 400)	300	(-200, 200)	400
(400, 100)	-300	(200, -200)	-400
(200, 300)	100	(-100, 100)	200
(300, 200)	-100	(100, -100)	-200
(250, 250)	0	(-250, 250)	500
		(250, -250)	-500

[10] The fixed presentation order could result in an order effect, as we see later.

Each participant was given a two-page questionnaire, one group of sequences on each page. Half of the participants encountered the positive sequences first and the other half the mixed sequences first. They were instructed to rank the desirability of these sequences by assigning “1” to the sequence they perceived as the most attractive, “2” to the sequence as the second most attractive, and so on. I attach the questionnaire as *Appendix B.*

Results

All fifty-six participants completed the rankings for the positive sequences (n=56); all but three participants completed the rankings for the mixed sequences (n=53). Tie ranks appeared only twice in all the responses and were subsequently included in the analyses.

The hypothesized positive contrasts (Table 7.1) predict a preference for improvement or *negative* time preference. In terms of the rank order of the events, this leads to a preference for (-250,250), (-200, 200), (-100,100), (100, -100), (200, -200), (250, -250) in the mixed sequences, and (100, 400), (200, 300), (250, 250), (300, 200), (400, 100) in the positive sequences. The exact opposite (the reversed rank-orders) would indicate a *positive* time preference.

Table 7.2a and 7.2b present the number of participants who assign the row rankings to the column sequences within each group. As shown, out of 53 participants who complete the rankings of the mixed sequence, twenty-six rank (-250, 250) as the *most* attractive, whereas nine rank the sequence as the *least* attractive. The *modal* ranking of each sequence is underscored. In both the mixed and positive conditions, the modal rankings match the predictions of negative time preferences. At the global level, this preference predicts 28% (or 15 out of 53) of all the rankings observed in the mixed condition and 32% (or 18 out of 56) of those in the positive condition.

Table 7.2a. Rankings of the "mixed" group (n=53)

Rankings	(-250, 250)	(-200, 200)	(-100, 100)	(100, -100)	(200, -200)	(250, -250)
1	<u>26</u>	6	4	4	5	13
2	5	<u>24</u>	5	4	11	4
3	5	3	<u>24</u>	14	5	2
4	4	4	15	<u>24</u>	2	4
5	4	8	3	2	<u>28</u>	6
6	9	8	2	5	2	<u>24</u>

Table 7.2b. Rankings of the "positive" group (n=56)

Rankings	(100, 400)	(200, 300)	(250, 250)	(300, 200)	(400, 100)
1	<u>29</u>	4	5	4	14
2	5	<u>29</u>	1	14	8
3	4	12	<u>30</u>	7	3
4	1	10	9	<u>29</u>	6
5	17	1	11	2	<u>25</u>

Despite the support for the hypothesis, there is a large number of inconsistent rankings. As can shown in Table 7.2, the second most popular ranking reflects positive time preferences, i.e. the opposite of preference for improvement, which predicts 15% and 13% of all the observed rankings respectively in the mixed and positive conditions. Assuming a participant is equally likely to have positive, negative and *neither* positive nor negative time preferences, a chi-square test reveals significance, $\chi^2(3)$ = 29.77, p<.0001[11]. Figure 7.1 presents the distribution of the rankings.

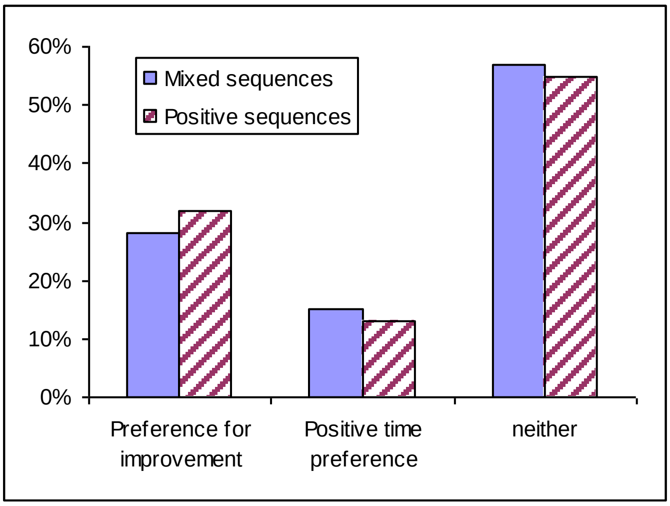

Figure 7.1. Distribution of the observed rank-orders in the ranking task.

In fact, over half of the rankings (57% of the mixed group and 55% of the positive group) fall in the category of "neither positive nor negative time preferences". A closer look reveals that these rankings, collectively known as the "irregular", exhibited no distinct patterns. For the mixed group, 30 participants produce 26 different rankings and for the positive group, 31 participants produce 22 different rankings. In other words, each irregular ranking is produced by no more than two participants.

To see whether the irregular rankings were in part driven by positive and negative time preferences, I correlate each of these rankings with the ones predicted by positive time preference. A more positive/negative Pearson correlation coefficient is taken as indicating a higher likelihood this ranking is driven by positive/negative time preferences. The mean correlation coefficients are -0.23 and -0.07 respectively

[11] Unless otherwise stated, all statistical analyses reported in this thesis are two-tailed.

for the mixed and positive sequences, suggesting a general preference for improvement, which is more pronounced when sequences contain gains as well as losses. In fact, the modal rankings of the mixed sequences still conform to a preference for improvement, i.e. the same as in Table 7.2a. The one in the positive group is however (100, 400), (400,100), (200,300), (300, 200), (250, 250), from the best to the worst.

This procedure also allows us to gain insights into rankings at the individual-level. Having correlated all the rankings with the predictions of positive time preferences for the mixed and positive sequences, I then compute the absolute difference between the two correlation coefficients for all the individuals who have ranked both types of sequences and produced no tie ranks. The idea is that the smaller this difference, as indicated by the length of bar in Figure 7.2, the more the rankings in the two conditions are driven by the same factors, and vice versa.

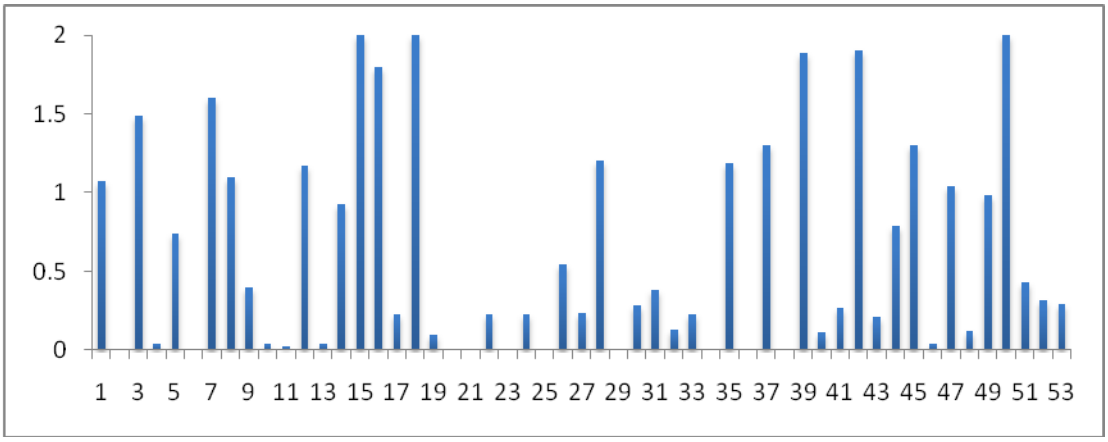

Figure 7.2. Individual differences in ranking the mixed and positive sequences.

Each bar indicates the difference in the rankings of the positive and mixed sequences for an individual participant. The longer the bar, the more different the rankings are. Bars with maximum length (2 or -2) indicate that rankings are motivated by opposing time preferences. Bars with zero length indicate that the rankings are motivated by the same preference.

As shown in Figure 7.2, there are large discrepancies (long bars) within the same individual (*x*-axis). Consistent with this, the overall Pearson correlation of the correlation coefficients for each of the two conditions is low, R=0.29. Only 10 out of 53 participants are consistent in the two tasks (bar length=0), while three display opposing preferences (bar length =2).

Discussion

H1.1 receives support from the results. The signed value difference (preference for improvement) predicts the most frequently observed rankings in sequences that contain only gains as well as in those that contain a gain and a loss. However, a large proportion of participants also exhibit positive time preference. Positive and negative time preferences together predict nearly half of all the observed rankings (43%=28%+15% for the mixed sequences and 45%=32%+13% for the positive sequences). This means that the larger the value difference between the outcomes, the more extreme one's preferences become.

Several things are worth noting. First, preference for improvement seems more pronounced in the mixed group than in the positive group. Participants are also not inclined to rank the two different types of sequences similarly. Although the proportions of participants exhibit preference for improvement are similar (32% in the positive group versus 28% in the mixed group), only in the mixed group does the modal rankings of the "irregular" group conform to the preference for improvement. By contrast, the modal responses to the *positive* group coincide with the presentation order of the sequences (Table 7.1), signalling lack of any preference. One explanation might be that the magnitude of contrast effects is larger in the mixed group than in the positive group. This magnitude effect could even be exacerbated by loss-aversion

(Kahneman & Tversky, 1979) that the contrast between a gain and a loss (e.g. 200 and -200) could be more pronounced than one between two gains (e.g. 400 and 0).

Second, positive time preference receives support, implying “discounting by interval” (Read, 2001b; Read & Roelofsma, 2003) with the earlier outcome in the sequence. This is unexpected (but see (Frederick & Loewenstein, 2008)), especially when compared to previous investigations of similar sequences, e.g. Ross and Simonson (1991). This is made even more surprising by the fact that the interval between the outcomes is one day, making value decay hard to justify. Further, the timing of the outcomes is ambiguous – participants may interpret it as outcomes occurring in the past or in the future. If outcomes have occurred, then the second, later outcome is actually closer to the present than the first, earlier outcome, in which case the improvement is predicted by both contrast effects and positive time preference and should therefore received stronger support than it does now. Since the support is actually weaker than expected, most participants seem to believe that the outcomes occur in the future.

Compared to preference for improvement, preference for spreading receives little support. The constant sequence (250,250) was ranked the highest by 9% of the participants (or 5); the mixed sequences with the smallest contrast value, i.e. (-100, 100) and (100, -100), were ranked at the top by 8% of the participants (or 4) each. Given the design of the experiment, this is hardly surprising. For two outcomes distributed over a period of two days, the “convenience” achieved by spreading the outcomes is minimal (see Chapter 2).

7.2 Summary

The ranking task provides evidence for preference for improvement when the sequences contain just two outcomes. Other things being equal, the more positive this difference, the more attractive the sequence becomes. This holds for sequences containing only gains as well as a mixture of gains and losses. There is no evidence for preference for spreading.

It is worth noting that due to the control on the total nominal value (NV), the signed value difference has a perfect positive correlation with the value of the second outcome in the sequence. I attribute the observed preference for improvement to the value *difference* and therefore *the contrast effect* but it is possible that this preference in fact comes from the desire to have the later outcome as desirable as possible. To assume no contrasts, we would have to assume that participants ignore the control on the total nominal value such that an increase in the value of the later outcome is always accompanied by a decrease in the value of the earlier outcome. This is problematic not only because such ignorance seems highly unlikely but also because even if this were indeed the case, participants would have exhibited a positive time preference, that is, a desire to have the *earlier* rather than the later outcome as desirable as possible, inconsistent with the dominant finding.

The flaw in the design of the experiment however needs to be remedied. In Chapter 8, I seek to prove that the global assessment indeed depends on interactions between the outcomes by testing influences of the relatedness and interval, in addition to the signed value difference (i.e. the trend).

Chapter 8 INTRA- AND INTER-PERSONAL CONTRASTS

8.0 Introduction

The contrasts model predicts that two relational variables hypothesized in the model, namely relatedness (R) and interval (I), affect sequence preferences via exerting influences on contrast effects. One aim of this chapter is to test this claim. Another aim is to examine a postulate made in Chapter 4 that context effects between two outcomes occurring to the same person (i.e. intrapersonal, intertemporal or sequential outcomes) parallel context effects between two outcomes occurring to two different persons (i.e. interpersonal or social outcomes). For these reasons, I report in this chapter two studies: one sequence judgment task that investigates influences of relatedness and interval, and one social judgment task that adopts an almost identical design to allow for a comparison between context effects in the two different types of judgment tasks.

8.1 General methods

The outcomes are monetary gains – an intertemporal task that solicits sequence preferences and an interpersonal task that solicits preferences for interpersonal experiences. I manipulate three independent variables, which are (1) the *valence* of the contrast effect (*positive, null, negative*), (2) the domain *relatedness* of the gains (two *related* working bonuses, *unrelated* working bonus and lottery win) and (3) the *interval* between the gains (received *on the same day* or *half-day interval*, *one-day interval*, or *one-week interval*).

In the sequence assessment task, participants assess the satisfaction of a hypothetical decision maker, Mr A, who has just received a fixed total amount (nominal value) over two days that are either related or unrelated, segregated by either one of the three intervals. In this context, a positive, null or negative contrast corresponds to a sequence of gains either increasing in magnitude, remaining constant or decreasing. The design of the experiment is 3 Trend x 2 Domain x 3 Interval within-subjects.

In the interpersonal judgment task, participants assess the satisfaction of Mr A, who has just received a gain when his colleague, Mr B, also has received a gain either related or unrelated to the gain received by Mr A, either on the same day or has a one week interval. In this context, a positive, null or negative contrast indicates that Mr B's gain is smaller than, the same as, or larger than Mr A's gain. The design of this experiment is 3 Amount x 2 Domain x 2 Interval within-subjects.

These arrangements give rise to a total number of 18 (=3x2x3) sequences of gains received by Mr A in the intertemporal task and 12 (=3x2x2) isolated gains received by Mr B in the interpersonal task. In both cases, the same participant assesses either all the sequences or all the individual gains. Such a design can entail a large number of comparisons both within and between the three independent variables. To facilitate these comparisons, I group the gains that have the same *valence* together and present them in a matrix. So the intertemporal gains are grouped based on their *trend*, i.e. either increasing, constant or decreasing and the intertemporal gains are grouped based on their level of *amount*, i.e. either positive, null, or negative. Within each matrix, the relatedness and interval between the gains are presented in the first two columns; and the last column is left blank so participants can fill in satisfaction ratings. I use a 9-point scale, with "1" indicating the *least happiness* and "9" indicating the *most happiness*. Sample matrices are presented below. I counterbalance the presentation order of the matrices, columns and rows within each matrix.

The contrast model predict for both the intra- and inter-personal judgments (1) the contrast effect or the effect of the signed value difference and (2) the moderating effect of relatedness and interval on the contrast effect. In what follows, I discuss each study in turn, starting with the sequence judgment task.

8.2 The sequence judgment task

The contrasts model makes the following predictions for the sequence judgment task:

H2.1 The contrast effect

The more positive (negative) the signed value difference, the more pronounced the contrast effects, the more (less) desirable the sequences are, and vice versa.

H2.2 The relatedness effect on trend

The more related the outcomes, the more pronounced the contrast effects are, and vice versa.

H2.3a The interval effect on trend

The shorter the interval, the more pronounced the contrast effects are, and vice versa.

Since the contrast value is a function of the relatedness-interval ratio (*R/I*), interval can only influence contrasts if the outcomes are related:

H2.3b Relatedness moderates the interval effect

The interval effect (H2.3a) is more pronounced for related events than for unrelated events.

Methods

Subjects. A total number of 138 undergraduates, 47 (35%) females, studying at a large university in Shanghai, China took part in this study. They received and returned the questionnaires (written in Microsoft Word®) to the experimenter by email. They were between 19 and 24 year-old and were unpaid.

Methods. The design was 3 Trend (increase, constant, decrease) x 2 Domain (related, unrelated) x 3 Interval (half-day, one day, one week) within-subjects. Participants rated the satisfaction of Mr A who has received two gains worth in total 4,000RMB[12] (approx. £266) on two separate occasions: either 1,500 on Day 1 and 2,500 on Day 2 (the increasing trend), or 2,000 on both days (the constant trend), or 2,500 on Day 1 and 1,500 on Day 2 (the decreasing trend). Table 8.1 shows the sample matrix that was used to solicit the ratings of six *increasing* sequences.

In addition to the within-subjects factors, I tested a between-factor called scenario "ownership"[13]. Sixty-eight participants were randomly allocated to the "high-ownership" condition and judged "How *you* would feel" about the gains by imagining they were Mr A. The rest of the participants, seventy in total, were allocated to the "low-ownership" group and judged "How *Mr. A* would feel". The ownership condition was included to test the impact of two common but different ways of

[12] This was roughly the average monthly salary a Chinese undergraduate expected to earn in Shanghai when the study was conducted in 2005 when the study was done.

soliciting sequence preferences. I translated the questionnaire to English and attached it as *Appendix C*.

Table 8.1. The assessment of the increasing sequences

Source of Income (Domain)	Received (Interval)	Increasing Incomes 1500 and 2500
Two bonuses	On the same day	
Two bonuses	Over two days	
Two bonuses	Over a week	
One bonus & One lottery win	On the same day	
One bonus & One lottery win	Over two days	
One bonus & One lottery win	Over a week	

Results

The within-effects I analyze the ratings using a repeated measure Analysis of Variance (ANOVA) model. Table 8.2a and 8.2b present the results. I employ the rating difference between the increasing and decreasing sequences as a measurement of preference for improvement and the rating difference between the increasing (decreasing) sequence and the constant sequence (with a constant contrast value of 0) as a measurement of positive (negative) contrast effects.

Main effects Consistent with the contrast effect hypothesized in H2.1, the mean rating is the highest for the increasing trend (7.47), followed by the constant trend (7.13), and then by the decreasing trend (6.40), $F(2,272)=66.726$, $p<.0001$, $\eta^2=.327$. The negative contrast effect (-0.73=6.40-7.13) is more than twice the size of the positive contrast effect (0.34=7.47-7.13).

Table 8.2a. Mean Ratings and *standard deviations* (N=138)

Domain	Interval	Increase (1500, 2500)		Constant (2000, 2000)		Decrease (2500, 1500)		**Means**
		Mean	*s.d.*	Mean	*s.d.*	Mean	*s.d.*	
Same	Same day	7.65	*1.32*	7.22	*1.46*	5.89	*2.31*	**6.92**
Same	Day	7.37	*1.24*	7.02	*1.32*	6.07	*1.7*	**6.82**
Same	Week	6.92	*1.17*	6.60	*1.28*	5.94	*1.56*	**6.49**
Means		**7.31**		**6.95**		**5.97**		**6.74**
Different	Same day	7.92	*1.31*	7.61	*1.45*	6.89	*1.92*	**7.47**
Different	Day	7.64	*1.23*	7.39	*1.32*	6.83	*1.74*	**7.29**
Different	Week	7.33	*1.25*	6.95	*1.41*	6.76	*1.62*	**7.01**
Means		**7.63**		**7.32**		**6.83**		**7.26**
	Same day	**7.79**		**7.42**		**6.39**		**7.20**
	Day	**7.51**		**7.21**		**6.45**		**7.05**
	Week	**7.13**		**6.78**		**6.35**		**6.75**
Overall		**7.47**		**7.13**		**6.40**		**7.00**

Table 8.2b. ANOVA model results (within-subjects)

Source	*df*	F	Sig.	η^2	Hypothesis
Trend	2, 272	66.726	0.000	.327	H2.1
Domain	1, 136	80.089	0.000	.370	N.H.
Interval	2, 272	38.983	0.000	.222	N.H.
Trend × Domain	2, 272	26.247	0.000	.161	H2.2
Trend × Interval	4, 544	16.4	0.000	.108	H2.3a
Trend × Domain × Interval	4, 544	2.616	0.034	.019	H2.3b

N.H. Not Hypothesized

Interactions The significant three-way interaction (Trend×Domain×Interval) and two-way interactions (Trend×Domain and Trend×Interval) provide evidence for the hypothesized relatedness and interval effect on trend, i.e. H2.3a, H2.2, and H2.3b. The interactions are depicted in Figure 8.1, Panel A (the related condition) and Panel B (the unrelated condition). I discuss each in turn.

Panel A Related gains (bonus, bonus) **Panel B Unrelated gains (bonus, lottery win)**

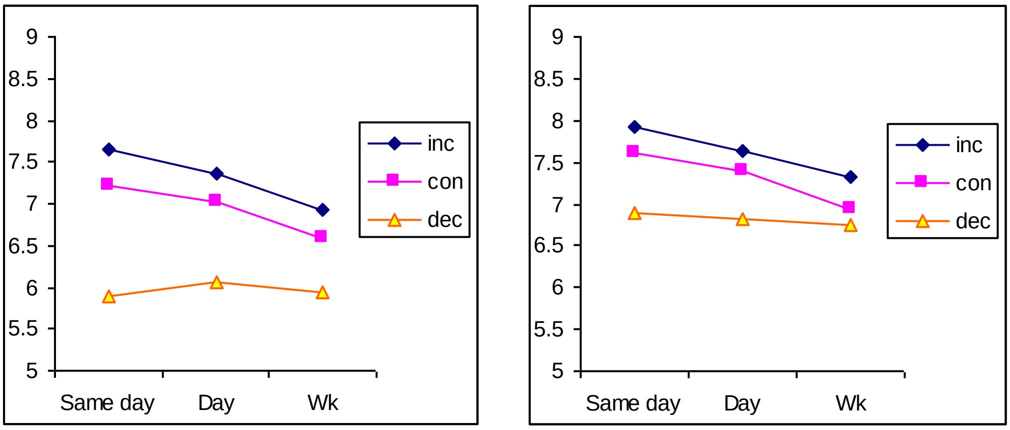

Figure 8.1. Domain × Interval × Trend

First, the interaction between the interval and the trend ($F(4,544)=16.4$, $p<.0001$, $\eta^2=.108$) provides evidence for the hypothesized interval effect (H2.3a) that the rating difference between the increasing and decreasing sequences, which indicates the magnitude of a preference for improvement, is larger when the gains are temporally near (1.40=7.79-6.39 for the half-day interval) than when the gains are temporally distant (.78=7.13-6.35 for the one week interval), $t(137)=4.43$, $p<.001$. This interval effect also holds for the related gains (1.76=7.65-5.89 versus .98=6.92-5.94) as well as for the unrelated ones (1.03=7.92-6.89 versus .57=7.33-6.76).

Second, the interaction between the domain and the trend ($F(4,544)=26.247$, $p<.0001$, η^2 =.161) provides evidence for the hypothesized relatedness effect (H2.2) that the rating difference is larger between the related gains (1.34=7.31-5.97) than between the unrelated gains (0.8=7.63-6.83), $t(137)=5.717$, $p<.001$.

Third, the three-way interaction between Trend, Domain and Relatedness, $F(4,544)= 2.16$, $p<.04$, η^2 =.019 provides support for H2.3b that the interval effect depends on relatedness. That is, the rating difference between the increasing and decreasing sequences decreases more with interval when the gains are related (0.78=1.76-0.98) than when they are unrelated (0.46=1.03-0.57).

In addition to these, I also observe two unexpected main effects. First, receiving two working bonuses are judged to be less attractive than receiving one working bonus and one lottery win (6.74 versus 7.26) at all levels of interval and trend, $F(1,136)=80.089$, $p<.0001$, η^2=.370. Second, receiving gains that are temporally near is more desirable than those temporally distant. The mean ratings are respectively 7.20, 7.05 and 6.75 when the intervals are half-day, one day and one week, $F(2,272)=38.983$, $p<.0001$. However, a closer look at the ratings reveals that this interval effect holds for the increasing gains (0.66=7.79-7.13, $t(137)=7.556$, $p<.001$) as well as for the constant gains (0.64=7.42-6.78, $t(137)=7.556$, $p<.001$), but not for the decreasing gains (0.04=6.39-6.35, $t(137)$=.1.508, p=.134).

The between-effects The experiment manipulates the "situation ownership" (Table 8.3 & Fig.8.2). Those who imagine receiving the gains themselves (the high-ownership condition) derive higher satisfaction than those who imagine Mr A receiving the gains (the low-ownership condition), mean ratings 7.25 versus 6.76, $F(1,136) = 6.395$, $p<.02$. However, As shown in Figure 8.2, the "ownership effect" holds for the decreasing sequences (6.06 versus 6.75, $t(136)=2.6$, $p<.05$), as well as the increasing sequences (7.26 versus 7.69, $t(136)=2.36$, $p<.05$), but not for the constant sequences (6.96 versus 7. 30, *n.s.*).

Table 8.3. The ownership effect in the sequence judgment task

	Low	High
Increase	7.26	7.69
constant	6.96	7.30
decrease	6.06	6.75
Means	**6.76**	**7.25**

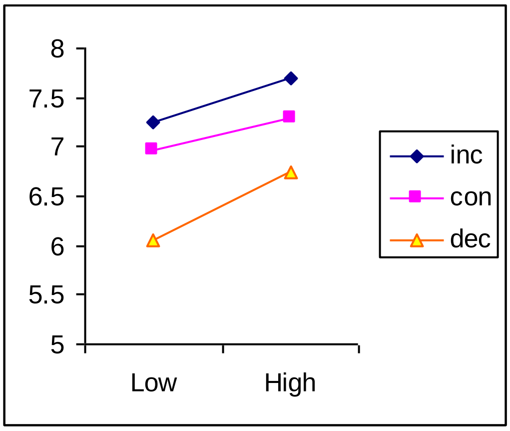

Figure 8.2. The ownership effect in the sequence judgment task

Discussion

The results provide support for backward contrast effects on sequence assessments. As in the ranking task, increasing sequences that have positive contrast values are preferred to decreasing sequences that have negative contrast values (H2.1). Evidence that such preference is driven by comparisons between the outcomes rather than purely by preferences for individual outcomes come from influences exerted by the two relational variables that depict outcome relationships, i.e. their domain relatedness and temporal interval. The results show that the trend effect is more pronounced, that is, the value gap between the increasing and decreasing sequences is larger, when the outcomes are of the same than different kinds (H2.2) as well as when the interval between the outcomes is short than long (H2.3a). This interval effect is also more pronounced for the related gains than for the unrelated outcomes (H2.3b). Note that the interval effect persists even when the gains are "unrelated" (Fig.8.1), indicating that some level of outcome integrity is retained between working bonuses and lottery wins. This happens presumably because the gains, despite differing in terms of the source, are both money received by the *same* individual.

Evidence of loss-aversion emerges (Kahneman & Tversky, 1976). The negative contrast between a larger earlier gain and a smaller later gain has a much larger and detrimental impact on the global assessment than the positive contrast of the same nominal value, using the ratings assigned to the constant sequences as the benchmark (Fig.8.1).

Loss-aversion might even interfere with the ownership effect. When participants imagine that they were Mr A and receive the gains themselves, their satisfaction improves in all three trends, *especially* in the decreasing sequences. Since the value gap between the increasing and decreasing sequences comes only from their differences in the contrast values, one explanation is that imagining one's own gains has a similar impact as a long time delay – they both enhance outcome integrity and foster the integrated model of assessments (Chapter 3). As a result, the inherent worth of the gains (i.e. the endowment) becomes more important in the global assessments relative to the comparison between the individual gains (i.e. the contrast or the trend effect). An alternative account is that the high-ownership condition enhances the vividness of the gains. This results in time discounting (Mischel, Shoda, *et al*., 1989), making the decreasing trend more attractive. Since the timing of the gains is actually ambiguous, this account suggests the delay of the second outcome is assessed based on that of the first, implying "discounting by interval" (Read, 2001b; Read & Roelofsma, 2003). Further, if the vividness does increase as a result of the ownership, imagining one's own *losses* should have a symmetric effect, exerting a detrimental effect on one's satisfaction compared to imagining losses of some irrelevant individuals. Future investigation can test these hypotheses.

This investigation also demonstrates influences exerted by relatedness and interval *on their own*, in addition to their interactions with the contrast (the trend). Sequences are more attractive if they consist one working bonus and one lottery win rather than two working bonuses. One explanation is that lottery wins carry an element of luck, making people happier compared to working bonuses of the same amount[14]. An alternative account comes from Linville and Fischer's (1991a) notion of limited coping capacities that for large gains, people prefer to distribute them across time, which is however weaker for the gains from different domains. In other words, spreading could take place both on time or in terms of the kind (see Chapter 2).

However, while this "preference for spreading" explains the main effect of relatedness, it contradicts the main effect of interval. Participants prefer temporally near gains to those distant, as long as the gains are increasing or constant but not when the gains come in a decreasing trend as in (2500, 1500). This could result from several "conflicting motives" associated with interval. First, longer intervals protect participants with limited coping capacities from being overwhelmed by the gains.

[14] I thank Peter Ayton and Nick Chater for pointing this out.

Second, longer intervals decrease the magnitude of the contrasts (H2.3a). Third, due to "discounting by interval", longer intervals mean the first gain is discounted more and therefore have a detrimental effect on the endowment of the first gain. For increasing and constant sequences of gains, only the first account predicts a preference for longer intervals, whereas for the decreasing sequences, both the first and the second accounts predict a preference for longer intervals.

8.3 The social judgment task

This experiment examines contrast effects when people assess an isolated gain received by one person (Mr A) in the context of a gain received by another person (Mr B). The same four hypotheses hold:

H3.1 The contrast effects in social judgments

The more positive (negative) the target experience compared to the contextual experience, the more (less) attractive the target is.

H3.2 Relatedness moderates the contrast effects

The more/less related the target and contextual experiences, the more/less pronounced the contrast effects are.

H3.3a Interval moderates the contrast effects

The shorter (longer) the interval between the target and contextual experiences, the more (less) pronounced the contrast effects are.

H3.3b Relatedness moderates the interval effect

The interval effect (H3.3a) is more pronounced if the target and contextual experiences are related rather than unrelated.

Methods

Subjects. Twenty-seven Chinese undergraduates, 12 (45%) females, studying at a large technological university in China participated in this study. They received and returned the questionnaires (written in Microsoft Word®) to the experimenter by email. They were between 19 and 22 years and were unpaid.

Table 8.4. A sample matrix of the interpersonal judgment task

If Mr B receives on the same day…

Source of Income (Domain)	Worth (RMB)	How happy is Mr. A?
A Bonus	2500	
A Bonus	2000	
A Bonus	1500	
A Lottery win	2500	
A Lottery win	2000	
A Lottery win	1500	

Methods. I employed a 3 Amount (more, less, the same) x 2 Domain (related, unrelated) x 2 Interval (half-day, one week) within-subject design. Participants rated the happiness of Mr A after receiving a working bonus of 2,000 RMB (approx. £123), when Mr B, his officemate, received either a working bonus or a lottery win, either on the same day or in the same week, that was either at a *higher* amount (2,500 RMB), the *same* (1,500 RMB) or *lower* (2,000 RMB). Table 8.3 shows a sample matrix. I translated the questionnaire from Chinese to English and attached it as *Appendix D*.

Results

Table 8.5a and 8.5b present respectively the mean ratings and results of a repeated measure ANOVA model.

Table 8.5a. Mean Ratings and *standard deviations* (n=27)

Interval	Mr B's	Related gains		Unrelated gains		**Means**
	Amount	mean	*s.d.*	mean	*s.d.*	
Day	Higher	4.52	*2.17*	5.52	*2.08*	5.02
Day	Same	6.15	*1.38*	5.93	*1.59*	6.04
Day	Lower	6.93	*1.82*	6.04	*1.72*	6.49
Means		**5.87**		**5.83**		**5.85**
Week	Higher	5.19	*1.94*	5.59	*1.78*	5.39
Week	Same	6.56	*1.48*	5.93	*1.47*	6.25
Week	Lower	6.93	*1.86*	5.96	*1.68*	6.45
Means		**6.23**		**5.83**		**6.03**
	Higher	**4.86**		**5.56**		**5.20**
	Same	**6.36**		**5.93**		**6.14**
	Lower	**6.93**		**6.00**		**6.46**
Overall		**6.05**		**5.83**		**5.94**

Table 8.5b. ANOVA model results

Source	df	F	Sig.	η^2	Hypothesis
Amount	2, 52	6.89	.010	.209	H3.1
Domain × Amount	2, 52	16.718	.000	.391	H3.2
Interval ×Amount	2, 52	7.455	.004	.223	H3.3a
Interval × Domain × Amount	2, 52	2.448	.096	.086	H3.3b
Interval × Domain	1, 26	5.477	.027	.174	N.H.

N.H.: not hypothesized

Consistent with H3.1, the more positive the contrast, the more attractive the gains are, $F(2,52)=6.89$, $p=.01$, $\eta^2=.209$; the mean ratings of Mr A's satisfaction are respectively 6.46, 6.14 and 5.20, when Mr B receives a lower, the same and a higher amount. The negative contrast value, as measured by the rating difference between the "higher" and the "same" conditions (0.94=6.14-5.20) almost triples the size of the positive contrast value, as measured by the rating difference between the "lower" and "same" conditions (0.32=6.46-6.14).

Three significant two-way interactions provide support for H3.2, H3.3a and H3.3b. These interactions are presented in Panel A and Panel B, Fig.8.3. First, as depicted in Panel A, the interaction between Domain and Amount ($F(2,52)=16.718$, $p<.0001$, $\eta^2=.391$) is consistent with the hypothesized relatedness effect (H3.2) that the contrasts are more pronounced when the two interpersonal gains are two working bonuses ("same") than one working bonus and one lottery win ("different"). That is, the value gap between the "higher" and the "lower" gains is significantly larger when the gains are related than when the gains are unrelated, Wilcoxon $z=3.755$, $p<.001$.

Panel A Domain × Amount **Panel B Interval × Amount**

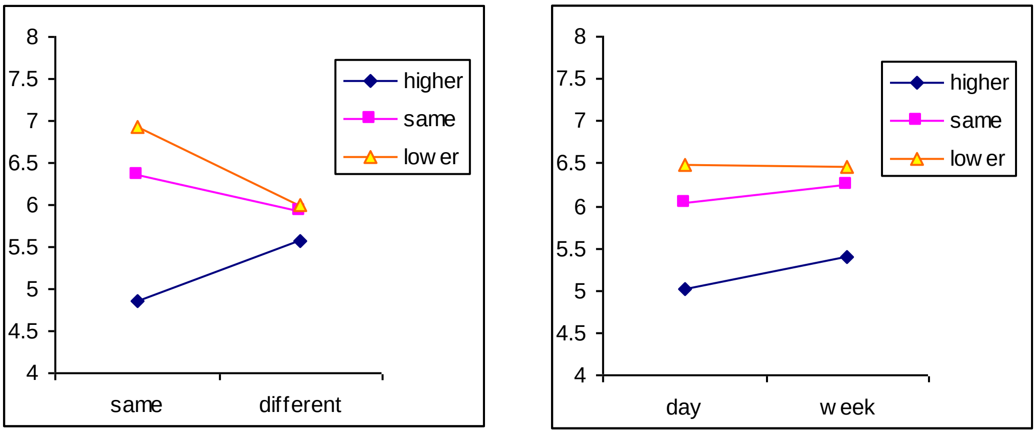

Figure 8.3. The two-way interactions

Second, as shown in Panel B, the interaction between Interval and Amount ($F(2,52) = 7.455$, $p<.0005$, $\eta^2=.223$) provides support for the hypothesized interval effect (H3.3a) that the contrast effects are more pronounced when Mr A and B's gains are temporally near ("day") than distant ("week"), expressed as the larger value gap associated with the shorter interval, Wilcoxon $z=2.691$, $p<.001$.

H3.3b hypothesizes that the interval effect (H3.3a) depends on the domain relationship between the gains. This explains the marginally significant three-way interaction between Interval, Amount and Domain, $F(2,52)=2.488$, $p<.10$. The effects are shown in Fig. 8.4, Panel A (the related condition) and Panel B (the unrelated condition). As can be seen, the lines that correspond to the three levels of the amount of the gains are almost horizontal in Panel B but exhibit a converging trend in Panel A. This provides evidence for the hypothesis that the interval effect is only applicable when the gains received by Mr A and Mr B come from the same source, $F(2,52)=7.367$, $p<.002$, but not when they come from two different sources, $F(2,52)=.0536$, $p>.5$.

Panel A Domain = Same **Panel B Domain = Different**

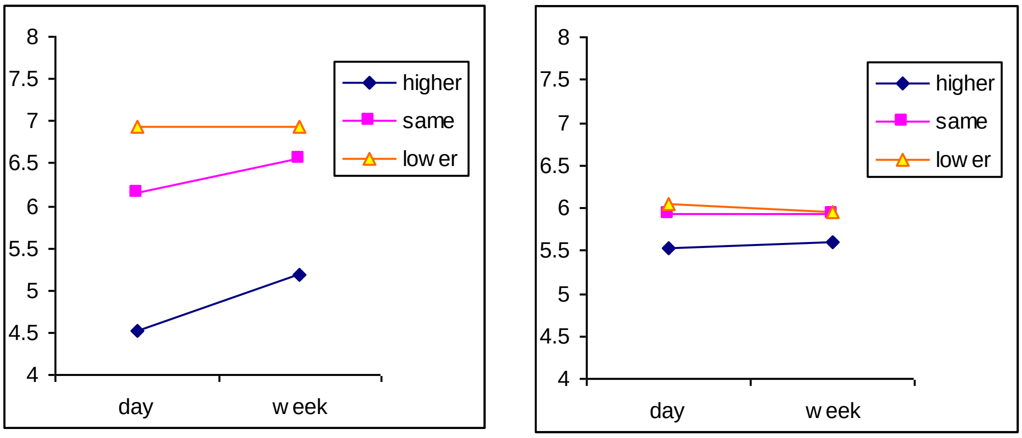

Figure 8.4.

The three-way interaction: Interval × Amount × Trend

Finally, the lines in Panel A of Fig. 8.4 all exhibit an upward slope. This provides evidence for a simple effect of interval (Interval × Amount) that is not hypothesized, $F(1,26) = 5.477$, $p<.03$. Participants judge Mr A to be more satisfied with his working bonus if the interval with Mr B's working bonus is one-week than one-day. The one-week interval is preferred both when Mr B receives the same amount as Mr A (Wilcoxon $z=-1.862$, $p<.05$, one-tailed) and when B receives a higher amount (Wilcoxon $z=2.719$, $p<.01$), but not when B receives a *lower* amount (Wilcoxon $z=0$, n.s.), in which case the contrast would be positive.

However, no such effect is observed if Mr B's gain comes from a lottery win. In fact, when the interpersonal gains are unrelated, the only effect is a negative impact exerted by the *higher* amount Mr B receives, which lowers the satisfaction of Mr A significantly, both when the interval is one day (Wilcoxon $z=2.484$, $p<.05$) and when it is one week ($z=2.530$, $p<.05$). The magnitude of this effect is however much smaller compared to the one in the related condition, as can be seen by the much narrower gap between the lines that correspond respectively to the “same” and “higher” conditions in Panel B compared to Panel A in Fig.8.4.

Discussion

The results provide support for H3.1, H3.2, H3.3a&b. Positive contrasts with Mr B enhance Mr A’s satisfaction whereas negative contrasts undermine it, both compared to the control condition where Mr B receives the same amount as Mr A and hence null contrast. Contrast effects are more pronounced when Mr A and B receive the same kind of gains, i.e. two working bonuses, or when their gains are intervened by a long rather than short interval. The domain relatedness is the more influential factor – the interval effect on contrasts virtually disappears when Mr A and Mr B’s gains come from two different sources.

Evidence of loss-aversion emerges. The negative contrast with B decreases A’s satisfaction more than the positive contrast enhances it, comparing to when the two receive the same amount. The negative contrast persists even when the gains are one working bonus and one lottery win, that is, unrelated.

Unexpected for the related gains, a simple effect of interval emerges. Participants prefer the long interval (one-week) to exist between the gains received by Mr A and Mr B to the short one (half-day), as long as Mr B’s gain does not constitute a positive contrast with Mr A’s. As in the sequence judgment task, this could reflect several underlying motives. Participants use the timing of Mr A’s gain as the benchmark to assess Mr B’s gain such that the longer the interval, the more discounted Mr B’s gain is, which would in turn enhance A’s satisfaction. That this preference is not observed when Mr B receives a working bonus of a smaller size suggests people intuitively apply the interval effect on contrasts (H3.3a).

It is worth noting that due to a flaw in the design of the sequence judgment task, one explanation offered for the main effect of domain is that lottery gains are generally preferred to working bonuses of the same amount. If this account holds, we should observe a main effect of domain in the social judgment task, this time lowering the satisfaction of Mr A when Mr B receives a lottery win instead of a working bonus, i.e. Mr A's gain is more satisfactory if Mr B's gain is a working bonus rather than a lottery win. However, no such effect is observed, $t(26)=.709$, n.s., suggesting other factors at play that lead to the preference for having two unrelated gains to two related ones of the same total amount.

8.4 General discussion

The results obtained in the sequence and the social judgment tasks provide support for the influences of the signed value difference (H2.1, H3.1), the moderating effect of relatedness (H2.2, H3.2) and that of interval (H2.2a, H2.3b, H3.2a, H3.3b). That is, decision makers' satisfaction increases/decreases with positive/negative contrasts with his own earlier experiences *and* with experiences of another (related) person. The contrast effects are more pronounced when the inter- and intra-personal experiences come from the same source (i.e. related) than different (i.e. unrelated), as well as when the interval between the experiences is short than long. The parallel between the inter- and intra-personal contrasts indicate that preference for improvement is a special case of preference for positive contrasts. Evidence that the preference is driven by comparisons between the outcomes rather than by the values of the individual outcomes comes from both the influences of the two relational variables, i.e. relatedness and interval, as well as from loss aversion[15]. That is, in both

[15] I thank Peter Ayton for suggesting this.

settings, negative contrasts have a larger, more detrimental impact on satisfaction than does the beneficial impact of positive contrasts of the same amount.

Differences between the two kinds of judgments emerge, and among them, the influences of domain and interval. For sequences, unrelated gains are preferred to related gains, and gains received over a short period are preferred to those received over a long period, as long as the gains are not *decreasing*. In comparison, the main effect of relatedness is not observed in the social judgment task and participants prefer to segregate Mr A and Mr B's gains by a long rather than short interval, as long as the gains are not *increasing*. In both cases, the effects can be explained by joint influences of limited coping capacities, time discounting (by interval), and an awareness of the interval effect on contrasts.

It is worth noting that relatedness exerts a far larger impact on contrast effects in the social judgment task than in the sequence judgment task (effect size η^2 =.391 versus .161). This is the case despite that the signed value difference between two interpersonal gains is half the size of the difference between two intrapersonal gains (ranging from -500 to 500 versus from -1000 to 1000). One reason is that relatedness judgment is context-dependent – working bonuses and lottery wins are related as money for the same individual but unrelated as source of income for different individuals. Domain relatedness is also more crucial in social judgments – it endows interpersonal comparisons with diagnostic values to one's decisions, e.g. to assess one's work-related performances (Festinger, 1954). Without this, such comparisons would be meaningless.

8.5 Summary

The results obtained in Chapter 8 provide support for the contrast effects hypothesized in the contrasts model. Results from the sequence judgment task and the social judgment show that positive contrasts are preferred to negative contrasts and that this preference is enhanced by high relatedness between the gains and short intervals. Loss-aversion means negative contrasts exert a far larger impact than positive contrasts of the same amount. Sequences of gains are also more desirable if the gains are of different kinds and temporally near. When the contrasts are with another individual, people however prefer a long interval to exist between the interpersonal outcomes. In both cases, however, the simple effect of interval is observed only for the related gains *and* when it does not contradict the predictions made by the interval effect on contrasts. Evidence of discounting emerges, mainly in the form of discounting by interval rather than the normative discounting by time delay. Chapter 9 reports a scheduling task that directly tests discounting, by manipulating delay and interval at the same time.

Chapter 9 THE SCHEDULING TASK

9.0 Introduction

The ranking task (Chapter 7) and sequence judgment task (Chapter 8) provide evidence for positive time preferences in the assessments of two-event sequences. In the ranking task, this is expressed as a large proportion of participants who rank the decreasing sequences as more attractive than constant and increasing sequences; in the intertemporal judgment task, this is expressed as the high ratings assigned to the gains that are temporally near rather than distant.

How does delay change preference for improvement? Example 2.3 (Loewenstein & Prelec, 1993) shows that 7% fewer participants preferred (Aunt, Friends) to (Friends, Aunt) when the schedules were delayed from this weekend till six months later. In other words, delay undermines preference for improvement. As we see in Chapter 6, the contrasts model places no constraints *how* value decays, and in so doing, predicts that delay reduces, enhances or has no impact on preference for improvement if the value decay of the earlier outcomes compared to the later ones is less/more/the same. In this chapter, I replicate Example 2.3, the abrasive aunt experiment to explore how delay and interval together influence sequence preferences.

9.1 The scheduling task

I define the delay of a sequence as the delay of the *first sequence event*, assuming all events taking place either in the present or in the future. In the scheduling task, the schedules consist of two visits. The delay of the second visit is therefore the sum of the delay of the schedule and the interval between the visits. This interval is sometimes called the *spread* (Loewenstein & Prelec, 1993). For the reasons that will become clear shortly, I run the study twice, referred to as **Scheduling task I** and **II**.

9.1.1 Scheduling task I

Methods

Subjects. Twenty-seven participants, fifteen (54%) females, were randomly approached on the campus of the London School of Economics (LSE). They were between twenty and thirty-nine years old (mean age = 26). They were unpaid.

Methods. As in Loewenstein and Prelec (1993), participants were told they were travelling to another city and were planning to pay two visits during the time: one to a group of friends, whom they liked a lot and the other to an abrasive aunt, who was a horrendous cook. Visiting the friends was pleasant whereas visiting the aunt was unpleasant. The first visit was to take place either *this weekend* (i.e. a delay of one week) or *twenty-six weeks* later (or a delay of six-month); the interval between the two visits was either *one, four* or *twenty-six week(s)*. This arrangement gave rise to a 2 Delay x 3 Interval within-subjects design and six pairs of schedules. For simplicity, I refer to a condition (question) by its corresponding level of delay and interval.

For example, "d0i4" refers to the choice between two schedules that are both "immediate" with a short spread:

Suppose one outing will take place this weekend, the other 4 weeks later.

Schedule	This weekend	4 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Participants were asked to first make a choice between the two schedules, and then indicate the strength of their preference by assigning a number on a 7-point scale, from a *very weak* preference (1) to a *very strong* preference (7). The order of the questions was counterbalanced. The questionnaire is attached as *Appendix E.*

Hypotheses

The contrasts model predicts H.4.0 and H4.1:

H4.0 Preference for improvement

The increasing schedule (Aunt, Friends) is more attractive than the decreasing schedule (Friends, Aunt).

H4.1 The interval effect

Longer intervals undermine preference for improvement.

Although the contrasts model does not prescribe how delay changes sequence preferences, Loewenstein and Prelec's results suggest H4.2:

H4.2 The delay effect

Longer delays undermine preference for improvement.

Results

In order for the ratings to reflect the valence of one's time preferences, the ratings from those participants preferring (Friends, Aunt) and (Aunt, Friends) are reported as positive and negative respectively, to be consistent with the implied positive and negative time preferences. In both cases, the larger the rating, the more pronounced one's time preference is and vice versa. The results are shown in Table 9.1 and Figure 9.1. I discuss each hypothesis in turn.

Preference for improvement

Preference for improvement is not supported. The reverse is – the decreasing schedule (Friends, Aunt) is preferred by a majority of the respondents in all six conditions (Fig.9.1a). Combined choice across all the six conditions show that this pattern is not random, $\chi^2(1)=13.06$, $p<.001$. In other words, positive time preference dominates the responses. This preference is also more pronounced when the interval is long – percentages preferring (Friends, Aunt) are 54%, 66% and 75% respectively when the interval is one, four and twenty-six weeks (Panel A, Figure 9.1), Friedman $\chi^2(2)=12.133$, $p<.01$. Delay has little impact on this preference – only 6% fewer participants choosing (Friends, Aunt) when the schedules are delayed.

Similar patterns results are observed in the mean ratings. As shown in Fig. 9.1b, the ratings are more positive for those sequences that are closer to the present (1.25 for d0 and 0.52 for d26) or have a long spread (-0.19, 0.74 and 2.09 for i1, i4 and i26).

Table 9.1.
Choice percentages and mean ratings in Scheduling Task I (N=27)

	% choosing (Friends, Aunt)				Mean ratings *s.d.*		
	d0	d26	**Means**		d0	d26	**Means**
i1	54%	54%	**54%**	i1	-0.11	-0.26	**-0.19**
					4.67	*4.68*	
i4	69%	62%	**66%**	i4	1	0.48	**0.74**
					4.86	*4.14*	
i26	81%	69%	**75%**	i26	2.85	1.33	**2.09**
					4.2	*4.62*	
Means	**68%**	**62%**	**66%**	**Means**	**1.25**	**0.52**	

Panel A

% choosing (Friends, Aunt)

Panel B

Mean ratings

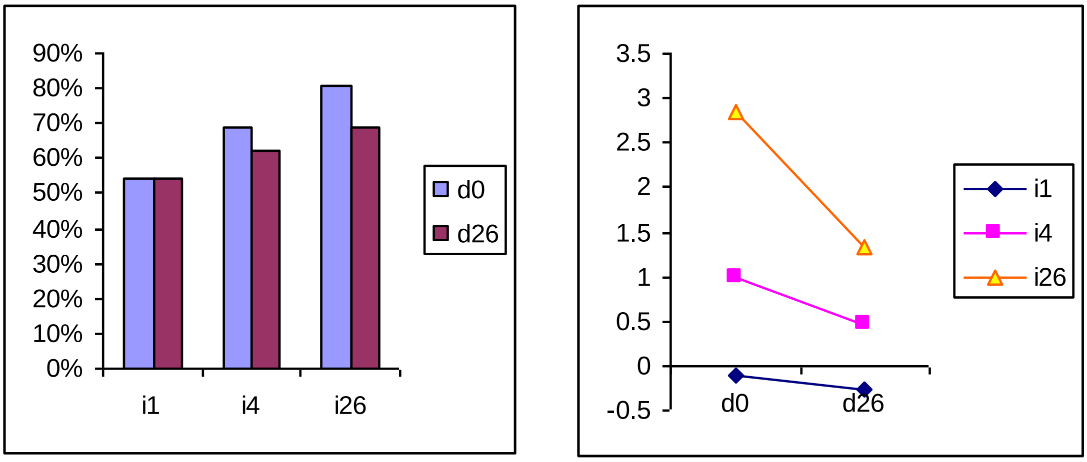

Figure 9.1. Results of Scheduling Task I

The interval effect

H4.1 hypothesizes an interval effect that long intervals undermine preference for improvement. We do not find preference for improvement. However a consistent result is that long intervals enhance positive time preference. As can be seen from Panel B, Fig.9.1, the mean ratings at three levels of interval, i.e. short (one week), medium (4 weeks) and long (26 weeks or 6 months), are respectively -0.19, 0.74 and 2.09, $F(2,52) = 7.603$, $p<.01$, $\eta^2 = .226$.

The delay effect

H4.2 hypothesizes that delay undermines preference for improvement and enhances positive time preference. Contrary to the hypothesis, 6% *more* participants prefer the increasing schedule when the schedules are delayed (32% versus 38%). Likewise, the mean ratings are also *less* positive in the distant condition than in the immediate condition (0.52 versus 1.25), $F(1,26)=4.18$, $p=.051$, $\eta^2= .138$. Fig.9.1b shows that the pattern is more pronounced when the interval is long than short, evidenced by the steeper slopes of the lines associated with the longer intervals. The interaction between delay and interval is however non- significant, $F(2,52) = 1.23$, *n.s*.

Discussion

The schedules consist of the same events, i.e. a pleasant visit to one's friends and an unpleasant visit to one's abrasive aunt. It follows that the sequences have the same nominal value (NV) and relatedness (*R*). The contrasts model predicts that preferences between the increasing (Aunt, Friends) and decreasing (Friends, Aunt) depend on two *value* differences – one between the endowment values of the two schedules and one between their contrast values. While (Aunt, Friends) has a more attractive contrast value, (Friends, Aunt) has a more attractive endowment value.

Interval exerts dual influences. A long interval not only entails a long delay to the second, later visit and therefore enhances the advantage in endowment of the decreasing (Friends, Aunt), it also weakens the contrast effect, and therefore undermines the advantage of the increasing (Aunt, Friends). In any case, longer intervals are detrimental to preference for improvement. This corresponds to the finding of the interval effect (H4.1), despite that the hypothesis assumes preference for improvement would dominate the responses.

A closer look at the results however reveals little evidence for contrast effects. Among all six conditions, the only mean rating that is significantly different from 0 happens when the first visit takes place this weekend whereas the second visit 26 weeks later, i.e. d0i26, one sample *t*-test, $t(26)=3.525$, $p<.01$. The contrasts model predicts that a long interval like this would have diminished the contrast value to close to zero. Therefore the preference is driven by discounting rather than by contrasts. The response pattern that delay seems to reduce positive time preference can also be accounted entirely by discounting. That is, as a result of delay, the difference in the endowment value between the two schedules is now smaller, thus weakening the attractiveness of (Friends, Aunt) relative to (Aunt, Friends). Without contrast effects as a motive for preference for improvement, it is hardly surprising that the decreasing schedule (Friends, Aunt) is chosen by a majority of the participants in all six conditions.

The results of Task I constitutes a sharp contrast with the original finding that adopts the same design. For the three identical conditions, i.e. d0i1, d26i1 and d0i26, Loewenstein and Prelec (1993) reported a preference for (Friends, Aunt) by 7%, 13%

and 48% of the participants, while this study found 54%, 54% and 83%. Why did I fail to find any preference for improvement? There may be several reasons for this. The respondents were recruited from a college with heavy emphasis on economic and financial courses. They may be familiar with the notion of discounting as well as its implications for the net present value of a sequence of outcomes. However, since the sequences consist of non-monetary outcomes, it is doubtful to what extent the disciplinary factor affects the results.

Another possible reason is the way in which the schedules were presented – the tabulated format of presentation vertically aligns the visits according to their respective time delays. An easy way of "constructing" one's preferences (Lichtenstein & Slovic, 2006) is therefore to determine what one prefers to do at a given time, e.g. whether to visit one's aunt or friends this weekend, rather than what one prefers to do *over* time. Such judgment mode requires no comparisons between the events within the *same* sequence and prevents trend, which depends on such comparisons, from being important. With these in mind, I revised the design and run the study for the second time, reported below as **Scheduling task II**.

9.1.2 Scheduling task II

Methods

Subjects. Thirty-two students, twelve (38%) females, studying at the University College London were randomly approached on the campus. They were between eighteen and thirty years old, with a mean of twenty-two. They were unpaid.

Methods. I adopted the same 2 Delay (this weekend, 26 weeks from now) x 3 Interval (one, four and 26 weeks) within-subject design. To make the trend salient, I presented the schedules in "time-line graphs" (Loewenstein & Prelec, 1993). An example is shown in Fig. 9.2 for the increasing schedule "d0i4". To simplify the task, I also combine the choice and the rating into one. Instead of making a choice first and then indicating one's strength of preference, participants were asked to assign a single rating on an 11-point scale ranging from -5 "strongly prefer (Aunt, Friends)" to 5 "strongly prefer (Friends, Aunts)", with 0 indicating "indifference between the two schedules".[16] I counterbalanced the order of the questions. I attach the questionnaire as *Appendix F*.

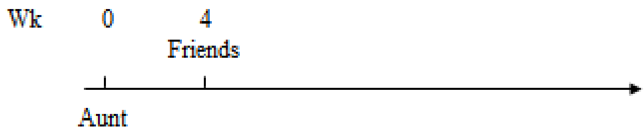

Figure 9.2. A time-line graph representation of the increasing (Aunt, Friends)

Results

Task II tests the same three hypotheses, namely preference for improvement (H4.0), the interval effect (H4.1) and the delay effect (H4.2). As in Task I, negative and positive ratings indicate respectively negative and positive time preferences. Different from Study I, this study allows for indifference, i.e. no trend preference, indicated by a rating of zero. In what follows, I first report within-subjects effects, which include time preferences and influences of delay and interval, and then the between-effects attributable to the sex (gender) of the participants.

[16] Similar inclusion of the "indifference" option was adopted by Thaler (1985)

Within-effects

Fig.9.3 presents the proportion of participants who assign positive, zero and negative ratings, and thereby express a preference for (Friends, Aunt) (Panel A), indifference (Panel B), for (Aunt, Friends) (Panel C). I discuss each in turn.

Table 9.2. Choice percentages in Scheduling Task II.

	% (Friends, Aunt)			% Indifferent			% (Aunt, Friends)		
	d0	d26	**means**	d0	d26	**means**	d0	d26	**means**
i1	28%	16%	**22%**	9%	19%	**14%**	63%	66%	**65%**
i4	41%	31%	**36%**	9%	22%	**16%**	50%	47%	**49%**
i26	34%	44%	**39%**	13%	31%	**22%**	53%	25%	**39%**
means	**34%**	**30%**	**32%**	**10%**	**24%**	**17%**	**55%**	**46%**	**51%**

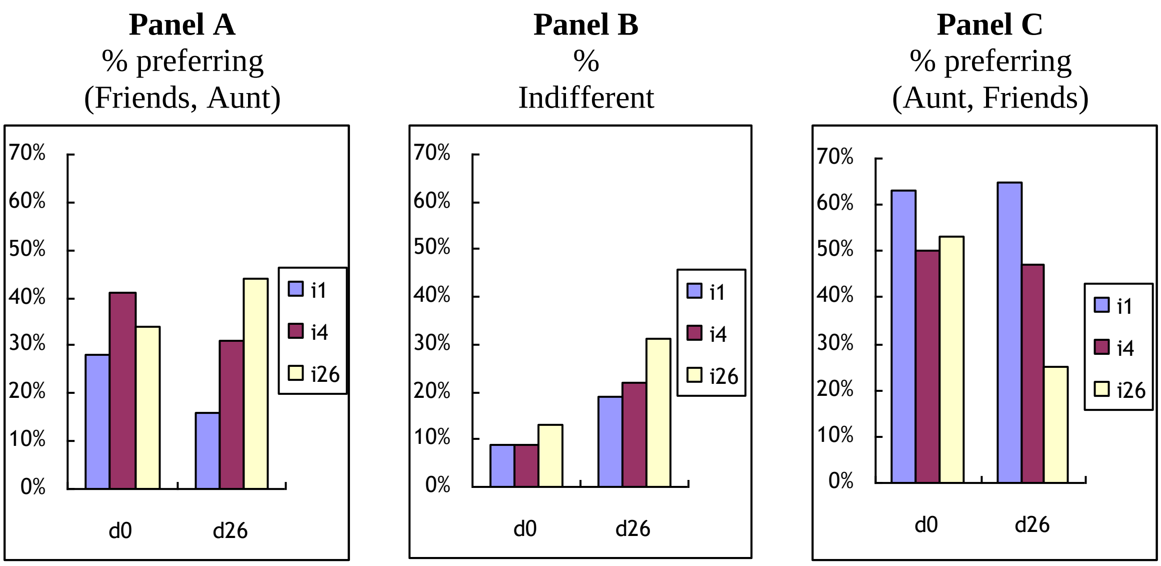

Figure 9.3. % Participants show different time preferences in Scheduling Task II.

Indifference

As shown in Panel B, Fig.9.3, more participants become indifferent between (Aunt, Friends) and (Friends, Aunt), as implied by a rating of zero, when the schedules are distant (d26) than near (d0), as well as when the interval is long (i26) than short (i4 or i1). When the schedules are both distant and have a 26-week interval (d26i26), nearly one-third of the participants (31%) are indifferent, compared to 9% when the schedules are immediate and have either a short or a medium interval (d0i1, d014). Indifference seems to depend more heavily on delay than on interval – a delay of 26 weeks increases the indifference percentage significantly by a range between 10% and 18%, Wilcoxon z=2.98, p<.01, whereas an interval of the same duration increases it by a range between 4% and 12%, Friedman $\chi^2(2)$=2.1, *n.s.*.

Negative and positive time preferences

As shown in Panel A and C in Fig.9.3, with the exception of the condition in which the schedules are both distant and long (d26i26), more participants prefer (Aunt, Friends) to (Friends, Aunt), Wilcoxon z=2.141, p<.05. This provides support for a preference for improvement (H4.0), which is however weak – the largest proportion preferring (Aunt, Friends) is 66%, observed when the schedules are distant and short (d26i1).

Influences of interval

The mean ratings are presented in Table 9.3 and depicted in Figure 9.4. As can be seen, longer intervals decreases the attractiveness of (Aunt, Friends) relative to (Friends, Aunt) – the mean ratings are -1.17, -0.44 and 0.34 respectively when the interval is one, four and twenty-six week(s). This provides support for the interval effect hypothesized in H4.1, $F(2,62) = 4.784$, $p<.02$.

The response pattern observed in the long-spread condition (i26) is worth noting. Firstly, inconsistent with the contrasts model, 19% *more* participants preferred the increasing (Aunt, Friends) to the decreasing (Friends, Aunt) (53% versus 34%) for sequences with such a long spread. Secondly, inconsistent with the immediacy effect (Prelec and Loewenstein, 1991) in time discounting that decision makers tend to amplify the significance of the immediate (relative to delayed) experiences, (Friends, Aunt) becomes *more* preferred when the schedules are delayed till 26 weeks later.

Table 9.3. Mean ratings in Scheduling Task II.

	d0	d26	**means**
i1	-0.78	-1.56	**-1.17**
	3.79	*3.11*	
i4	-0.25	-0.63	**-0.44**
	3.51	*3.03*	
i26	-0.13	0.81	**0.34**
	4.01	*3.32*	
means	**-0.39**	**-0.46**	**-0.42**

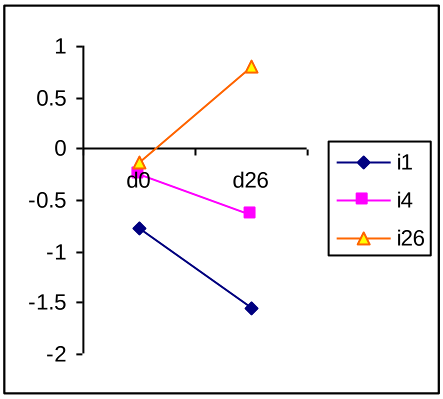

Figure 9.4. Means and *sds* observed in Scheduling Task II.

Influences of delay

According to Loewenstein and Prelec's results, H4.3 hypothesizes that delay undermines preference for improvement. This would lead to a higher proportion of participants choosing (Friends, Aunt) and more positive (less negative) ratings in the distant condition. Neither of these two is observed. Fig.9.3 shows the percentages choosing the two schedules have no distinct pattern. Table 9.3 shows that the mean rating was slightly more rather than less negative in the distant condition than in the near condition: -0.46 versus -0.39.

Recall that delay enhances indifference, which implies a rating of 0. Why do ratings in Fig.9.4 diverge rather than converge to zero? A closer look at Fig.9.3 reveals that delay exerts differential influences on the attractiveness of the two schedules – more detrimental on (Friends, Aunt) than on (Aunt, Friends) when the spread is short and medium (i1 and i4) but the opposite is true when the spread is long (i26) (Table 9.4).

Table 9.4. Impact of delay on sequence preferences in Scheduling Task II

	i1	i4	i26
(Friends, Aunt)	-12%	-10%	+10%
(Aunt, Friends)	3%	-3%	-28%

Between-effects

Table 9.5a and 9.5b present the percentages of male and female participants who exhibit positive, null and negative time preferences. Fig.9.5 contrast the ratings of males (Panel A) and females (Panel B).

Table 9.5a. Males' time preferences in Scheduling Task II

preferring	d0i1	d0i4	d0i26	d26i1	d26i4	d26i26
(Friends, Aunt)	45%	50%	40%	25%	50%	35%
Indifferent	10%	15%	15%	15%	20%	45%
(Aunt, Friends)	45%	35%	45%	60%	30%	20%
Mean ratings	**0.33**	**0.41**	**0.23**	**-1.1**	**0.35**	**1.25**

Table 9.5b. Females' time preferences in Scheduling Task II

preferring	d0i1	d0i4	d0i26	d26i1	d26i4	d26i26
(Friends, Aunt)	8%	33%	33%	8%	8%	50%
Indifferent	8%	0%	8%	25%	25%	8%
(Aunt, Friends)	83%	67%	58%	67%	67%	42%
Mean ratings	**-2.58**	**-1.33**	**-0.67**	**-2.33**	**-2.25**	**0.08**

Panel A: Male **Panel B: Female**

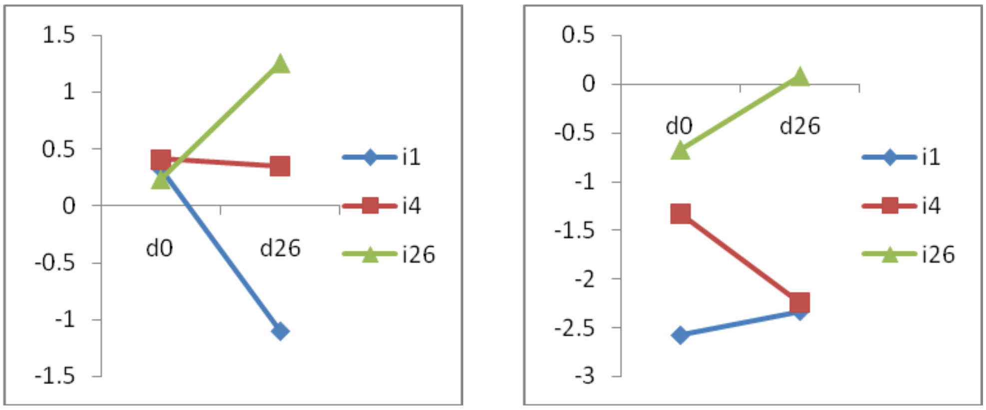

Figure 9.5. The gender effect in Scheduling Task II.

First, a main effect of sex emerges, $F(1,30) = 4.21$, $p<.05$, $\eta^2=.123$. As can be seen in Fig.9.5, while the ratings are mostly positive for males, they are mostly negative for females. That is, while males discount more heavily than females, females have a more pronounced preference for improvement than males. The only condition where male exhibit a preference for improvement is d26i1, where 60% of males prefer (Aunt, Friends), compared to 25% who prefer (Friends, Aunt). There is however no evidence for interactions between sex and interval or sex and delay.

Second, delay enhances indifference for both genders. In general, females are less likely to become indifferent between the increasing and decreasing trends compared to males. This is especially the case when the schedules are distant and long (d26i26), in which case 45% of the males are indifferent compared to only 8% of the females.

Third, the interval effect (H4.2) is only significant for females, $F(2,22) = 4.319$, $p<.03$, but not for males, $F(2,38) = 1.605$, *n.s*. That is, longer intervals diminish females' preference for (Aunt, Friends); they however do not enhance males' preference for (Friends, Aunt). Fig.9.5 shows that this is mainly because males have the same mean ratings in the immediate condition (d0) regardless of the length of interval.

Fourth, delay has divergent influences on time preferences of male and female participants. As shown in Table 9.5, delaying the short increasing schedule (Aunt, Friends) leads to 15% *more* males preferring the schedule (60%-45%) but 16% *fewer* females (67%-83%) doing so.

Discussion

The second run of the scheduling task provides evidence for a negative time preference, i.e. a preference for improvement – the increasing sequence (Aunt, Friends) is most attractive in the distant short condition (d26i1) when chosen by a majority of 66% of the participants. Compared to the original findings where 93%, 52% and 87% were obtained in d0i1, d0i26 and d26i1 (Loewenstein & Prelec, 1993), the preference is weak. One reason is that the rating scale in this study includes a neutral point (0) to indicate indifference, which was not allowed in the original investigation. If we assume that the indifferent participants were equally likely to prefer (Aunt, Friends) and (Friends, Aunt), the proportions choosing (Aunt, Friends) become 68%, 60% and 76%. The gap is now much smaller but persists, especially in the immediate short condition (d0i1). Sex is another contributing factor. Male participants turn out to be far more impatient than female. The percentages of females choosing (Aunt, Friends) are 83%, 58% and 67% in d0i1, d0i26 and d26i1, which become 87%, 58% and 80% when including half of the indifference proportions.

The sex difference in Task II is striking. While the response pattern of females conforms largely to the predictions of the contrasts model, including preference for improvement and the interval effect, that of males does not. Males have a complex response pattern. For instance, 15% *more* males preferred the short (Aunt, Friends) in the delay condition than in the immediate condition. As in Scheduling Task I, this can be attributed to discounting that as a result of delay, the value difference in the endowment between the two schedules is now smaller. However, discounting cannot explain why 10% *more* males preferring (Aunt, Friends) when visiting aunt happens this weekend, but visiting Friends is delayed from 4 weeks from now till 6 months later (d0i4, d0i26). Actually neither can backward contrast effects because the 26-week interval is detrimental to integrity. The pattern is however consistent with influences of *anticipatory savouring* and *dread* (Loewenstein, 1988). A longer interval implies a longer delay to the second visit in the sequence, thus greater anticipatory effects. Delaying desirable outcomes enhances savouring whereas having undesirable outcomes as soon as possible minimizes dread. Thus, contrary to the interval effect predicted by the contrasts model, savouring and dread together predict a stronger preference for (Aunt, Friends) over (Friends, Aunt) when the interval is *longer*. That this pattern is only observed in the immediate condition but not in the delayed condition is consistent with the notion that anticipatory effects are more profound when the hedonic experiences are closer in time (Loewenstein & Elster, 1992).

9.2 General discussion

While Task I finds evidence for a positive time preference, Task II finds evidence for a preference for improvement. The main difference of these two studies lies in the way the sequences are presented. Task I presents the schedules in a tabulated format; Task II adopt the time-line graph (Fig.9.2) to focus attention on the value difference between the positive experience of visiting one's friends and the negative experience of visiting the abrasive aunt. Consistent with the idea that contrast effects thrive on comparisons, preference for improvement is observed in Task II but not in Task I. This result reveals how sensitive sequence preferences are to presentation effects.

Despite the identical material, the two experiments agree with each other only in terms of *the interval effect*. That is, longer intervals between the visits make the increasing schedule less attractive while the decreasing one more. Note that we only obtain evidence for contrast effects in Task II but not in Task I. The observation of the interval effect in both tasks is consistent with the fact that this effect can be attributed to either discounting or backward contrast effects. This provides support for the notion of the *dual influences of interval*, when it functions as part of delay to the later outcomes in the sequence and as an indicator of the temporal relationship between the sequence outcomes.

Compared to interval, the impact of delay on sequence preferences is far from straightforward. The contrasts model posits that depending on how the outcomes are discounted, delay can have differential impact on sequence preferences. Although this claim is not tested directly, the findings of Task II show that delay indeed enhances as well as undermines preference for improvement for males and females, expressed by the positive and negative slopes of the lines in Figure. 9.5. Perhaps the only non-ambiguous effect of delay observed in Task II is that delay obscures one's time preferences by fostering indifference in both male and female participants, and perhaps more so in males.

The sex difference obtained in Task II is worth noting. Preference for improvement is more pronounced for females than for males. This is consistent with the assumption of the contrasts model that such preference is driven by a focus on the relationship between the outcomes, which characterizes how females think but how way males do (Chapman, 1975). That males focus more on individual events is however consistent with their preference for the decreasing (Friends, Aunt). It is also consistent with the notion of savouring and dread, which is the only mechanism that can predict an enhanced preference for the increasing (Aunt, Friends), that is, when the interval increases from 4 weeks to 26 weeks.

9.3 Summary

The results obtained in Chapter 9 demonstrate that sequence preferences can be affected by delay, interval, as well as presentation format. The only effect consistently observed in the two scheduling tasks is the interval effect that long intervals undermine negative time preferences or enhance positive time preferences. This provides support for the dual influences of interval, when it functions as part of delay to the later sequence outcomes or as indicating relationship between the outcomes. Delay, apart from fostering indifference towards the trend, does not have a distinct impact on sequence preferences. A gender effect emerges. That preference for improvement is observed only in females but not in males is consistent with the notion that females are relationship-focused whereas males are individual-event-focused. Note that the contrasts model attributes preference for improvement to contrast effects. Thus to predict such preferences when they are motivated by non-relational effects, e.g. savouring and dread, the model has to rely on endowment effects, by allowing the discount parameter to be negative rather than positive as assumed.

Chapter 10 THE HAPPINESS TASK

10.0 Introduction

The experiments reported in Chapter 9 provide support for the dual influences of interval. That is, interval affects the endowment value by changing the time delay to the later outcomes; interval also affects the contrast value by changing the contrasts between the outcomes. This chapter explores two questions. First, do interval effects persist when the total nominal value of the outcomes is not controlled for? Second, are the dual influences, as found with interval, unique to time? Positive answers to both questions would provide support for the approach of modelling sequence preferences as a function of two kinds of values, namely the relational and the non-relational. I answer these questions by the so-called *happiness task*, as reported next.

10.1 The happiness task

The design is inspired by Tversky and Griffin's (1991) study, which I discussed in Chapter 4. Each sequence consists of one past event and one present event. The past event is either *positive*, i.e. "receiving an excellent mark" (EX) or *negative*, i.e., "receiving a poor mark" (PR); and the present event is either *related* to the first event, i.e. "receiving an acceptable mark" (OK) or *unrelated*, i.e. "cleaning one's flat" (CL). In addition to the *quality* of the first event and the *domain relatedness* between the two events, I also manipulate the *interval* to be either *one week* (WK) or *one month* (MT). This arrangement gives rise to a 2 Quality (negative, positive) x 2 Relatedness (related, unrelated) x 2 Interval (one week, one month) within-subject design and a total number of eight sequences. Table 10.1 presents the design of the experiment, along with the short names of the outcomes and sequences.

Table 10.1 The design of the happiness task

Sequence	Quality (Trend)		Relatedness (Content)		Interval (Delay)	
	EX	PR	OK	CL	WK	MT
EXOKWK	✓		✓		✓	
EXCLWK	✓			✓	✓	
EXOKMT	✓		✓			✓
EXCLMT	✓			✓		✓
PROKWK		✓	✓		✓	
PRCLWK		✓		✓	✓	
PROKMT		✓	✓			✓
PRCLMT		✓		✓		✓

EX: excellent mark; PR: poor mark; OK: average mark; CL: cleaning; WK: week; MT: Month

Note that the manipulation on Quality, Relatedness and Interval influences *both* the endowment value and the contrast value. That is, each independent variable has a "confounder", as shown in the "()s" in the first row in Table 10.1 such that while quality, relatedness and interval exert direct influences on EV or CV, their confounders, i.e. trend, content and delay, exert direct influences on CV or EV. I explain what this means.

First, the manipulation on the *quality* of the first outcome changes not only makes it more or less attractive but also changes its relationship with the second present outcome. Since the value of the second outcome is always neutral, a *positive* first event implies a *decreasing* trend whereas a *negative* one implies an *increasing* trend. While the quality affects the nominal value and thereby the endowment, the trend affects the signed value difference and thereby the contrast. Second, the manipulation on outcome *relatedness* is achieved by changing the *content* of the second outcome. While the relatedness affects the contrast value, the content affects the endowment value. Third, the *interval* between the two outcomes is also the time *distance* of the first event from the present, i.e. the “delay”. Thus, the longer this interval, the weaker the contrast value but also the more the value decay of the first outcome will be, which in turn affects the endowment value of the sequence.

Methods

Participants. Forty-one students attending a short-term management course at the London School of Economics participated in the study. The questionnaires were completed at the end of a lecture. They were unpaid.

Methods. The experiment consisted of three separate tasks, referred to as *Task 1*, *2* and *3*. I discuss each in turn.

In Task 1, participants assessed the happiness of a hypothetical decision maker after he or she experienced a sequence of events. The name of the hypothetical decision maker varied for each question (condition). For example, the question that solicited preference for EXOKWK (Table 10.1) read:

> *A week ago*, Alice received an *excellent* mark in a quiz, much better than she expected.
>
> *Today*, she received an *acceptable* mark in another quiz. This was the mark she expected.

Task 2 is similar to Task 1 except that I solicited time preferences for *isolated* outcomes. For example, the question for EXWK read:

> *A week ago*, Alex received an *excellent* mark in a quiz, much better than she expected.

In both Task 1 and 2, participants were asked to assess "*How happy do you think Alice (Alex) is today*?" by assigning a rating on an 11-point scale, ranging from "the least amount of happiness" (0) to "the most amount of happiness" (10).

Different from the previous two tasks, Task 3 presented a choice. Participants had to decide which of the two intervals, *one week* or *one month*, they would like to segregate between four different pairs of events, which were combinations of the two levels of relatedness (related, unrelated) and the two levels of quality of the first event (positive, negative). For example, the choice presenting the positive first event (EX) and the related second event (OK) read:

First event: You receive an *excellent* mark in a quiz, much better than you expected.

Second event: You receive an *acceptable* mark in another quiz. This was the mark you expected.

I would rather have

___ the first event occur *a month earlier* than the second event.

___ the first event occur *a week earlier* than the second event

The order of the questions in all three tasks was counterbalanced. I attach the questionnaire as *Appendix F*.

Results & discussion

Each participant completed two tasks. All forty-one participants received and completed Task 1. Among these, eighteen of twenty participants who were randomly assigned Task 2 completed the questionnaire; the remaining twenty-one participants received and completed Task 3.

Since Task 2 serves as a manipulation check, I discuss the results in the order of Task 2, 1 and 3. For simplicity, I sometime refer to the events based on their shared independent variable(s). For instance, the *positive* condition consists of EXOKWK, EXOKMT, EXCLWK and EXCLMT. The *positive related* condition consists of EXOKWK and EXOKMT.

Task 2 results

Table 10.2 shows the mean and standard deviation of the ratings assigned to the six component events.

Table 10.2. Results of Task 2 (n=18)

	Description	Mean	*s.d.*
EXWK	Receiving an excellent mark a week ago	7.17	1.82
EXMT	Receiving an excellent mark a month ago	6.94	1.80
PRWK	Receiving a poor mark a week ago	4.00	2.00
PRMT	Receiving a poor mark a month ago	4.67	1.28
OK	Receiving an average mark today	6.06	1.70
CL	Cleaning one's flat today	5.11	2.27

First, the manipulation on Quality and Trend is successful. The two positive first events, EXWK and EXMT, are rated higher than the two present neutral events, OK and CL, $F(1,17)=19.372$, $p<.0001$, which are rated higher than the two negative first events, PRWK and PRMT, $F(1,17)=8.152$, $p<.02$. This finding implies that the positive pairs have a decreasing trend whereas the negative pairs have an increasing trend.

Second, the mean ratings provide evidence for positive time preference. Receiving an excellent mark (EX) is more attractive if it takes place a week ago

(EXWK=7.17) than a month ago (EXMT=6.94). The reverse is true for the negative experience, which is *less* attractive if it takes place a week ago (PRWK=4.00) than a month ago (PRMT= 4.67). Thus, delay leads to value decay for both positive and negative events.

Third, the results are consistent with the *content effect*. That is, receiving an average mark (OK=6.06) is considered more attractive than cleaning one's flat (CL=5.11). The difference is however non-significant, $t(17)=1.165$, $p>.13$, one-tailed.

The results observed in Task 2 of the happiness task allow us to make predictions of sequence preferences in Task 1, which I present in Table 10.3.

Table 10.3. The dual influences in the happiness task.

Independent variables	Influence on	Predictions of the contrasts model	
Quality (Trend)			
Quality	EV	Better quality preferred (first event)	EX>PR
Trend	CV	Increasing trend preferred	EXOKWK(MT) < PROKWK(MT)
Relatedness (Content)			
Relatedness	CV	Relatedness enhances the trend effect	EXOKWK(MT) < EXCLWK(MT) PROKWK(MT) > PRCLWK(MT)
Content	EV	Better quality preferred (second event)	OK > CL
Interval (Delay)			
Interval	CV	Interval undermines the trend effect	EXOKWK < EXOKMT PROKWK > PROKMT
Discounting	EV	Delay fosters value decay	EXWK > EXMT PRWK < PRMT

>: *preferred to;* <: *less preferred to; EV=endowment value; CV=contrast value*

The table shows that preferences between the sequences are uncertain as they depend on a balance between conflicting forces. Consider EXOKWK(MT) and PROKWK(MT) for example. While the positive sequences are better in terms of the endowment value due to Quality (EX>PR), they are worse in terms of the contrast value due to the decreasing trend (EXOKWK(MT)< PROKWK(MT)). The preference between the two is therefore a function of the importance as well as the magnitude of the endowment value relative to the contrast value.

Task 1 results

I discuss the results within the framework of the contrasts model. I express the value of a sequence as the sum of the endowment value and the value derived from improvement, i.e. $SV=EV+CV$. I omit the spreading predictor in the contrasts model, i.e. the term incorporating $|CV|$. This is done for two reasons. First, the original experiment of Tversky and Griffin (1991) found no evidence for spreading; neither are the experiments reported so far in this thesis. Second, the sequences under investigation are either increasing or decreasing, the preferences for which are supposedly predicted by preference for improvement, i.e. *CV*.

In this simplified formulation of sequence preferences, *EV* is expressed as the sum of two values, one for each of the two events. As Tversky and Griffin, I assume *CV* is zero when the events are *unrelated*; i.e., when their relatedness index (*R*) is 0. Since the contrast values depend on both the valence of the signed value difference and the interval, I denote the contrast value as *C(valence, interval)*. Table 10.4 and Fig.10.1 show the results along with the predictions of the contrast model.

Table 10.4. The results of Task 1 and the predictions of the contrasts model.

	Mean rating (s.d.)	SV=EV+CV
EXOKWK	6.2 (2.37)	EXWK+OK+C(+,WK)
EXCLWK	6.3 (1.89)	EXWK+CL
EXOKMT	6.1 (1.88)	EXMT+OK+C(+,MT)
EXCLMT	5.5 (1.86)	EXMT+CL
PROKWK	5.5 (2.27)	PRWK+OK+C(-,WK)
PRCLWK	3.1 (2.40)	PRWK+CL
PROKMT	5.5 (2.09)	PRMT+OK+C(-,MT)
PRCLMT	3.6 (2.13)	PRMT+CL

Panel A — **Quality = Positive (EX)**

Panel B — **Quality = Negative (PR)**

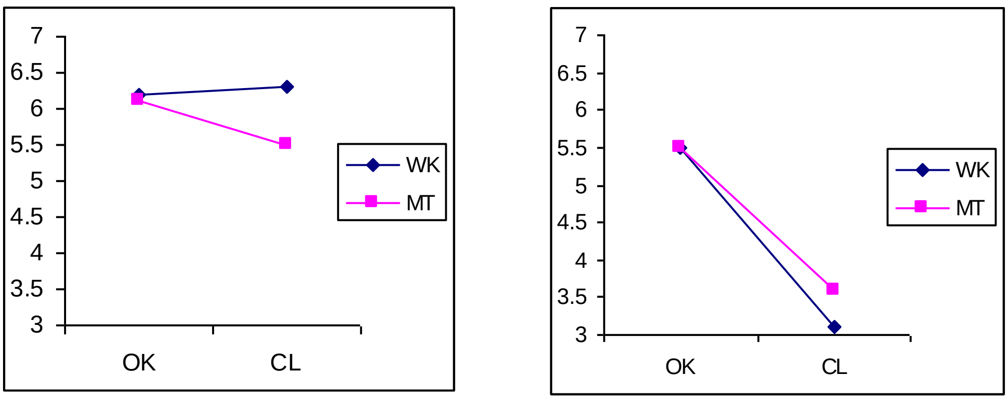

Figure 10.1. Mean ratings of the sequences (n=41)

Quality

As shown in Fig.10.1, the four ratings assigned to the positive sequences (Panel A) are all higher than the ones assigned to the negative sequences (Panel B). This indicates a main effect of quality, $F(1, 40) = 15.878$, $p < .0001$, $\eta^2 = .284$.

Relatedness and interval

To unveil the influences of relatedness and interval on contrasts, I employ two step-wise comparisons. A summary of this analysis is presented in Table 10.5a for the positive (decreasing) sequences and Table 10.5b for the negative (increasing) sequences.

Table 10.5a. The impact of relatedness and interval for the positive pairs.

	Rating diff.	Expressed as	*t*(40)
EXOKWK – EXCLWK	-0.12	OK-CL+C(+, WK)	-.289, *n.s.*
EXOKMT – EXCLMT	0.59	OK-CL+C(+, MT)	1.493, *n.s.*
Difference	- 0.71	C(+, WK) – C(+, MT)	

n.s. not significant

Table 10.5b. The impact of relatedness and interval for the negative pairs.

	Rating diff.	Expressed as	*t*(40)
PROKWK - PRCLWK	2.32	OK-CL+C(-, WK)	5.680***
PROKMT - PRCLMT	1.83	OK-CL+C(-, MT)	6.357***
Difference	0.49	C(-, WK) - C(-, MT)	

Paired-samples *t*-test, two-tailed; *: p<.05, **: p<.01, ***: p<.001

First, for the positive and negative sequences, I compare the ratings assigned to the related and unrelated conditions, holding constant the interval and the trend. In so doing, I obtain two pairs of rating differences within each level of quality, i.e. one between EXOKWK(MT) and EXCLWK(MT), and one between PROKWK(MT) and PRCLWK(MT). Each of these rating differences is the sum of the content effect (i.e. the value difference between OK and CL) and the contrast effect (i.e. the value of C(+, WK/MT) and C(-, WK/MT)).

Second, for each level of quality, I again obtain the difference between the pair of rating differences obtained in Step 1. Since these rating differences share the same content effect, the remaining difference is therefore the difference between the two contrast effects as a function of interval, i.e. between C(+/-, WK) and C(+/-, MT).

For the positive condition, the content effect predicts that the related pairs (EXOKWK, EXOKMT) are more attractive than the unrelated pairs (EXCLWK, EXCLMT) because "receiving an average mark" (OK) is more attractive than "cleaning one's flat" (CL). The contrast effect however predicts the opposite, because the related pairs are decreasing and therefore have negative contrast values; and the shorter the interval, the more negative the contrast values become. By contrast, the content and the contrast effects make *consistent* predictions for the negative pairs. That is, the related pairs (PROKWK, PROKMT) is more attractive than the unrelated pairs (PRCLWK, PRCLMT), because the related pairs performs better in terms of both the content and the trend.

Consistent with these predictions, Table 10.5a shows that when the pairs are positive and decreasing, the rating difference between the related and unrelated pairs is small and non-significant, -.12 and .59, *n.s.*. By contrast, Table 10.5b shows that when the pairs are negative and increasing, the rating difference between the related and the unrelated pairs is both large and statistically significant, 2.32 and 1.83, $p<.001$. The significant versus non-significant difference is consistent with the prediction of the contrasts model and provides evidence for the relatedness effect on contrasts.

The interval effect on contrasts is embodied in the magnitude of these rating differences within each level of quality, i.e. C(-,WK) versus C(-,MT) and C(+,WK) versus C(+,MT). When the pairs are positive and the contrast values are negative, the rating difference is more *negative* for the one-week interval than for the one-month interval (-.12 versus .59). By contrast, when the pairs are negative and the contrast values are positive, the rating difference is more *positive* for the one-week interval than for the one-month interval (2.32 versus 1.83). Since the only other effect to which these rating differences are attributed to remains constant (i.e. OK-CL), these results are consistent with the prediction that shorter intervals enhance contrasts, making positive contrasts more positive and negative contrasts more negative.

Time discounting

Positive time preference receives support from the results obtained in Task 2. That is, receiving an excellent mark (EX) is more attractive if it is near (EXWK) than distant (EXMT) but receiving a poor mark is more attractive (less aversive) if it is distant (PRMT) than near (PRWK). For sequences, this delay is simultaneously the interval. The hypothesized dual influences of time posit that delay (interval) affects not only the endowment but also the contrast. To isolate discounting, I compute the rating differences between those pairs with the same component events but different intervals (delays), and do so only for the unrelated pairs in order to control for the interval effect on contrasts. The result is shown in Table 10.5c. As predicted, the valences of the rating differences are always consistent with the predictions of positive time preference. It is positive for positive experiences and negative for negative experiences. In both cases, the rating differences reach statistical significance.

Table 10.5c. The impact of discounting.

	Rating diff.	Effects	$t(40)$
EXCLWK - EXCLMT	0.80	EXWK-EXMT	3.680**
PRCLWK - PRCLMT	-0.49	PRWK-PRMT	-2.427*

Paired-samples *t*-test, two-tailed; *: $p<.05$, **: $p<.01$, ***: $p<.001$

Overall

I employ regression analysis to examine how the contrasts model performs as a whole. The dependent variables are the collapsed ratings of all the sequences. The predictors are three dummy variables, one for each independent variable: Quality (*1=positive; 0=negative*), Relatedness (*1=related; 0=unrelated*), and Interval (*1=week; 0=month*). The model reaches significance, Pearson correlation coefficient $R= .417$, $F(3,324) = 22.677$, $p< .0001$.

A hierarchical multiple regression analysis provides support for the notion that the contrast effects and the endowment effects make separate and independent contributions to global satisfaction. The predictors in this case are the mean ratings of the six individual events obtained in Task 2, the signed value difference computed from these ratings, and the levels of the three independent variable as captured by the dummy variables. No evidence of multicollinearity is found. Pearson correlation coefficient R increases from 0.384 to 0.454 when the signed value difference is included as a predictor. The adjusted model that includes contrasts as a predictor accounts for significantly more variances in the observed ratings, $F(1, 136)= 10.013$, $p= .002$.

Task 3 results

Task 3 employs a choice task to test the dual influences of time. There are two predictions. First, effects of delay, i.e. discounting, and effects of interval, i.e. contrasts, *always* make contradictory predictions for the preference for EXOKWK/MT, as well as for PROKWK/MT. Second, since contrasts do not exist for the unrelated pairs EXCLWK/MT and PRCLWK/MT, the choice for these pairs depends on discounting alone. The results are summarized in Table 10.6 and Fig.10.2.

Table 10.6. Results of the happiness task III (n=21)

	% choosing week	% choosing month
EXOK	60%	40%
EXCL	75%	25%
PROK	80%	20%
PRCL	40%	60%

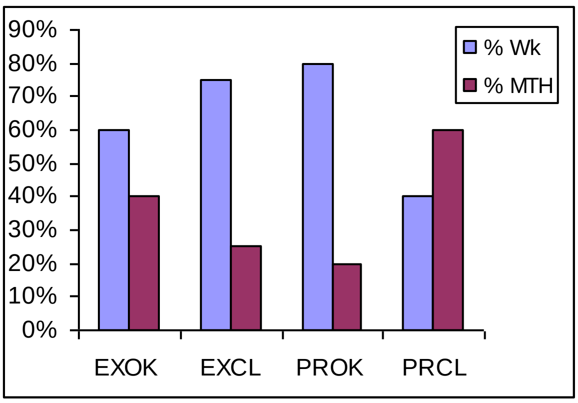

Figure 10.2. Choice percentages observed in the happiness task III

Consistent with discounting, a majority of the participants prefer “week” in EXCL (75%), *binomial test p*<.04, but “month” in PRCL (60%), *n.s.* Consistent with an interval effect on contrasts that works against the time discounting, the pattern is diminished or even reversed for the related pairs. The percentage preferring “week” to “month” decreases by 15% to 60% for EXOK whereas the percentage preferring “month" to “week” is halved to 40% for PROK, Wilcoxon z=2.53, p<.05.

A disparity in preferences for positive and negative pairs of events emerges. For the positive pair EXOK and EXCL, discounting dominates the preferences – “week”, the option favoured by discounting, is chosen by a majority in both the related and unrelated conditions. For the negative pair PROK and PRCL, however, the dominant force is discounting for the unrelated pairs but contrast for the related pairs. Put differently, discounting is more salient for the positive event than for the negative event, consistent with the notion of the *sign effect* of discounting (Loewenstein & Prelec, 1992).

Comparing the response pattern in Task 3 to the sequence ratings observed in Task 1 (Table 10.7) reveals that the preferences are by and large consistent, except for PROKWK and PROKMT.

Table 10.7. Mean ratings of the sequences observed in Task 1.

	Week	Month
EXOK	6.2	6.1
EXCL	6.3	5.5
PROK	5.5	5.5
PRCL	3.1	3.6

An overwhelming majority of the participants (80%) prefer the one-week interval between receiving a poor mark and receiving an average mark, whereas the ratings assigned to PROKWK and PROKMK are the same (5.5). Why does this happen? Since choice tasks do not enhance preference for improvement, additional motives other than the interval effect on contrasts must have motivated the preference for the short interval (Frederick & Loewenstein, 2008). One explanation is that shorter intervals foster the integrated mode of assessments (Chapter 3), allowing the positive experience to serve as a cushion for the negative experience. Since the integrated mode is only applicable to related events, this explains why significantly more participants preferring "week" in PROK than in PRCL.

Model fit

I examine how well the contrasts model fits globally by a logistic regression analysis [17] using Relatedness (*1=related, 0=unrelated*), Quality (*1=positive, 0=negative*) and their interaction (*1= related & positive, 0= all the rest of the combinations*) as the predictors and Interval (*1= week*, *0= month*) as the dependent variable. Table 10.8 displays the results. The model achieves statistical significance, $\chi^2(3) = 8.424$, $p= .038$. Since more participants prefer Week to Month, the model is correct 41.4% of the time when Month is chosen but 84.3% of the time when Week is chosen. In total the model makes correct predictions 68.8% of the time.

[17] The logistic regression predicts the log-odds of choosing week based on the dummy variables.

Table 10.8. Results of the logistic regression for Task 3 results

Variable	B	Wald	Odds Ratio[18]	95.0% C.I. odds ratio	
				Lower	Upper
Relatedness	1.792	6.164*	6.000	1.458	24.685
Quality	1.504	4.763*	4.500	1.166	17.372
Relatedness x Quality	-2.485	6.200*	.083	.012	.589
Constant	-.405	.789	.667		

*: $p<.05$

Individual-level analysis

Loewenstein and Prelec (1993) argued for the benefit of performing analysis at the individual level to detect time preferences that might be masked by data aggregation. Following this advice, I apply *Solver*®, a built-in procedure of Excel®, to the ratings observed in Task 1. The aim is to estimate the values of the four individual events (EXMT, OK, CL, PRCL) and the relatedness-interval ratios for the four related pairs, based on the eight sequence ratings produced by each individual. I make the following assumptions. First, the value of β, i.e. the improvement parameter, is constant across the eight sequences for each participant. The value of σ, i.e. the spreading parameter, is zero. Second, the values of the individual events are bounded between 0 and 4. EXWK is the most attractive event and has a fixed value of 4; PRWK is the least attractive event and has a fixed value of 0[19]. Third, the relatedness-interval ratio (*R/I*) is bounded between -1 and 1 for the related sequences, but fixed at 0 for the unrelated pairs.

[18] Odds ratios indicate the ratios of the odds of choosing week over month. For instance, relatedness has an odds ratio of 6. This means that the odds of choosing week (prob(week)/prob(month)) when the pairs are related are 6 times the odds when the pairs are unrelated.
[19] This assumes that the model conforms to an interval scale. Thus, the degree of correlation between observation and model prediction will not be affected by such a transformation.

Table 10.9. Results of the *Solver* analysis

Events	Mean estimates of event value	Sequence	Mean estimates of *R/I*
EXMT	2.78	EXOKWK	0.67
OK	3.06	EXOKMT	0.23
CL	2.52	PROKWK	0.69
PRMT	1.40	PROKMT	0.15

The *Solver* procedure produces estimates that minimize the proportion of the squared errors between the observed ratings and the predictions, which are based on the contrasts model. Table 10.9 presents the results, which are largely consistent with the observed mean ratings assigned to individual events in Task 2. Receiving an average mark (OK) is more attractive than cleaning one's flat (CL). The mean estimates for the two are 3.06 versus 2.52. This pattern is observed in 61% of the 41 participants. The estimates of individual outcome values are bounded between 0 and 4. However, consistent with discounting, the mean estimate for EXMT is much less than 4 and the mean estimate for PRMT is much higher than 0, suggesting that while EXMT is less attractive than EXWK, PRMT is more attractive than PRWK.

The estimated relatedness-interval ratios are consistent with the hypothesized impact of relatedness and interval effect on contrasts. First, the ratios are always positive. This means that the value of a sequence always changes in the direction as dictated by the valence of the signed value difference. In other words, positive (negative) signed value differences enhance (undermine) attractiveness, implying preference for improvement. Second, all the four ratios have values that are notably beyond 0, thus supporting the contrast effects in the related pairs. Third, the ratios are larger when the interval is one week than when the interval is one month, consistent with the interval effect on contrasts. This is true for both the positive and decreasing sequences and the negative and increasing sequences. At individual level, this pattern is observed in 63% of the participants for EXOKWK and EXOKMT, and 66% for PROKWK and PROKMT.

Somehow surprisingly, the estimated value of OK is higher than that of EXMT (3.06 versus 2.78). This contradicts the result of Task 2, which, if true, would invalidate the manipulation on *trend*. A close look reveals that the reason lies in the *Solver* procedure itself. As many as 41.5% of the participants assign a higher rating to the negative increasing sequence PROKWK than to the positive decreasing sequence EXOKWK. Based on the contrasts model, the value difference between these two sequences can be decomposed into two parts, the endowment value and the contrast value. The difference in endowment is however fixed at 4, or the value difference between EXWK and PROK. Therefore the attractiveness of PROKWK can only be attributed to its more positive contrast value – either because this sequence has a large signed value difference between PRWK and OK, or because it has a high relatedness-interval ratio. Since the latter is bounded between 1 and -1, *and* the value of PRWK is fixed at 0, *Solver* can only overestimate the value of OK to explain the attractiveness of PROKWK. However, the fact that more than 40% of the participants judged PROKWK to more attractive than EXOKWK is itself evidence for the contrast effect on sequence preferences.

If we employ individual-level estimates (values for individual outcomes and relatedness-interval ratio) to predict sequence ratings, the contrasts model achieves Pearson correlation coefficients ranging from -.004 to 1. This coefficient exceeds 0.80 for 82.9% of the participants.

Model comparison

I compare the performance of the contrasts model to two other models: Loewenstein and Prelec's (1993) (LP) and a truncated contrasts model with only the first term, i.e. EV. The parameters are assumed to be: (1) β = 1, (2) R =1 for related events, 0 for unrelated sequences; (3) I=1 for one-week interval and 2 for one-month interval. The value of the individual outcomes, which is needed to compute the contrast values and the endowment values are based on the mean ratings obtained in Task 2[20]. Table 10.10 shows the results.

Table 10.10. A comparison of model predictions: LP (Loewenstein & Prelec, 1993), Contrasts (the contrasts model) and Endowment value only

	Reported	LP	*MSE*	Contrasts	*MSE*	Endowment	*MSE*
EXOKWK	6.20	5.89	*.09*	5.19	*1.00*	6.60	*0.16*
EXCLWK	6.32	4.11	*4.89*	5.40	*.83*	5.40	*0.84*
EXOKMT	6.10	5.75	*.12*	5.75	*.12*	6.32	*0.05*
EXCLMT	5.51	3.96	*2.39*	5.12	*.15*	5.12	*0.15*
PROKWK	5.46	3.89	*2.46*	5.19	*.07*	2.60	*8.20*
PRCLWK	3.15	2.11	*1.08*	1.40	*3.04*	1.40	*3.05*
PROKMT	5.46	4.32	*1.32*	4.32	*1.32*	3.44	*4.09*
PRCLMT	3.63	2.53	*1.23*	2.25	*1.93*	2.25	*1.92*
		r =.880	*1.698*	r = .972	*1.058*	r = .857	*2.308*

MSE: mean squared error; *r*: Pearson correlation coefficient, all significant at .01 level

[20] The ratings are rescaled to 0-4, to reflect the fact that the sequence has a higher endowment value than each of its component outcomes.

The contrasts model achieves the highest correlation with the observations, *r* =.972, *p*< .0001, followed by LP, *r=.879*, and then the Endowment, *r=.857*[21]. It is worth noting that in this case, the contrasts model and the Endowment only model make different predictions for only half of the total eight pairs of events, i.e. the four related pairs, i.e. EXOKWK, EXOKMT, PROKWK, PROKMT.

10.2 Summary

The happiness task reported in Chapter 10 provides evidence for the contrast effects, time discounting, interval and relatedness effects on contrasts. The judgment task (Task 1) and the choice task (Task3) both provide support for the dual influences of time that delay fosters discounting whereas interval moderates contrast effects, even when delay and interval are in fact the same period of time. The results obtained in Task I provide general support for the notion of dual influences when a variable simultaneously influences the value of individual outcomes and the relationship between the outcomes. Decision makers are capable of distinguishing between the relational and non-relational effects both when their predictions coincide and when they conflict. This provides support for the approach of modelling sequence preferences as a function of relational and non-relational values.

[21] The differences in the correlation coefficients are non-significant.

Chapter 11 FINAL REMARKS

11.1 Introduction

The contrasts model proposed in this thesis distinguishes between influences of interval and delay; it also describes influences of relatedness. The model accomplishes these by assuming that people derive satisfaction from two divergent sources of values, known as *non-relational* and *relational*. The non-relational value, as embodied in the endowment effect, is a function of nominal value and delay. The relational value, as embodied in the contrast effect, is a function of signed value difference, interval and relatedness.

As depicted in the model, sequence preferences reflect the interplay of two conflicting forces, i.e. the desire to have more attractive experiences as soon as possible (positive time preference) versus the desire to experience positive contrasts with the earlier outcomes (negative time preference or preference for improvement), accomplished by delaying more attractive outcomes. The interval effect arises because, unlike delay, a long interval not only signals a long delay to the later outcomes but also a weaker contrast between the outcomes. As a result, increasing sequences become less attractive not only because of a smaller contrast but also a smaller endowment (discounted nominal value). The impact of delay on preference for improvement is much less straightforward. Depending on how the decision maker discounts the component outcomes, delay can enhance or reduce preference for improvement, or it may have no impact at all.

The dual-influence approach is the most important feature of the contrasts model and distinguishes it from Loewenstein and Prelec (1993). Their model (LP) makes no such assumptions. As such, many hypotheses investigated in this thesis are not applicable to LP, including time discounting as well as influences of relatedness and interval on the shape of a sequence as captured in the relational value (contrasts). When LP does apply, its predictions coincide with the ones made by the contrasts model. This is perhaps not surprising as both models aim at providing a descriptive account of sequence preferences and their main differences, the difference in describing spreading, is not an issue when sequences contain just two events.

Table 11.1 presents a summary of the main findings of this thesis. Both the contrasts model and LP predict preference for improvement ("Trend") and the more attractive the individual outcomes, the more attractive the sequence becomes ("NV"). The contrasts model also predicts, uniquely, that the improvement (deterioration) is more (less) desirable when its magnitude is larger, when the events are more related ("RxTrend") and when their intervals are shorter ("IxTrend").

Table 11.1. Summary of main findings.

		Non-relational			Relational	
Chapter	Task	NV	Delay	Trend	R x Trend	I x Trend
7	The Ranking task			✓		
8	Sequence judgment			✓	✓	✓
8	Social judgment			✓	✓	✓
9	Scheduling I (table)		✓	X		✓
9	Scheduling II (graph)		X	✓		✓
10	Happiness (judgment)	✓	✓	✓	✓	✓
10	Happiness (choice)		✓		✓	✓

✓: the hypothesis about the column variable received support from a task; **X**: the hypothesis was not supported; **R**: relatedness; **I**: interval; **NV**: nominal value; Shaded cells indicate hypotheses that are not tested.

11.2 Positive, null and negative time preferences

Positive, null and negative time preferences predict preferences for increasing, constant and decreasing sequences, which have negative, null and positive signed value differences and therefore contrast values of the same valences. Preference for improvement receives the most support, from the results obtained in the ranking task (Chapter 7), the sequence judgment task (Chapter 8), the second run of the scheduling task for the female participants (Chapter 9) and the happiness task (Chapter 10). These experiments show that when facing two monetary outcomes (either two gains or one gain and one loss) or non-monetary outcomes (e.g. visits, academic experiences, cleaning), participants prefer their values to improve over time rather than remain constant or even deteriorate. The more positive the later outcome compared to the earlier one, the larger the degree of improvement, the more attractive the sequences are and vice versa.

Preference for improvement seems to be a specific case of a general preference for positive contrasts. The finding in the social judgment task (Chapter 8) shows that participants believe that the target individual (Mr A) derive higher satisfaction from a given income if A receives more than his colleague, Mr B (positive contrasts), but lower satisfaction if A receives less than B (negative contrasts).

Preference for improvement is however less pronounced than expected. In the ranking task, a sizeable proportion of participants exhibit positive time preference by preferring to receive a larger gain before a smaller one or a gain before a loss. This holds even when the second outcome occurs one day after the first outcome. In the sequence judgment task, participants prefer to receive gains over a short rather than a long period. Positive time preference also dominates the responses in the first run of the scheduling task, where most participants prefer the decreasing schedule (Friends, Aunt) to the increasing (Aunt, Friends) across all six conditions, with the intervals ranging from one week to 26 weeks. By adopting the time-line graphs that foster attention on the trend, I obtain evidence of preference for improvement in the second run of the study, though only for female participants. The male-female difference is consistent with the notion that positive time preference discounting follows from focusing on individual outcomes when making assessments, typical for males, whereas negative time preference follows from focusing on the relationship between the outcomes, typical for females. Consistent with this, males' response patterns seem in part motivated by savouring and dread, an individual event driven preference for improvement. However, the fact that no gender difference emerges in other studies suggests the possibility that the gender difference mainly hinges on how each responds to manipulation on delay, which could be exacerbated by a pictorial display of the outcome (the time-line graph). Future investigation can explore these.

The happiness task provides evidence for the simultaneous influences of positive and negative time preferences. Participants prefer to receive a past gain nearer to the present, but a past loss more distant from the present. Such preferences are however mitigated or even reversed when the gains and losses are embedded in sequences, in which case the delay coincides with the interval and the interval effect contradicts discounting in terms of their implications for the global attractiveness. Preference for spreading is not salient on its own in any of these experiments.

11.3 Interval and relatedness

Interval and relatedness, the two relational variables hypothesized in the contrasts model, exert influences at two different levels, i.e. on their own (as main effects) and via contrast effects (as interactions with the signed value difference). This is evident in the sequence judgment task. The contrast effects are more pronounced, and therefore the value discrepancy between the increasing and decreasing sequences of gains is larger, when the gains are related (two working bonuses) than unrelated (one working bonus and one lottery win) or when the interval is short (half a day or one day) than long (one week). In the happiness task, the contrast effect under a one-week interval is about three times the size of the one under a one-month interval.

There is also evidence that unrelated gains are preferred to related gains of the same magnitude. A possible account is Linville and Fischer's (1991) notion of limited coping capacities. This is testable, by asking two groups of participants to assess sequences, one under cognitive load (the experimental group) and the other not (the control group). If limited coping capacities play a role, then we expect the experimental group to favour unrelated gains even more than does the control group.

On the other hand, limited coping capacities cannot explain why concentrated gains are preferred to distributed gains. The interval effect is however reversed in the interpersonal judgment task, in which case participants believe they are better-off receiving gains that are temporally more distant from the ones received by their colleague. The seemingly contradicting results actually provide support for the notion of contrast effects. This is because the shorter interval is only preferred in the sequence judgment task when the trend is increasing (i.e. positive contrasts) and the longer interval is only preferred in the social judgment task when the colleague receives a larger amount than oneself (i.e. negative contrasts). In both cases, the direction of the interval effect is consistent with the notion that shorter intervals enhance contrast effects, which leads to a larger influence on the global judgment.

11.4 Delay

Delay rather than interval leads to time discounting. However, when the timing of the present is ambiguous, as in the ranking task, the sequence judgment task and the social judgment task, results show that participants discount the second outcomes based on their interval with the first "earlier" outcomes. This is consistent with the notion of discounting by interval (Read, 2001). The happiness task obtains evidence of discounting for gains and losses both when they are assessed in isolation (Task 2), and when they are embedded in sequences (Task 1, *Solver* estimates).

What happens when the entire sequence is delayed? One clear impact of delay, which emerged from Scheduling Task II, is that it obscures time preferences, that is, the more distant the schedules, the more participants who become indifferent between the increasing and decreasing trends. The contrast model posits that delay has divergent influences on preference for improvement depending on how the decision maker discounts within a target sequence. The result of the scheduling tasks shows that delay can result in *fewer*, about the same, or more participants preferring the decreasing schedule (Friends, Aunt). I did not investigate this in this thesis, which should be the topic of future studies. Although the pattern of the results in the scheduling task suggests interactions between delay and interval, the results are statistically unreliable. That is, second-order effects due to an impact of delay on interval, or vice versa, do not exert significant influences.

11.5 Dual influences

Tversky and Griffin (1991) employ the term *dual influences* to refer to an endowment effect and a contrast effect exerted by a past event on one's present well-beings. In this thesis, I use the term more broadly to capture non-relational and relational effects exerted by the same variable, as exemplified by the endowment and the contrast. The happiness task provides evidence for the dual influences. The *delay* of the first event coincides with the *interval* between the events. The *quality* of the first event determines the *trend*; the *content* of the second event determines the *relatedness* between the events. The results show that participants are capable of separating the two kinds of effects even when they have opposing implications for time preferences.

Note that in the happiness task the first event takes place in the "past". Delay describes its distance to the present. Unlike future events, past events have occurred. This removes uncertainty as one motive underlying discounting. By comparing discounting of past and future events, future research can provide insights into different motives underlying time preferences.

11.6 Other findings

Evidence of loss-aversion emerges. This explains why the negative impact of a decreasing trend is twice the size of the positive impact of an increasing trend of the same magnitude in the sequence judgment task, using constant sequences as the control condition. In the social judgment task, loss-aversion provides an account for the only influence exerted by the *unrelated* interpersonal gains. That is, Mr A's satisfaction from a working bonus is lowered by the lottery win received by Mr B of a larger size.

An "ownership effect" means participants derive higher satisfaction simply by imagining they own the gains. Self-other discrepancies may interact with loss-aversion. The ownership effect is the most pronounced when the gains have a decreasing trend. This suggests the possibility that people focus more on the total amount and less on the individual gains when making the assessment. Future investigation can explore two things: whether vividness fosters a large hedonic impact and whether vividness influences assessment mode. If the first hypothesis holds, imagining losses should entail a larger negative effect on one's satisfaction.

One weakness of this investigation is that the stimuli sequences these investigations contain just two events, and hence are not representative of most real-life sequences. This manipulation maximizes the salience and therefore the impact of relatedness and interval but provides only limited support for the model. Chapter 6 obtains preliminary evidence that the contrasts model works for assessing sequences containing multiple periods as well. This should be the focus of my future research.

Finally, in all experiments, the participants were presented with imaginary experiences that are mainly positive, e.g. receiving a bonus or having an excellent mark. And in all but the happiness task, the participants were asked to *predict* their experiences. To test the external validity of the model, future investigation should consider using real-world settings, such as playing sequences of computer games that may result in real monetary gains and losses (e.g. Tversky and Griffin (1991)).

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APPENDIX A Results of the model comparison (Chapter 6)

	Sequences					Mean Reported rating	The Contrasts model*	LP**	LP fitted***
1	0	0	1	1	2	6.11	4.82	4.75	6.14
2	0	0	1	2	1	5.74	4.67	4.60	6.11
3	0	0	2	1	1	5.57	4.67	4.45	6.08
4	0	1	0	1	2	6.81	5.08	4.60	6.11
5	0	1	0	2	1	6.32	4.93	4.45	6.08
6	0	1	1	0	2	6.08	5.08	4.45	6.08
7	0	1	1	2	0	5.36	4.52	3.94	5.63
8	0	1	2	0	1	5.68	4.93	3.99	5.73
9	0	1	2	1	0	5.58	4.52	3.64	5.31
10	0	2	0	1	1	5.36	4.93	4.04	5.83
11	0	2	1	0	1	5.72	4.93	3.74	5.50
12	0	2	1	1	0	5.55	4.52	3.38	5.08
13	1	0	0	1	2	5.60	4.67	4.40	5.99
14	1	0	0	2	1	5.36	4.52	4.25	5.96
15	1	0	1	0	2	7.32	4.93	4.25	5.96
16	1	0	1	2	0	5.51	4.37	3.74	5.50
17	1	0	2	0	1	6.34	4.78	3.79	5.60
18	1	0	2	1	0	5.32	4.37	3.43	5.18
19	1	1	0	0	2	5.34	4.67	3.99	5.73
20	1	1	0	2	0	5.06	4.37	3.49	5.28
21	1	1	2	0	0	3.55	4.11	2.77	4.43
22	1	2	0	0	1	4.26	4.52	3.13	4.85
23	1	2	0	1	0	4.85	4.37	2.77	4.43
24	1	2	1	0	0	3.62	4.11	2.36	3.91
25	2	0	0	1	1	4.62	4.11	3.43	5.18
26	2	0	1	0	1	5.13	4.37	3.13	4.85
27	2	0	1	1	0	4.98	3.96	2.77	4.43
28	2	1	0	0	1	4.11	4.11	2.72	4.33
29	2	1	0	1	0	4.43	3.96	2.36	3.91
30	2	1	1	0	0	3.32	3.70	1.95	3.38
Mean squared error (MSE)							.99	3.0	.23

* Parameter values used in the contrasts model: β = .28 and σ'= .13

** Parameter values used in LP: β = .28, σ=-.13

*** LP fitted makes predictions using parameter values derived from ratings of each individual participant

APPENDIX B Questionnaire of the ranking task

For each of the following pairs of events, please try to imagine how you would feel if they happened to you. Using the boxes provided beside each letter, please rank order the events according to how good you would feel after they occurred. Use ‘1’ for the event that would be best, ‘2’ for the next best, and so on.

Question 1

❑ **A** One day, you experience an unexpected loss of £200.
The next day, you experience an unexpected gain of £200.

❑ **B** One day, you experience an unexpected gain of £200.
The next day, you experience an unexpected loss of £200.

❑ **C** One day, you experience an unexpected loss of £100.
The next day, you experience an unexpected gain of £100.

❑ **D** One day, you experience an unexpected gain of £100.
The next day, you experience an unexpected loss of £100.

❑ **E** One day, you experience an unexpected loss of £250.
The next day, you experience an unexpected gain of £250.

❑ **F** One day, you experience an unexpected gain of £250.
The next day, you experience an unexpected loss of £250.

Question 2

❑ **A** One day, you experience an unexpected gain of £100.
The next day, you experience an unexpected gain of £400.

❑ **B** One day, you experience an unexpected gain of £400.
The next day, you experience an unexpected gain of £100.

❑ **C** One day, you experience an unexpected gain of £200.
The next day, you experience an unexpected gain of £300.

❑ **D** One day, you experience an unexpected gain of £300.
The next day, you experience an unexpected gain of £200.

❑ **E** One day, you experience an unexpected gain of £250.
The next day, you experience an unexpected gain of £250.

APPENDIX C Questionnaire of the sequence judgment task

Translated from Chinese

Imagine that you (Mr A) have just received 4000 RMB on two separate occasions, the details of which are presented in the three tables shown below. In each table, the trend in which you receive these two incomes differs, which is either increasing (1500, 2500), constant (2000, 2000) or decreasing (2500, 1500). Given trend, the incomes differ in terms of their source (either two working bonuses or one working bonus and one lottery win) or time interval (either received on the same day, over a period of two days or one week).

Your task is to assign a rating to each scenario that represents one combination of sources of income and intervals (i.e. each row in each of the three tables below). These ratings should reflect your personal perception in terms of *how happy you (Mr A) would be* after these experiences. There are no right or wrong answers.

First, read through the list of scenarios presented in all the tables. Next, assign a rating of 9 to the pair that would lead to the *most* happiness and assign a rating of 0 to the pair that would lead to the *least* happiness. Now rate all of the other pairs relative to these.

Interval	Source of income	An increasing sequence: 1500, 2500
One week	Two working bonuses	
One day	Two working bonuses	
Half day	Two working bonuses	
One week	One working bonus and one lottery win	
One day	One working bonus and one lottery win	
Half day	One working bonus and one lottery win	

Interval	Source of income	A decreasing sequence: 2500, 1500
One week	Two working bonuses	
One day	Two working bonuses	
Half day	Two working bonuses	
One week	One working bonus and one lottery win	
One day	One working bonus and one lottery win	
Half day	One working bonus and one lottery win	

Interval	Source of income	A constant sequence: 2000, 2000
One week	Two working bonuses	
One day	Two working bonuses	
Half day	Two working bonuses	
One week	One working bonus and one lottery win	
One day	One working bonus and one lottery win	
Half day	One working bonus and one lottery win	

APPENDIX D Questionnaire of the Interpersonal Judgment Task

Translated from Chinese

Suppose Mr A has just received a working bonus worth 2000RMB. His colleague Mr B has also received an income, but its time, amount and source vary, as specified in the following tables.

Your task is to assign a rating to each scenario that indicate how happy you believe Mr A will be given Mr B's income. These ratings should reflect your personal perception in terms of how happy the person would be after these experiences. There are no right or wrong answers.

First, read through the list of scenarios presented in all the three matrices. Next, assign a rating of 9 to the pair that would lead to the *most* happiness and assign a rating of 0 to the pair that would lead to the *least* happiness. Now rate all of the other pairs relative to these.

Suppose with *an interval of half a day*, Mr B receives:

Source of income	Worth (RMB)	How happy is Mr B?
A working bonus	2500	
A working bonus	2000	
A working bonus	1500	
A lottery win	2500	
A lottery win	2000	
A lottery win	1500	

Suppose with *an interval of one week*, Mr B receives:

Source of income	Worth (RMB)	How happy is Mr B?
A working bonus	2500	
A working bonus	2000	
A working bonus	1500	
A lottery win	2500	
A lottery win	2000	
A lottery win	1500	

APPENDIX E Questionnaire of the Scheduling Task I

Imagine you must schedule two weekend outings to a city where you once lived. You do not plan on visiting the city after these two outings. You must spend one of these weekends with an irritating, abrasive aunt who is a horrendous cook. The other weekend will be spent visiting former work associates whom you like a lot.

On the next few pages, you will be asked about your preferences between pairs of schedules. In each question, your task is (1) to make choice for a schedule that you believe will lead to more happiness and (2) to indicate the degree of your preference by assigning a rating on a 1 to 7 scale. A rating of ‘1’ represents a *very weak* preference, and a rating of ‘7’ represents a *very strong* preference (the higher the rating, the stronger the preference).

Please provide your demographic information.

Your gender: ______ (F/M)
Your age: ______ years

1. Suppose one outing will take place this coming weekend, the other the weekend after.

	This weekend	Next weekend
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

2. Suppose one outing will take place in 4 weeks, the other the weekend after (5 weeks).

	4 weeks from now	5 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

3. Suppose one outing will take place in 6 months (26 weeks), the other the weekend after (27 weeks from now).

	26 weeks from now	27 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

4. Suppose one outing will take place this coming weekend, the other in 4 weeks.

	This weekend	4 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

5. Suppose one outing will take place in 4 weeks, the other 4 weeks after (8 weeks from now).

	4 weeks from now	8 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

6. Suppose one outing will take place in 6 months (26 weeks from now), the other 4 weeks after (30 weeks from now).

	26 weeks from now	30 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

7. Suppose one outing will take place this coming weekend, the other in 6 months (26 weeks).

	This weekend	26 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

8. Suppose one outing will take place in 4 weeks, the other 6 months after (30 weeks from now).

	4 weeks from now	30 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

9. Suppose one outing will take place in 6 months (26 weeks), the other 6 months after (one year or 52 weeks from now).

	26 weeks from now	52 weeks from now
A	Friends	Abrasive aunt
B	Abrasive aunt	Friends

Which schedule do you prefer (circle one)? **A** **B**

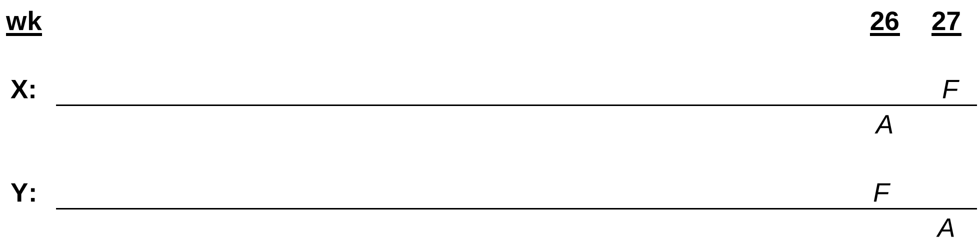
How much do you prefer this schedule to the other (circle one)?

1 **2** **3** **4** **5** **6** **7**

APPENDIX F Questionnaire of the Scheduling Task II

Imagine you must schedule two weekend outings to a city where you once lived. You must spend one of these weekends with an irritating aunt who is a horrendous cook. The other weekend will be spent visiting former work associates whom you like a lot.

In each of the following questions, you will be presented with two schedules, Schedule X and Schedule Y. Following Schedule X, you will visit the aunt before visiting the friends. Following Schedule Y, you will visit the friends before visiting the aunt. The time of these two schedules varies from question to question. One possibility is described in the following “time line” diagram.



The diagram describes a situation where the first visit will take place on the weekend 26 weeks (6 months) from now and the second visit one week after (27 weeks from now). Since visiting the friends (denoted by letter *F*) is more pleasant than visiting the aunt (denoted by letter *A*), *F* is marked above the time line whereas *A* is marked below.

In each question, your task is to indicate your relative preference between Schedule X and Y by assigning a rating on a -5 to 5 scale. The more positive your rating, the stronger is your preference for Schedule Y (visiting the friends before visiting the aunt, i.e., $(^{F}{}_{A})$), whereas the more negative your rating, the stronger is your preference for Schedule X, (visiting the aunt before visiting the friends, i.e., $({}_{A}{}^{F})$). A rating of 0 indicates you are indifferent between these two schedules.

Please bear in mind that once the choice is made, the two visits must be paid at the time you chose. There will be neither interruptions to the plan, nor any future chance of altering it.

Please provide your demographic information.

Your gender: ______ (F/M)
Your age: ______ years

1. One outing will take place this coming weekend, the other the weekend after.

wk	**1**	**2**
X:	*A*	*F*
Y:	*F*	*A*

-5	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**
Strongly prefer X					No Difference					Strongly prefer Y

2. One outing will take place this coming weekend, the other in 4 weeks.

wk	**1**	**4**
X:	*A*	*F*
Y:	*F*	*A*

-5	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**
Strongly prefer X					No Difference					Strongly prefer Y

3. One outing will take place this coming weekend, the other in 6 months (26 weeks)

wk	**1**	**26**
X:	*A*	*F*
Y:	*F*	*A*

-5	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**
Strongly prefer X					No Difference					Strongly prefer Y

4. One outing will take place in 6 months (26 weeks), the other the weekend after (27 weeks from now).

wk **26** **27**

X: ________________ *F*

A

Y: ________________ *F*

A

-5 -4 -3 -2 -1 0 1 2 3 4 5

Strongly prefer X | No Difference | Strongly prefer Y

5. One outing will take place in 6 months (26 weeks), the other 4 weeks after (30 weeks from now).

.**wk** **26** **30**

X: ________________ *F*

A

Y: ________________ *F*

A

-5 -4 -3 -2 -1 0 1 2 3 4 5

Strongly prefer X | No Difference | Strongly prefer Y

6. One outing will take place in 6 months (26 weeks), the other 6 months after (52 weeks or one year from now).

wk **26** **52**

X: ________________ *F*

A

Y: ________________ *F*

A

-5 -4 -3 -2 -1 0 1 2 3 4 5

Strongly prefer X | No Difference | Strongly prefer Y

Please tell us what kinds of things affected your preferences. We are especially interested in the effect of how far the two visits were from the present, how far they were from one another, and whether the visit to the aunt came before or after the visit to your friends.

1____

____

2____

____

3____

____

APPENDIX G Questionnaire of the happiness task

Part I

On the next few pages you will find 8 pairs of life events experienced by university students. Each pair of events contains two experiences. The first event occurred either *a week ago* or *a month ago*, and the second event always occurred today.

Your task will be to assign a rating to each pair of events. These ratings should reflect your personal perception in terms of *how happy the person would be* after these experiences. There are no right or wrong answers.

First, read through the list of 8 pair of events on the next few pages and assign a rating of 10 to the pair that would lead to the *most* happiness. Next, assign a rating of 0 to the pair that would lead to the *least* happiness. Now rate all of the other pairs relative to these.

Please make your ratings by *circling* the appropriate rating on the scale below each pair of events.

1. *A week ago*, **Alice** received an *excellent* mark in a quiz, much better than she expected. *Today*, she received an *acceptable* mark in another quiz. This was the mark she expected.
   How happy do you think **Alice** is today?

0 1 2 3 4 5 6 7 8 9 10

2. *A week ago*, **Betty** received an *excellent* mark in a quiz, much better than she expected. *Today*, she spent most of the day tidying up her flat.
   How happy do you think Betty is today?

0 1 2 3 4 5 6 7 8 9 10

3. *A month ago*, **Eva** received an *excellent* mark in a quiz, much better than she expected. *Today*, she received an *acceptable* mark in another quiz. This was the mark she expected.
   How happy do you think **Eva** is today?

0 1 2 3 4 5 6 7 8 9 10

4. *A month ago*, **Fiona** received an *excellent* mark in a quiz, much better than she expected.
   Today, she spent most of the day tidying up her flat.

How happy do you think Fiona is today?

0 1 2 3 4 5 6 7 8 9 10

5. *A week ago*, **Celia** received a poor mark in a quiz, much worse than she expected. Today, she received an acceptable mark in another quiz. This was the mark she expected.
How happy do you think Celia is today?

0 1 2 3 4 5 6 7 8 9 10

6. *A week ago*, **Donna** received a *poor* mark in a quiz, much worse than she expected. *Today*, she spent most of the day tidying up her flat.
How happy do you think Donna is today?

0 1 2 3 4 5 6 7 8 9 10

7. *A month ago*, **Gill** received a *poor* mark in a quiz, much worse than she expected. *Today*, she received an *acceptable* mark in another quiz. This was the mark she expected.
How happy do you think Gill is today?

0 1 2 3 4 5 6 7 8 9 10

8. *A month ago*, **Helen** received a *poor* mark, much worse than she expected. *Today*, she spent most of the day tidying up her flat.
How happy do you think Helen is today?

0 1 2 3 4 5 6 7 8 9 10

Part II

On the next two pages you will find 6 individual events experienced by university students. These events occurred independently to each student. Your task will be to assign ratings to these events. These ratings should reflect your personal perception in terms of how happy the person would be *today* after experiencing these events either *a month ago*, *a week ago* or *today*. There are no right or wrong answers.

First, read through the list 6 events on the next two pages and assign a rating of 10 to the event that will lead to *most* happiness. Next, assign a rating of 0 to the event that will lead to *least* happiness. Now rate all of the other events relative to these. Please make your ratings by *circling* the appropriate rating on the scale below each event.

1. *A week ago*, **Alec** received an *excellent* mark in a quiz, much better than he expected.
   How happy do you think Alec is today?

0 1 2 3 4 5 6 7 8 9 10

2. *A month ago*, **Ed** received an *excellent* mark in a quiz, much better than he expected.
   How happy do you think Ed is today?

0 1 2 3 4 5 6 7 8 9 10

3. *Today*, **Bill** received an *acceptable* mark in a quiz. This was the mark he expected.
   How happy do you think **Bill** is *today*?

0 1 2 3 4 5 6 7 8 9 10

4. *A week ago*, **Carl** received a p*oor* mark in a quiz, much worse than he expected.
   How happy do you think Carl is today?

0 1 2 3 4 5 6 7 8 9 10

5. *A month ago*, **Franc** received a *poor* mark in a quiz, much worse than he expected.
   How happy do you think Franc is today?

0 1 2 3 4 5 6 7 8 9 10

6. *Today*, **Donald** spent most of the day tidying up his flat.
   How happy do you think Donald is today?

0 1 2 3 4 5 6 7 8 9 10

Part III

On the next two pages you will find 4 questions. In each question that you will respond to, two events will be described. Assume that the first event will occur either *a week earlier* or *a month earlier* than the second event. Your task will be to decide when you would prefer to have the *first* event occur. Please indicate your choice by ticking the option that you consider as more desirable (or less undesirable).

Q1

First event: You receive an *excellent* mark in a quiz, much better than you expected.
Second event: You receive an *acceptable* mark in another quiz. This was the mark you expected.

I would rather have

___ the first event occur *a month earlier* than the second event.
___ the first event occur *a week earlier* than the second event.

Q2

First event: You receive a *poor* mark in a quiz, much worse than you expected.
Second event: You receive an *acceptable* mark in another quiz. This was the mark you expected.

I would rather have

___ the first event occur *a month earlier* than the second event.
___ the first event occur *a week earlier* than the second event.

Q3

First event: You receive an *excellent* mark in a quiz, much better than you expected.
Second event: You spend most of the day tidying up your flat.

I would rather have

___ the first event occur *a month earlier* than the second event.
___ the first event occur *a week earlier* than the second event.

Q4

First event: You receive a *poor* mark in a quiz, much worse than you expected.
Second event: You spend most of the day tidying up your flat.

I would rather have

___ the first event occur *a month earlier* than the second event.
___ the first event occur *a week earlier* than the second event.