The relation of general and specific locus of control to intertemporal monetary choice

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Abstract

We investigated the relationship between Locus of Control and discount rates for future monetary outcomes. Thirty-eight students completed delay discounting questionnaires for monetary gains and losses in personal and business scenarios. In addition, we measured Economic and Generalized Locus of Control (LOC) with Furnham’s (1986) and Rotter’s (1966) scales, respectively. Economic, but not Generalized LOC was correlated with distinct choice patterns: individuals with internal Economic LOC (E-LOC) discounted future gains and losses less steeply than individuals with external E-LOC, both in business and in personal scenarios. E-LOC appears useful in understanding intertemporal financial choices. It may also assist in the development of programs to modify impulsive choice behaviours.

Keywords: Intertemporal choice; Locus of control; Delay discounting; Financial planning; Impulsive behaviour

1. Introduction

* Delay discounting describes the phenomenon that the subjective value of a reward or loss decreases with its temporal distance. Future gains are viewed as less attractive and future losses less unattractive than if they were to be delivered immediately. Delay discounting thus influences
intertemporal choice decisions. A seller may be willing to sell at a lower price to a buyer who is able to deliver the payment immediately rather than one who is willing to pay more, but at a later date. In this case, the later payment is discounted in value such that it becomes less attractive than the immediate offer. Many companies offer delayed payment plans with the option to “buy now and pay nothing until next year!” These companies capitalize upon the fact that people tend to discount future losses, and thus view the price of a purchase as subjectively smaller in magnitude due to its temporal distance. Indeed, people often choose to make deferred purchases for much larger amounts than they would be willing to pay on the spot.

Delay discounting behaviour is best accounted for by a hyperbolic function (cf. Kirby & Herrnstein, 1995):

$$ V = \frac{A}{1 + kD} \quad (1) $$

where $A$ is the subjective value of the option, were it available immediately, $V$ the subjective value of the option at delay $D$, and $k$ is a free parameter representing the individual’s discount rate.

For an individual with a high discount rate, future outcomes rapidly lose their value. Hence, this person would favour small, immediate rewards (SIRs) over larger, delayed rewards (LDRs), and large delayed losses (LDLs) over smaller, immediate losses (SILs). For people with low discount rates, future outcomes tend to retain their value. In behavioural terms, the former individual would be termed impulsive, whereas the latter would be termed self-controlled. Indeed, individuals with addictions characterized by impulsive behaviours have been shown to have elevated discount rates (Kirby, Petry, & Bickel, 1999; Petry, 2001, 2003; Petry & Casarella, 1999).

1.1. Asymmetries between discounting of positive vs. negative outcomes

The subjective magnitude of negative outcomes is generally larger than that of equivalent positive outcomes (Kahneman & Tversky, 1979). This phenomenon – losses loom larger than gains – is best illustrated with the *endowment effect*: people will generally demand a much higher price to give up something than they would be willing to pay to obtain it (Kahneman, Knetisch, & Thaler, 1990). *Loss aversion* extrapolates to an asymmetry of discount gradients over time: negative outcomes generally increase more in subjective magnitude as they draw nearer in time than corresponding positive outcomes (cf. Rozin & Royzman, 2001). One would thus expect that losses would retain their negative value to a larger extent than equivalent gains; in other words, losses should be discounted less rapidly than gains. We will refer to this as the *Sign Effect*.

2. Locus of control, deferred gratification, and delay discounting

The LOC construct was first conceived by Rotter (1966), who proposed that a belief in internal control is evident when an individual perceives reinforcement as being contingent upon their own action. A belief in external control, however, constitutes a view that reinforcement is under the control of external agents such as luck, chance, fate or powerful others. A relationship between LOC and deferred gratification was first demonstrated in studies with children (see Lefcourt, 1982 for an overview). Using an intertemporal choice paradigm, internal children were found
to be more likely to choose delayed rewards than external children (cf. Bialer, 1961; Walls & Smith, 1970). Erikson and Roberts (1971) observed 40 institutionalized adolescent delinquents who were offered the attractive chance to attend public school away from the institution, in exchange for a delayed release. Out of the 20 inmates who chose this immediate reward despite long term disadvantages only 1 gave an internal response when asked why another boy was transferred to a the cottage reserved for those who declined the immediate reward; In contrast, 8 of the 20 adolescents who chose to decline the immediate reward provided internal responses to the same question. Platt and Eisenman (1968) further demonstrated that internal adults have more future-oriented time perspectives than externals.

More recent research has related LOC to financial choices. Duxbury, Haines, and Riding (1996) found that informal investors were more internal than non-investors, suggesting that internals are more likely than externals to plan financially for the future. Tokunaga (1993) found that individuals who had experienced serious financial problems as a direct result of excessive credit use were more external than controls. In addition, external individuals seek less information before making a purchase, making them more likely to “impulse buy” (Srinivasan & Tikoo, 1992). The literature suggests that, in general, internals tend to make decisions to secure their financial future whereas externals tend to make choices that provide them with instant gratification.

2.1. Neuroscientific and neurobiological evidence

Neuropsychological research raises the possibility that similar brain regions may be involved in delay discounting and LOC. The prefrontal cortex (PFC) has repeatedly been implicated in impulse control. Kheramin et al. (2003) found that in rats, lesions of the orbital PFC increased delay discount rates. Using fMRI, McClure, Laibson, Loewenstein, and Cohen (2004) demonstrated that, in humans, areas of the limbic system showed greater activation with SIR choice, whereas lateral PFC showed greater activation with LDR choice.

Similar brain regions to these have been postulated to underlie individual differences in LOC. De Brabander and Declerk (2004) provide a review of the literature which links internal LOC to better performance on tests of “executive functions” characterized by substantial PFC involvement, for example, working memory, planning ability, and impulse control. Interestingly, Rowe, Toni, Josephs, Frackowiak, and Passingham (2000) report that greater activation of lateral PFC tends to be observed when actions are specified by voluntary choice than when externally specified.

De Brabander and Declerk (2004) discovered that in a sample of breast cancer patients, elevated dopamine (DA) metabolism was associated with external LOC. Interestingly, the limbic structures implicated in SIR choice by McClure et al. (2004) are all heavily innervated by dopamine. To summarize, the neuropsychological evidence links both internal LOC and LDR choice with greater PFC involvement. An external LOC is linked tentatively with DA hyperactivity. These neurological commonalities suggest that LOC and delay discounting may be psychologically related.

2.2. Locus of control and discounting of losses

Overall, converging psychological and neurological evidence supports a link between internality and a preference to delay personal rewards. Simply because internals may have lower discount
rates for gains does not mean this is necessarily also the case for losses. In a study with MBA students from one of the top-US programs, Shelley (1994) found that loss was discounted faster than gain – contrary to the expected *Sign Effect*. Shelley’s sample may have been characterized by a high internal LOC: participants were likely to have been ambitious and achievement motivated – traits associated with internality (Bar-Tal & Bar-Zohar, 1977; Lefcourt, 1982). Furthermore, March and Shapira (1987) suggested that managers believe they can control the future through their own actions, and thus also believe they can avoid or reduce future losses. Thus an internal LOC, and an associated belief in personal control of the future may explain the attitudes of managers to business related losses, and the high discount rates for losses shown by Shelley.

March and Shapira (1987) note that managers are more likely to accept business-related than personal risk. Hence, they may be more likely to discount loss faster than gains in a business scenario. For this reason, the current study investigated discount rates in both business and personal scenarios.

### 2.3. Specific vs. general locus of control

Our review of the literature suggests a link between general LOC and delay discounting. However, since the advent of the LOC construct, a number of more specialized scales have been proposed, with better predictive value in more specific contexts. Furnham’s (1986) Economic LOC (E-LOC), for instance successfully differentiates between unmanageably indebted individuals and controls (Corkish, 1992). Since the process of becoming indebted often involves intertemporal choice decisions such as the use of consumer credit, we expect that E-LOC will be related to delay discount rates. Furnham and Steele (1993) note that few studies have attempted to compare specific and general LOC. We administered both scales. This allowed us to (a) investigate the explanatory power of each construct with respect to delay discounting, and (b) examine the relation between the two constructs.

We hypothesized that internals (on either LOC, E-LOC, or both) will discount gains less steeply than externals in the personal condition, related to a propensity to delay gratification. This effect may extrapolate to the discounting of business gains. Furthermore, internals are predicted to discount losses more steeply than externals in the business condition. This effect may extrapolate to personal losses. The variables manipulated were the sign of the outcome and the scenario, resulting in four within-subject conditions; personal gains (PG), personal losses (PL), business gains (BG) and business losses (BL). LOC and E-LOC were measured and employed as between-subject variables (via median-split) in the analysis. The DV was the participant’s discount rate.

### 3. Experiment

#### 3.1. Method

#### 3.1.1. Participants

Thirty-eight undergraduate psychology students (27 females, $M$ age = 20) from Cardiff University participated in exchange for course credit or voluntarily. One participant appeared to have answered randomly and was excluded from the analyses.
3.1.2. Materials

All participants completed the LOC (Rotter, 1966) and E-LOC (Furnham, 1986) scales. The LOC scale comprises 29 binary choices between two statements and yields a single score consistent with the number of external choices made by the participant. There are six filler items; thus the maximum score is 23. An example item from the scale is (a. is the external choice):

- a. In the long run the bad things that happen to us are balanced by the good ones.
- b. Most misfortunes result from a lack of ability, ignorance, laziness, or all three.

E-LOC, is a four-dimensional construct, comprising the sub-scales Internal, Chance, External/Denial and Powerful Others, each measured with 7-point Likert scales to indicate agreement with a statement. Examples of items are:

**Internal:** Saving and careful investing is a key factor in becoming rich.

**Chance:** Becoming rich has nothing to do with luck.

**External/Denial:** People's poverty results from their own idleness.

**Powerful others:** I feel that my finances are mostly determined by powerful people.

We calculated separate scores for these factors and combined them to form a composite score for the purpose of analysis. As external control beliefs are usually taken to encompass beliefs in chance and powerful others as well as denial, scores on these three factors were added together to form a total external score (high values representing greater internality). The internal score (low scores representing greater internality) was then subtracted from this, yielding a possible range of composite scores from $-34$ to $98$, where higher scores represent more internal beliefs.

An adaptation of the delay discounting questionnaire devised by Kirby et al. (1999), comprising 27 items, each of which requires a choice between a SIR and a LDR at a certain delay period, was used to calculate discounting rates (see Table 1). Twenty-three different delay periods are encompassed, ranging from 7 to 186 days. Participants were assigned indifference ($k$) values according to the procedure devised by Kirby et al. Each questionnaire item corresponds to one of nine $k$ values, calculated according to Eq. (1). If a participant was indifferent between the two values in question, the corresponding $k$ value would represent their discount rate. For example, if a participant was indifferent between £34 today and £50 in 30 days, he or she would have a $k$ value of .016.

Due to the forced choice nature of the methodology, an indifference value cannot be assigned on the basis of a single question. If participants choose the SIR on this trial they have a $k$ value greater than .016, whereas if they choose the LDR, they have a $k$ value of less than .016. So, if a participant’s responses to two items indicate that their discount rate is greater than one $k$ value but less than the next, they might be assigned a $k$ value corresponding to the midpoint of the two values. One might assume then, that the $k$ value assigned to each participant would then reflect the point in Table 1 at which they shift from choosing the SIR to the LDR. However, participants are not always entirely consistent in their choices. Multiple shifts in preference may be made and a single point of change thus unidentifiable. For this reason, the number of the participant’s responses consistent with each of the nine $k$ values is calculated, and the $k$ value consistent with the highest number of choices assigned. If two $k$ values are equally consistent, the geometric midpoint of these values is assigned.
An adaptation of Kirby et al.’s (1999) questionnaire was devised in order to assess personal loss discount rates. The item values remained constant, but the wording of the questions was changed such that participants were asked, for example, “Would you prefer to pay £34 today or £50 in 30 days?” Discount rates were calculated in the manner outlined above except that in this case, choice of the LDR was consistent with a $k$ value greater than the associated $k$ value, and choice of the SIR was consistent with a $k$ value less than that value. Two further adaptations of the Kirby et al. questionnaire were devised in order to assess delay discounting of gains and losses in a hypothetical business scenario. Participants were instructed to imagine that they were the manager of a business and that they were required to choose between two contracts that would bring (cost) money to the business. Choices were presented in the following format:

Contract 1: £25,000 paid (deducted) today.
Contract 2: £30,000 paid (deducted) in 80 days.

### Table 1

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<th>Order</th>
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<th>Delay (days)</th>
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*Note.* SIR = smaller, immediate reward. LDR = larger, delayed reward. Amounts are in £.
The scenario was kept simple and free from any unnecessary contextual information in order to avoid bias. The monetary values were those used by Kirby et al., multiplied by a factor of 1000 to make them more realistic for a business scenario. The order of questions in each questionnaire was randomized.

3.2. Design and procedure

Sign (gain vs. loss) and Scenario (personal vs. business) were manipulated within subjects to allow measurement of four different $k$-values, one for each $Sign \times Scenario$ combination. The order of the four delay discounting questionnaires was counterbalanced, with one LOC measurement presented as a ‘filler’ halfway through the questionnaires, and the other presented at the end of the experiment. Which scale (LOC vs. E-LOC) appeared as filler or at the end of the experiment was counterbalanced between participants. Materials were organized in a booklet. The entire experiment took approximately 30 min.

LOC and E-LOC scores were dichotomized using a median split, and served as two separate between-subjects variables.

4. Results

Composite E-LOC scores ranged from 31 to 69 ($Mdn = 51.5$), LOC scores from 7 to 21 ($Mdn = 13$). Specific E-LOC and general LOC were negatively correlated, $r = -.37$, $p < .05$, reflecting the opposite polarity of the two scales: High E-LOC scores indicate greater internality, while high LOC scores reflect greater externality.

![Graph of mean discount rates](image)

Fig. 1. Mean discount rates of participants with internal and external Economic Locus of Control for personal gains (PG), personal losses (PL), business gains (BG) and business losses (BL). Error bars represent standard errors.
Fig. 1 shows a clear difference in the discount rates of internals and externals, as differentiated by E-LOC. As originally expected, individuals with high internal E-LOC discounted gains (both in personal and business situations) less steeply than individuals with high external E-LOC. Contrary to our prediction, high internal E-LOC participants also discounted losses less rapidly than external E-LOC participants. Furthermore, gains were generally discounted more rapidly than losses.

A $2 \times 2 \times 2$ E-LOC (internal vs. external) $\times$ Sign (gain vs. loss) $\times$ Scenario (personal vs. business) mixed ANOVA corroborated these observations and revealed main effects of E-LOC, $F(1,35) = 8.04$, Sign, $F(1,35) = 29.923$, and Scenario, $F(1,35) = 10.91$, and no interactions. The main effect of Scenario revealed that business outcomes were discounted more rapidly than personal outcomes.

Internals and externals as defined by a median split over General LOC did not differ in their discounting behaviour, $F(1,35) = .08$, ns, nor were there any interactions associated with LOC (all $Fs < 2.9$). A post-hoc power analysis (Buchner, Faul, & Erdfelder, 1997) with an effect size $d = .5$ revealed a power of .84 for this result; $d$ was calculated based on the observed difference in $k$-values for Internals and Externals as defined by E-LOC, with the hypothesis that a comparable difference (in terms of standard deviations) would be found for LOC. Thus, even though specific E-LOC and LOC are clearly related, as evidenced by the correlation between them, the former seems to have better explanatory power over intertemporal monetary choice.

5. General discussion

Although our experiment revealed no difference in the discount rates of internals and externals, as differentiated using the original LOC construct (Rotter, 1966), such a difference was found when E-LOC (Furnham, 1986) was employed: internals discounted both gains and losses less steeply than externals across business and personal scenarios. The more specific E-LOC thus has greater validity in differentiating participants with high and low discount rates for financial outcomes and should be used in future research in this field. A lower discount rate for personal rewards in individuals with internal E-LOC is consistent with previous research suggesting that internals are more inclined to defer gratification than externals.

The effect extrapolated to personal loss, business gain and business loss conditions. This presents novel evidence to the field, as the discounting of losses and business outcomes have heretofore not been investigated with respect to LOC. The Sign Effect was consistent with most previous research but at variance with Shelley’s (1994) results. However, Shelley found only 7 out of 30 participants actually discounted loss faster than gain; the pattern of response that contributed to the final model. Thus, the effect was not universal. In our study, only one participant discounted personal and business losses faster than gains; two further participants discounted business losses heavier than gains.

Our findings advance theory in the field by broadening the profile of factors differentiating individuals with high and low monetary discount rates. An external E-LOC orientation predisposes an individual to have a high monetary discount rate, along with factors such as young age (Read & Read, 2004), low income (Green, Myerson, Lichtman, Rosen, & Fry, 1996), and smoking (Baker, Johnson, & Bickel, 2003), and may be a causal factor in elevated monetary discount rates.
There is no sense in choosing a delayed reward over an immediate reward when one perceives the financial future as inherently uncertain due to external influences. However, an attribution of causality precludes the scope of the present study. An external E-LOC may emerge as a result of financial difficulties caused by a pattern of impulsive intertemporal monetary choices. Alternatively, a reciprocal pattern of influence may exist. Future investigation is required to uncover the casual nature of the observed relationship. A starting point may be offered by the finding that substance abuse recovery is associated with both increased internality (Oswald, Walker, Krajewski, & Reilly, 1994) and a lowering of discount rates (Petry, 2001). Longitudinal research may investigate the temporal changes in E-LOC and discount rates with addiction recovery in order to infer causality. Moreover, our hypothesis that LOC and delay discounting are psychologically related was originally based on structural commonalities reported in the neuropsychological literature. Future research into the neuropsychological underpinnings of this functional relationship might shed light on the causal relation between LOC and intertemporal monetary choice.

In society it is desirable to modify impulsivity; this trait is associated with risk for problems such as addiction and criminality (Farrington, 1995). It is generally assumed that personality traits such as impulsivity are resistant to change. However, Roberts and DelVecchio (2000) conclude from a quantitative review of longitudinal studies that delay of gratification is one of the personality traits most susceptible to change with adult experience. If monetary discount rates could be shown to originate from external economic control beliefs, then maladaptive or impulsive intertemporal financial choice behaviour might be modified by interventions to change such beliefs. Such interventions may reduce credit related problems and encourage long term financial planning. Furthermore, even without specifying causality, the findings of the present study may have important implications for the development of treatment programs for improving financial self control. Such programs might be tailored to the more externally oriented individual as defined by E-LOC.

References