Effects of measurement methods on the relationship between smoking and delay reward discounting

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ABSTRACT

Aims Delay reward discounting (DRD) measures the degree to which a person prefers smaller rewards soon or larger rewards later. People who smoke have been shown to have higher DRD. There are several ways of measuring DRD, and the method used might influence the association between smoking and DRD. The key differences are the order in which the items are presented, the delays used and the magnitude of the delayed amount.

Setting An international online study running from September 2010 to June 2011.

Participants A total of 9454 individuals; 38% male, mean age = 23.1 years.

Design and measurements Users completed a multi-item DRD task. They were randomly presented the immediate rewards in an ascending, descending or randomized order. The delays were between 1 week and 5 years. The delayed amounts were $1000 for all delays, and $100 for 1 month. Users also self-reported their smoking status.

Findings A hyperbolic DRD function fitted better than an exponential function. There were differences in the derived DRD function based on methodology used; items presented in a randomized order, longer delays and smaller rewards showed steeper discounting. However, these did not interact with smoking status, as for all methodologies used daily smokers showed the steepest discounting, followed by non-daily smokers, then non-smokers.

Conclusions Smokers discount future consequences more than non-smokers, irrespective of which measurement is used, but variations in method lead to different estimates that are not comparable between experiments.

Keywords Delay discounting, exponential discounting, hyperbolic discounting, impulsivity, magnitude effect, online social networks, smoking.

INTRODUCTION

Delay reward discounting (DRD) measures how a reward’s subjective utility decreases as the interval before it is obtained increases. Steeper DRD has been found to be related to a range of addictive behaviours: smoking [1–6], the success of smoking cessation [7,8], the initiation of regular smoking in adolescents [9], drinking [10], heroin and cocaine [11,12], opioids [13] and marijuana [14]. However, the measurement of DRD varies, and it is possible that this may affect estimates of effect size or cross-experiment comparisons [15]. We therefore compared multiple methods of measuring DRD to estimate whether the relationship between DRD and smoking changed depending upon the measurement method.

In humans, DRD is measured typically by giving individuals repeated choices between various immediate amounts and a larger amount delayed for various lengths of time. Normally the rewards are hypothetical, but equivalent results have been found whether DRD is measured using real or hypothetical rewards [16]. For example, an individual is asked to choose either $500 today or $1000 in a month. The point at which an individual switches from preferring a delayed reward to an immediate reward allows estimation of how much they value subjectively the delayed reward in today’s money.

In normative economics, it has been assumed that individuals have an exponential discounting function. This implies that individuals are time-consistent. Using an exponential curve, a parameter \( k \) can be calculated which represents the individual’s degree of DRD, where \( D \) is the delay in months, \( A \) is the amount of the reward and \( V \) is the subjective value of the reward as determined by an individual’s preferences

\[ V = Ae^{-kD} \]
A large $k$ indicates that the individual steeply discounts the future, whereas a low $k$ indicates that the individual is more willing to wait. However, in humans DRD is found typically to follow a hyperbolic curve, such that small delays have a proportionately larger impact than longer delays [17]:

$$V = A/(1 + kD)$$

This accounts for time-inconsistent preferences, where an individual switches their preference from a delayed reward to an immediate reward as the time before the reward is available decreases. The exact form of the DRD function has important economic implications, as the regrets inherent in hyperbolic discounting could be corrected through taxation [18].

Although DRD has been conceptualized as a single stable trait that underlies decisions about delay in all domains [19], it has been found that different methods or parameters used when measuring delay discounting leads to different DRD parameter estimates. It is possible that these variations could cause illusory or differing effects to be found between addictive behaviours and DRD. We set out to confirm the effect of these methodological differences and to see how they might interact with different groups of smokers.

The first is that there is evidence that the order in which rewards are presented can affect the derived DRD parameter. Randomizing the order of the immediate rewards leads to the highest rate of discounting, followed by putting the rewards in an ascending order, and then in a descending order [20–22]. People who smoke tend to be higher in impulsivity, and impulsivity itself may lead to spurious findings that smoking is associated with delay discounting. For example, assessing delay discounting requires people to repeatedly rate a higher distant reward that remains constant against a smaller reward that changes. One measure of impulsivity, the Barratt Impulsivity Scale [23,24], measures a dimension called attentional impulsiveness (difficulty maintaining attention), which has been found by some researchers to be related most closely to DRD [25,26]. Smokers might switch to the immediate reward earlier simply because they want to stop choosing the same delayed reward. To mitigate order effects, researchers have used a titrating procedure where the immediate amount decreases after the immediate amount is chosen and increases after the delayed amount is chosen, leading to an increasingly accurate assessment of the switch-point. Rodzon et al. [27] found no difference in the derived DRD parameter between a fixed procedure and a titrating procedure (although with a sample size of just 24), but a titrating procedure still requires an initial amount against which future amounts could be anchored by the participant. This could lead to unexpected effects due to trait impulsivity interacting differentially with the anchoring effect, rather than differences in DRD. In the current experiment, participants were allocated randomly to three groups where the immediate rewards were either presented in an ascending, descending or randomized order.

The second parameter difference is that, in DRD studies, multiple delays are used typically ranging from 6 hours to 25 years. Within a study, the DRD parameters for each delay are calculated and then averaged. This averaging is understandable if it is assumed that an individual has a single delay DRD parameter measured accurately by their discounting function and that variations around this are noise; however, it may be that some individuals discount some delays more than others. For example, smokers could plausibly be expected to discount the distant future comparatively more than they discount tomorrow, as smoking involves negative returns over a decadal time-frame. In the current experiment, participants’ DRD parameters were calculated separately for each delay and then compared to determine whether smokers discounted certain time-frames more than others.

The third parameter difference is the size of the delayed amount. Often $1000 is used; however, when other amounts are used studies find that smaller amounts are discounted more steeply than large amounts [28–30]. This is known commonly as the ‘magnitude effect’. It is possible that larger amounts may be discounted more by smokers than smaller amounts, as smoking involves repeatedly choosing a smaller reward over a long-term health decline. In the current study, $1000 and $100 were compared within subjects at a time delay of 1 month.

We aimed to test whether these differences in DRD methodology would systematically bias the observed relationship between smoking and DRD, and to determine whether the relationship is found only under certain conditions. Because these effects are subtle, a large sample size was necessary to achieve reliable results. We therefore used an application which runs on the Facebook social network. Nearly 9500 international users completed a multiple-item DRD task in return for feedback on their results, and agreed to share their data with the researchers.

**METHOD**

**Delay reward discounting measure**

Participants were asked to make repeated choices between two monetary amounts; various amounts now compared to larger amounts at some future point. The delays and amounts are a subset of those used in previous DRD research [1,17]. The 15 immediate monetary
rewards were $1000, $950, $900, $850, $750, $600, $500, $400, $250, $150, $100, $60, $20, $10 and $1, and the six delays were 1 week, 2 weeks, 1 month, 6 months, 1 year and 5 years. These were all compared to $1000 at the future time-point. Participants were also asked an extra set of questions which asked for their preferences of rewards at a delay of 1 month that were a tenth of the size of those above ($100, $95, etc.) and compared to $100 at the future time-point. This totalled seven sets of questions, which were presented in a randomized order for each participant.

Participants were allocated randomly to one of three groups. Within each set of questions, the amounts were either presented in an ascending order ($1, $10, [...], $1000), descending order ($1000, $950, [...], $1) or randomized order.

To calculate the participant’s hyperbolic DRD parameter \( (k) \) for each delay in both their feedback and for the research, an indifference point was established by calculating an average between the maximum immediate monetary amount chosen and the minimum delayed monetary amount chosen [1]. The parameter was then calculated according to the hyperbolic DRD formula mentioned above. As the distribution of \( k \) is often found to be non-normal [1,17], the data were approximately normalized using the natural-log transformation. The \( k \) parameter reflects the steepness of the discount curve, whereby greater \( k \)-values reflect a sharper decline in the subjective value of money as the delay to obtain that money increases.

**Procedure**

Users of the ‘My Personality’ application on the Facebook social network [31] were invited to participate in a new questionnaire called ‘Today or Tomorrow?’, and told that they would receive feedback on their results. Users who chose to start the ‘Today or Tomorrow’ questionnaire were given further information about the study (Appendix 1), including being told that their DRD function would be estimated but that the rewards were hypothetical. As ‘My Personality’ is used by an international audience, users were given the option to choose a currency that they either used or were most familiar with from nine of the most widely used world currencies (British pound, Canadian dollar, euro, Filipino peso, Indian rupee, Indonesian rupiah, Singapore dollar, South African rand, United States dollar). The delayed amounts were based on a published study that used US dollars, and so the amounts were converted to the other currencies using the exchange rate from Google’s exchange rate function on 22 June 2010 (see Table 1).

Users were also asked to answer the question ‘Do you smoke?’, with answers ‘daily or more’, ‘less than daily’ or ‘never’, and complete the Cigarette Dependence Scale (CDS-5) [32]. Users also completed the Alcohol Use Questionnaire (AUQ) [33] and the Assessment of Substance Misuse in Adolescence (ASMA) [34], although these results are not presented here. Users were told that completion of these questionnaires was optional and would not affect their feedback. Users then completed the DRD measure (Fig. 1), including short instructions telling them to assume no inflation [35]. Finally, for feedback users were told in which quartile their calculated DRD parameter was, and shown a graph with their personal DRD curve compared to the mean DRD curve (Fig. 2).

The ‘Today or Tomorrow’ questionnaire received ethical approval from the University of Nottingham School of Psychology Ethics Committee. Respondents gave consent for their results to be used in an anonymized format for research, were able to stop at any time without pressure by simply closing the browser window and were able to delete their information after completing the study through an automatic form mechanism within the ‘My Personality’ application.

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol used on ‘My Personality’</th>
<th>Conversion per USD$1 n</th>
<th>Mean age (SD)</th>
<th>% Male</th>
<th>% daily/non-daily/ non-smokers</th>
<th>Mean [log (k)] (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>British pound</td>
<td>£</td>
<td>0.68</td>
<td>915</td>
<td>25.0 (10.2)</td>
<td>38%</td>
<td>24/7/70, -0.93 (0.58)</td>
</tr>
<tr>
<td>Canadian dollar</td>
<td>$</td>
<td>1.02</td>
<td>436</td>
<td>22.4 (9.2)</td>
<td>33%</td>
<td>17/6/76, -1.09 (0.58)</td>
</tr>
<tr>
<td>Euro</td>
<td>€</td>
<td>0.81</td>
<td>644</td>
<td>24.7 (8.1)</td>
<td>42%</td>
<td>29/10/62, -0.98 (0.57)</td>
</tr>
<tr>
<td>Filipino peso</td>
<td>P</td>
<td>45.45</td>
<td>159</td>
<td>22.5 (6.1)</td>
<td>42%</td>
<td>11/14/75, -0.73 (0.60)</td>
</tr>
<tr>
<td>Indian rupee</td>
<td>Rs</td>
<td>45.65</td>
<td>156</td>
<td>23.1 (6.1)</td>
<td>56%</td>
<td>15/6/78, -0.75 (0.57)</td>
</tr>
<tr>
<td>Indonesian rupiah</td>
<td>Rp</td>
<td>9009</td>
<td>51</td>
<td>22.9 (6.1)</td>
<td>59%</td>
<td>16/6/78, -0.59 (0.67)</td>
</tr>
<tr>
<td>Singapore dollar</td>
<td>$</td>
<td>1.38</td>
<td>184</td>
<td>20.3 (6.4)</td>
<td>41%</td>
<td>10/4/86, -0.91 (0.58)</td>
</tr>
<tr>
<td>South African rand</td>
<td>R</td>
<td>7.51</td>
<td>63</td>
<td>26.7 (9.1)</td>
<td>36%</td>
<td>32/5/63, -1.03 (0.52)</td>
</tr>
<tr>
<td>United States dollar</td>
<td>$</td>
<td>1</td>
<td>6430</td>
<td>22.8 (9.2)</td>
<td>36%</td>
<td>17/7/75, -0.98 (0.56)</td>
</tr>
</tbody>
</table>

SD: standard deviation.

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Participants

From September 2010 to June 2011, 9454 unique users completed the full ‘Today or Tomorrow’ questionnaire, allowing their DRD parameter to be calculated. Respondents were tracked using their Facebook user ID, which allowed repeat respondents to be removed from the analysis. Of the 6549 who entered their gender, there were 2504 males (38%) and 4045 females (62%). Of the 6154 who entered their date of birth, the mean age was 23.1 years [standard deviation (SD) = 9.1]. Due to the random condition allocation process, there were 2964 participants in the ascending condition, 3195 in the descending condition and 3295 in the randomized condition. Table 1 shows the currencies chosen by participants and the demographic and smoking characteristics of users of each currency.

RESULTS

In order to examine whether the exponential or hyperbolic discounting function fitted individuals’ DRD best, curves were fitted for each participant using their six delays (between 1 week and 5 years). Sums of squared deviations were calculated for each participant’s six indifference points from the curves generated by the discounting functions [36]. It was found that the mean deviation from that predicted by the discounting function was smaller for the hyperbolic function (mean = 24 150, SD = 32 418, absolute difference = $155.40) than the exponential function (mean = 31 558, SD = 41 236, absolute difference = $177.65). For 86.8% of participants the hyperbolic function was a better fit to their DRD than the exponential function, which agrees with previous research [1,36,37]. There was no significant difference in the percentage of daily, non-daily and non-smokers who were best described by the hyperbolic function.

Because the hyperbolic discount function best describes most individuals’ DRD, for each participant estimated DRD log(k) parameters were averaged over the six delays which used $1000 as the delayed amount. To test whether self-reported smoking behaviour affected any effect of DRD order condition, participants were split into three groups: daily smokers, non-daily smokers and non-smokers. The validity of separating the daily and non-daily smoking groups was confirmed by the CDS-5 scores of the two groups; daily smokers scored 16.03 (SD = 4.60, n = 1520) and non-daily smokers scored 7.06 (SD = 2.67, n = 502). In all analyses, the group sizes are unequal and we therefore used a Type III sum of
squares analysis of variance (ANOVA) method in which each effect is controlled for every other effect, which ameliorates the problem.

Using the 9038 respondents who reported their smoking behaviour, a 3 × 3 between-groups ANOVA examined whether the order in which the items were presented is related to delay discounting. Condition (ascending, descending and randomized) and smoking status (daily smoker, $n = 1592$; non-daily smoker, $n = 669$; non-smoker, $n = 6777$) were the factors and log($k$) was the dependent variable (Fig. 3). A main effect of smoking status was found ($F(2, 9038) = 58.98$, mean square error $\text{MSE} = 0.32$, $P < 0.001$) and planned $t$-tests showed that daily smokers had a steeper DRD curve than non-daily smokers ($t(5887) = 3.02$, $P = 0.003$) who, in turn, had a steeper DRD curve than non-smokers ($t(7444) = 3.24$, $P = 0.001$). A main effect of condition was found ($F(2, 9038) = 11.20$, $\text{MSE} = 0.32$, $P < 0.001$) and planned $t$-tests found that all three conditions had different parameters from one another (ascending was steeper than descending $t(6157) = 2.48$, $P = 0.013$; randomized was steeper than ascending $t(6257) = 3.37$, $P = 0.001$; randomized was steeper than descending $t(6488) = 6.24$, $P < 0.001$). However, no interaction was found between smoking status and condition ($F(4, 9038) = 0.38$, $\text{MSE} = 0.32$, $P = 0.82$); the differences between smoking groups within each condition are the same, so the different smoking groups are affected equally by the DRD order condition.

To determine whether there were differences in the estimated DRD parameters at different delay lengths, and whether any differences were affected by smoking status,
a 3 x 3 x 6 mixed ANOVA was conducted with condition (ascending, descending and randomized) and smoking status (daily smoker, non-daily smoker, non-smoker) as the between-groups factors and delay length (1 week, 2 weeks, 1 month, 6 months, 1 year, 5 years) as the within groups factor. There was an effect of delay length ($F_{(5, 45145)} = 3195.15, \text{MSE} = 0.21, P < 0.001$), such that shorter delays led to a steeper discounting parameter. The three-way interaction was not significant ($F_{(20, 45145)} = 1.37, \text{MSE} = 0.21, P = 0.13$), but there was an interaction between delay length and smoking status ($F_{(10, 45145)} = 2.16, \text{MSE} = 0.21, P = 0.017$). Figure 4 illustrates that, for each of the smoking groups, the estimated DRD parameters become shallower as the delay length increased, but there was no clear pattern of changing differences between the smoking groups, indicating that similar results would be obtained no matter which delay period was used. Table 2 presents correlations between individuals’ estimated log($k$) parameters for various delays. It can be seen that as the time difference between two delays increases, the correlation between individuals’ estimated DRD curves decreases.
(the smallest correlation is between 1 week and 5 years). This indicates that the delay length effect found in the ANOVA above is not due simply to a missing parameter in the hyperbolic discounting function, which would affect the whole cohort of participants but not groups, and so we might still have expected to find differences between smoking groups. Nevertheless, this calls into question the estimation of a single DRD parameter across various delay lengths, as an individual’s DRD parameter at one delay may not be strongly predictive of their parameter at another delay.

In order to investigate the effects of differing delayed rewards, the DRD parameters for $1000 in 1 month were compared to the parameters for $100 in 1 month. A $3 \times 2$ mixed ANOVA with smoking status (daily smoker, non-daily smoker and non-smoker) as the between-groups factor and delayed amount ($100, $1000) as the within-subjects factor found a main effect of delayed amount ($F_{(1, 8940)} = 259.51, MSE = 0.17, P < 0.001$), but no interaction ($F_{(2, 8940)} = 1.73, MSE = 0.17, P = 0.18$). These effects are shown in Fig. 5 where the $100 delayed amount is discounted more steeply than the $1000 delayed amount and daily smokers discount more steeply than non-daily smokers. However, as the shape of the curves are identical, the same differences between smoking groups would have been found no matter what delayed amount was used in the DRD procedure. This analysis relies on the subjective difference between $100 and $1000 being the same for all currencies. Despite our attempt to equalize them using the exchange rate, it may still be that our monetary values are perceived as larger or smaller for some currencies depending upon local prices. In order to control for this effect, we repeated the analysis using only respondents who picked the US dollar as their currency. Again, we found a main effect of delayed amount ($F_{(1, 6362)} = 159.44, MSE = 0.17, P < 0.001$) but no interaction ($F_{(2, 6362)} = 0.23, MSE = 0.17, P = 0.79$), which corroborates our findings.

The daily, non-daily and non-smoker groups differed by demographic characteristics, particularly age; daily smokers were older than non-daily smokers, who were older than non-smokers. To control for any effects of age, the main analyses were repeated including age and gender as covariates (these are presented in the online supporting information Appendix S1, see details given at the end of the paper). The pattern of results replicated the current results, indicating that irrespective of which method of measuring discounting is used, the same effect of smoking group would be found.

**DISCUSSION**

We found three methodological differences that may challenge the assumption of a single DRD parameter across all situations. The order in which immediate rewards were presented led to differing derived

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**Table 2** Pearson correlations of individuals’ estimated log($k$) delay reward discounting parameters at various delays. All correlations are significant at $P < 0.001$.

<table>
<thead>
<tr>
<th>Delay</th>
<th>1 week</th>
<th>2 weeks</th>
<th>1 month</th>
<th>6 months</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks</td>
<td>0.736</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 month</td>
<td>0.647</td>
<td>0.736</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>0.531</td>
<td>0.619</td>
<td>0.701</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year</td>
<td>0.439</td>
<td>0.529</td>
<td>0.651</td>
<td>0.767</td>
<td></td>
</tr>
<tr>
<td>5 years</td>
<td>0.302</td>
<td>0.394</td>
<td>0.478</td>
<td>0.651</td>
<td>0.715</td>
</tr>
</tbody>
</table>

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**Figure 5** Mean delay reward discounting (DRD) parameter [log ($k$)] for the $1000 and $100 delayed amounts in 1 month. The matching curves indicate that the three smoking statuses are identically affected by the two delayed amounts. Error bars are standard errors.
discounting parameters, with the randomized order demonstrating the steepest discounting, followed by the ascending order, followed by the descending order. Also, smaller delay lengths led to a steeper discounting function, and small rewards were discounted more than large rewards. Finally, daily smokers demonstrated the steepest discounting, followed by non-daily smokers, followed by non-smokers. Nevertheless, despite the large sample size, there were no interactions between smoking status and any of the above effects. This indicates that the difference in DRD between different smoking groups is remarkably robust to the method of measurement: the order in which the items are presented is not important, nor which delayed time is used or which delayed amount is used. The results of this study do, however, underline the importance of not comparing discounting parameters directly between studies, as the method of eliciting them is important.

Consistent with previous research [1,36,37], it was found that a hyperbolic DRD curve fitted better than an exponential curve. This implies that individuals have inconsistent time preferences, and so may change their minds as the time before two rewards are available decreases. This has important implications for the external consequences used by economists when calculating the negative impacts of behaviours such as smoking [18], such that an individual may not take their future self’s preferences fully into account.

There are other variables that could affect DRD that were not studied here. It is known that individuals discount different types of rewards differentially [39], so it might be that daily smokers discount cigarettes more than non-daily smokers. Additionally, this study does not shed light on whether the difference in DRD is due to an acute nicotine effect or whether it is a trait that may explain why people smoke, although there is evidence that steep DRD leads to smoking rather than the reverse [9].

Running an online study was successful in obtaining a large sample and from countries that are under-represented in traditional research [40], but it presented a methodological problem specific to DRD in that the currencies used by participants differ. In order to standardize amounts the exchange rate was used, but it could be more appropriate to use a measure of purchasing power which takes account of unequal prices for the same goods between different countries. Additionally, the exchange rates on one date were used throughout the 10-month study. However, exchange rates fluctuated during this time; for example, the US dollar to British pound exchange rate peaked at 0.6513 and floored at 0.5984. Nevertheless, whichever exchange rate was used, the calculated discounting rate would remain unaffected, and so discounting rates in our experiment are comparable between currencies. However, as we found that larger amounts are discounted less steeply, the purchasing power of a currency could affect how long people are willing to wait to receive it.

We found differences in DRD rate between users who picked different currencies. Indonesian rupiah users had the steepest DRD functions, whereas Canadian dollar users were most self-controlled. Nevertheless, we view these differences extremely cautiously, because as well as the differences in purchasing power between currencies we also cannot be sure that the selection biases for ‘My Personality’ users are the same for each country. For example, users of ‘My Personality’ in the United States are more likely to be sociologically representative than users in countries such as India, where internet use is less common and where only a certain sociographic would use our English-language Facebook application.

In conclusion, irrespective of how we measured DRD—varying the order of the items, the length of the delay and the magnitude of the delay—daily smokers had a shorter temporal horizon than non-daily smokers who, in turn, had a shorter horizon than non-smokers. This is strong evidence that smoking is related reliably to DRD as a generalized behavioural preference function, rather than only a particular method of measuring discounting. It also indicates to researchers that the method they use to measure discounting should depend upon their convenience. However, researchers should compare discounting functions only within studies, or effect sizes between studies, as small changes in DRD methodology can affect the derived DRD parameter significantly.

Declarations of interest

David Stillwell was supported by an ESRC studentship (ES/F021801/1). He also receives revenue as an owner of the ‘My Personality’ website.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1 Reanalysis of main findings including age and gender as covariates.

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APPENDIX 1
'Today or Tomorrow' information

1. Important information about the questionnaire

'Today or Tomorrow?' measures what economists call your delay discounting function. This describes how much you prefer the present over the future, or how willing you are to wait for a reward. You will be asked to answer seven blocks of 15 questions asking whether you would prefer money now or in the future. Once you have done so, we will calculate your delay discounting function which estimates how much any reward drops in value as the delay to receive it increases. We will also compare this to others’ delay discounting functions and will tell you whether you value the present or the future more than most others do.

The survey will take about 12 minutes to complete. Allow yourself enough time so that you do not have to rush.

If you are interrupted you can return to the questionnaire and the questions that you have already submitted will be saved. To receive the most accurate results, you should complete the questionnaire in a quiet environment. You should specifically avoid taking the questionnaire while others are watching your responses. All answers you provide will be treated as confidential. We will only do research with your answers after the data has been anonymized so that it cannot be linked back to you.

Sadly, we cannot actually give you the rewards that you prefer, but we would still ask you to answer as honestly as you can as if the rewards were for real. This will also give you the most accurate results.

The questionnaire has been made available as part of research by David Stillwell and Dr Richard Tunney from the School of Psychology at the University of Nottingham. We are also grateful to Dr Lee Hogarth for his invaluable assistance.

I have read and understood all of the above, and I will follow its recommendations. I know that I can withdraw at any time by closing my browser window and not answering further questions.