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Abstract

Present bias is the economist's favorite explanation for self-control problems. However, the relationship between present bias and self-control is not yet fully understood. We present the T-SC model of intertemporal choice which integrates main psychological insights on self-control into economics and suggests that present bias is positively related to temptations T and negatively related to self-control SC. To test the model we elicit time preferences using an incentivized delay discounting task, trait temptation and trait self-control using scale measures, and everyday temptations, self-control attempts, and self-control failures using a day reconstruction methodology. In a sample of 142 participants we find that experimentally elicited present bias is not associated with self-control problems, neither when measured on the trait level nor in everyday life. The results are in line with a clear distinction between discounting and visceral influences as determinants of decision making. The results can also explain why recent studies find only weak empirical associations between present bias elicited in monetary delay discounting tasks and life outcomes in non-monetary domains.

JEL classification: D03; D91

Keywords: self-control; inter-temporal choice; present bias; elicitation of time preferences; day reconstruction method

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1. Introduction

The literature on present bias has blossomed in the past 20 years (O'Donoghue and Rabin, 2015). Present bias is the economist's favorite explanation for self-control problems in situations where individuals do not stick to plans they have made earlier (O'Donoghue and Rabin, 1999). Present bias has added to the economist's understanding of various behaviors related to self-control, such as job search, health behaviors, and consumption-saving decisions (O'Donoghue and Rabin, 2015), and has influenced policy making all over the world. Experimentally elicited present bias has been shown to predict various life outcomes that are related to self-control problems, including credit card borrowing, credit worthiness, and health (see Sprenger, 2015). Given the increasing relevance of present bias as a measure of self-control problems, there is a need to better understand the extent to which individual differences in present bias capture individual differences in self-control.

Self-control has received a lot of attention in psychology where self-control is defined as the ability to regulate one's behaviors, emotions, and thoughts (Ainslie, 1975; Baumeister and Tierney, 2011; Mischel et al., 1989; Moffitt et al., 2011). Self-control, often measured in surveys using scales such as the trait self-control scale (Tangney et al., 2004), predicts a range of desirable life outcomes, including healthier relationships, better school performance, and mental health. Recent developments highlight the importance of considering temptations when analysing self-control problems. Without temptations, self-control is not needed in the first place (Hofmann et al., 2009). Since temptations are difficult to measure in experimental settings and surveys, this literature elicits temptations and self-control in individuals' everyday lives using novel measurement techniques (Hofmann et al., 2012a).

In this paper, we aim to integrate recent theoretical and methodological advances in psychological self-control research into the economic analysis of self-control, and investigate whether experimentally elicited present bias predicts self-control failures in everyday life. We propose the T-SC model of intertemporal choice, which formalizes self-control problems and is a modification of the quasi-hyperbolic discounting model as introduced by Laibson (1997). The T-SC model proposes that present bias is positively associated with temptation T and negatively associated with self-control SC. We thereby integrate the main psychological insights on self-control into an economic inter-temporal choice framework, combining psychological intuition with economic mathematical rigor and discipline.

We test predictions generated by the T-SC model using a combination of up-

to-date economic and psychological measurement tools. To elicit present bias we use an incentivized multiple price list as discussed by Meier and Sprenger (2015), additionally controlling for utility curvature (Andersen et al., 2008). We measure trait temptation and trait self-control using psychological scales (Tangney et al., 2004; Tsukayama and Duckworth, 2010), which is standard procedure in psychology. Finally, we utilize a modified Day Reconstruction Method (Kahneman et al., 2004) to examine subjects' everyday desires, temptations, self-control attempts, self-control successes, and self-control failures adapting the procedure used by Hofmann et al. (2012a). 144 participants took part in the laboratory study between October 2014 and April 2015.

We document 3 primary findings. Firstly, we find variation in present bias. 45% of the participants are present biased, 21% are future biased, and the rest displayed consistent time preferences. The mean value for present bias is 0.94 (0.13) which is significantly smaller than 1. Secondly, of the 2059 desires that the participants recorded, about 70% (1423) were temptations, i.e. they conflicted with a higher order goal. Participants attempted to resist about 56% (798) of the temptations, were successful in 64% (512) of the cases, and failed in 36% (286). Finally, our main result is that present bias is not associated with any aspect of self-control problems, neither when measured using scales on the trait level nor when measured in everyday life. This suggests that the present bias that is experimentally elicited in financial delay discounting tasks is not a good measure for self-control problems.

The lack of association between experimentally elicited present bias and self-control is consistent with arguments suggesting that financial delay discounting questions do not provide meaningful information for studying time preferences (Ericson et al., 2015; O'Donoghue and Rabin, 2015). Our finding might explain why present bias does not correlate with some field behaviors and why the correlations between present bias and other field behaviors, such as credit card borrowing (Meier and Sprenger, 2010), credit default (Meier and Sprenger, 2012), obesity (Courtemanche et al., 2015), and consumer behavior (Bradford et al., 2014), tend to be small. Our main result is also consistent with the view that self-control failures are the result of unanticipated fluctuations of visceral influences (Loewenstein, 1996), such as hunger, thirst or other types of deprivation, which are not elicited in financial delay discounting tasks. The difference between delay discounting and visceral states is made explicit in the T-SC model which is thus a further step towards an integrated behavioral science of self-control that combines economic and psychological perspectives.

The paper also makes a methodological contribution by using the Day Re-

construction Method (DRM) for the first time as a tool for measuring everyday economic decision-making. The DRM is typically used to measure time allocation and subjective well-being in individuals' lives (Daly et al., 2014, 2009; Kahneman and Krueger, 2006; Kahneman et al., 2004; Knabe et al., 2010; Krueger and Schkade, 2008). This is the first paper that uses the DRM to investigate bounded willpower by eliciting everyday temptations, self-control, and self-control failures. An advantage of this measure is that everyday data on decision-making can be obtained efficiently in survey sessions which allows up-scaling of the procedure to representative samples in future research.

The reminder of the paper is structured as follows: Section 2 suggests a formal microfoundation of the present bias parameter based on the intrapersonal conflict between temptation and self-control. This section also introduces a simple two-goods model of self-control problems. Section 3 presents our study design and the measures of time preference parameters, psychological scales, and day reconstruction data. Section 4 presents our results. Section 5 discusses our study and relates our findings to the literature. Section 6 concludes.

2. Theoretical Foundations and Predictions

2.1. Present bias and self-control failures

The quasi-hyperbolic discounting model (Laibson, 1997), also called the $\beta\delta$ model, is arguably the most popular model used by economists to account for dynamically inconsistent preferences and self-control problems. The utility that a quasi-hyperbolically discounting individual attaches to a temporal prospect $(x_t, ..., x_T)$ can be formalized as

$$U(x_t, ..., x_T) = u(x_t) + \beta \sum_{\tau=1}^{T} \delta^{\tau} u(x_{t+\tau}), \tag{1}$$

where β and δ reflect two discount factors. The discount factor δ is a measure of impatience (O'Donoghue and Rabin, 1999). Whenever an outcome is delayed by one time period, its value is multiplied by δ (usually < 1) so that its present value is discounted. The discount factor β reflects a measure of present bias. All outcomes that are not obtained immediately are multiplied by β (usually < 1) so that immediate outcomes are given more weight compared to future outcomes. β reflects a "short-term desire or propensity that the person disapproves of at every other moment in her life" (O'Donoghue and Rabin, 2003, p. 187).

The $\beta\delta$ model can describe situations where individuals do not stick to plans

they have made earlier so that self-control failures occur. When planning for the future to obtain either a smaller sooner reward or a larger reward one time period later, the difference in terms of discounting between both options is represented by δ. However, when the sooner option becomes available immediately, present bias β kicks in and the difference between both options in terms of the discount factors becomes $\beta\delta$. Present bias, in particular when individuals are naive and do not anticipate it (O'Donoghue and Rabin, 2003), can lead to dynamically inconsistent behavior and self-control problems. The $\beta\delta$ model has been used to make sense of various behaviors that are affected by self-control, including procrastination (Ariely and Wertenbroch, 2002), gym attendance (DellaVigna and Malmendier, 2006), retirement (Diamond and Koeszegi, 2003), and job search (DellaVigna and Paserman, 2005). Our first hypothesis directly builds on this model.

Hypothesis 1 *Experimentally elicited present bias is associated with everyday self-control failures.*

2.2. Present bias, temptation, and self-control

While the existence of present bias is a good description of situations where individuals have dynamically inconsistent preferences and, potentially, self-control failures, the assumption of $\beta < 1$ does not explain why individuals are present biased, nor does it provide any information about the nature of self-control problems. In order to better understand why dynamic inconsistencies occur in some situations but not in others, and in some individuals but not in others, we need to know more about the processes underlying present bias.

A large literature in psychology suggests that self-control problems are caused by intrapersonal conflicts between temptation and self-control. When the former is stronger, self-control failures occur (Hoch and Loewenstein, 1991; Hofmann et al., 2009; Lades, 2012; Metcalfe and Mischel, 1999; Strack and Deutsch, 2004). Based on this literature, we propose the following microfoundation of the present-bias parameter β:

$$\beta = \frac{1}{1 + T(1 - SC)}, \tag{2}$$

where temptations T can take on any positive value and SC is typically bound between 0 and 1. This formalization suggests that present bias is positively associated with temptations (the higher T the lower β) and negatively with self-control (the higher SC the closer β is to 1). The formalization also suggests that the strength of the association between SC and β increases with T. Intuitively, the individual

capacity for self-control does not matter when the individual is not tempted in the first place; only when individuals are tempted they need self-control. This leads us to our next hypothesis:

Hypothesis 2 *The present bias parameter is negatively correlated with temptation and positively correlated with self-control. There is a positive interaction effect of temptation and self-control predicting the present bias parameter.*

2.3. The T-SC model of intertemporal choice

To integrate equation (2) into the $\beta\delta$ model it is helpful to start with the version of the model suggested by McClure et al. (2007). This version is a multiplicatively scaled transformation of the $\beta\delta$ model in which the decision utility (which is the experienced utility divided by β) that can be obtained from a temporal prospect $(x_t, \cdots, x_T)$ is given by

$$DU(x_t, \cdots, x_T) = \left(\frac{1}{\beta} - 1\right) u(x_t) + \sum_{i=0}^{T} \delta^i u(x_{t+i}). \tag{3}$$

The decision utility is separated into two distinct parts. The first part, i.e. $\left(\frac{1}{\beta} - 1\right) u(x_t)$, represents the impulsive decision-making system. If $\beta < 1$, this system increases the decision utility, i.e. the motivational value, of the immediately available good x_t, which can lead to dynamically inconsistent behavior. This is in line with recent neuroscientific insights suggesting that high temporal discounters overvalue immediate rewards rather than undervalue future rewards (Cherniawsky and Holroyd, 2013). If $\beta = 1$, the model simplifies to the standard exponential discounting model represented by the second part, $\sum_{i=0}^{T} \delta^i u(x_{t+i})$. This second part reflects the deliberative and controlled decision-making system which is dynamically consistent.

By substituting the microfoundation that we proposed in equation (2) for β in equation (3), we obtain the T-SC model of intertemporal choice:

$$DU(x_t, \cdots, x_T) = u(x_t) T_t (1 - SC_t) + \sum_{i=0}^{T} \delta^i u(x_{t+i}). \tag{4}$$

In this model, the term $u(x_t)T_t$ reflects the temptation, or the "motivation oomph" (Berridge, 2012; Lades, 2012; Zhang et al., 2009), that is added on top of the motivation based on cognitive representations of x_t. SC_t reflects our ability to resist (neutralize) this extra motivation. The impulsive decision-making system is hence formalized as an intraindividual conflict between temptation and self-control. Note

that by substituting T and SC for β, we change the underlying explanation of dynamically inconsistent preferences. While $\beta < 1$ in the $\beta\delta$ model explains dynamically inconsistent preferences solely through the passage of time, we highlight the fact that self-control failures are more often the result of unanticipated temptations than the result of the passage of time. Also note that we can substitute a hyperbolic discounting function for the discount factor δ in order to account for more cognitive forms of dynamic inconsistencies that are not the result of uncontrolled temptations but more closely related to the passage of time.

To obtain testable predictions, we apply the model suggested in equation (4) to the simple case of two goods. We assume that individuals can gain (experienced) utility from two mutually exclusive sources: the satisfaction of a short-term desire $u(x_1)$, for example a delicious but unhealthy dessert, and the adherence to a general lifetime goal $u(x_2)$, for example a healthy lifestyle. Individuals make plans in the present ($t = 0$) for behavior in the near future ($t = 1$) with impact in the far future ($t = 2$).

Table 1: Self-control problems in theory

	$t=0$			$t=1$	
SCC:	$u(x_1)$	$<$	$\delta u(x_2)$	$<$	$u(x_1)(1+T_t)$
SCS:	$u(x_1)$	$<$	$\delta u(x_2)$	$>$	$u(x_1)(1+T_t(1-SC_t))$
SCF:	$u(x_1)$	$<$	$\delta u(x_2)$	$<$	$u(x_1)(1+T_t(1-SC_t))$

Note: Our formal definitions of self-control conflicts (SCC), self-control successes (SCS), and self-control failures (SCF).

We define a self-control conflict as a situation in which individuals plan to stick to their general lifetime goal so that at $t = 0$, $\delta u(x_1) < \delta^2 u(x_2)$, but, when they have to act, are tempted to satisfy the short-term desire so that at $t = 1$, $u(x_1)(1 + T_1) > \delta u(x_2)$. Hence, the stronger the temptation in $t = 1$, the more likely it is that a self-control conflict occurs. Fortunately, individuals can use self-control in $t = 1$ in order to neutralize the temptations ($T_1(1 - SC_1)$). If there is no temptation in the first place, individuals have no reason to use self-control.

A self-control success is a situation where a self-control conflict is present, but individuals use self-control to reduce the impact of the temptation so that in $t = 1$, $u(x_1)(1 + T_1(1 - SC_1)) < \delta u(x_2)$. A self-control failure is a situation where individuals try to resist the temptation, but fail: $u(x_1)(1+T_1(1-SC_1)) > \delta u(x_2)$. In the model's simplest form individuals are naive in that they do not expect that their preferences in the near future will be influenced by temptations. The definitions of self-control conflicts and self-control failures suggest that enacting conflicting

temptations is more likely when the temptations are strong and when individuals do not use (enough) self-control. Table 1 summarizes the formal definitions and the predictions of this simple model are summarized in hypothesis 3 below.

Hypothesis 3 *(i) The stronger the temptation, the more likely it is that a self-control conflict occurs. (ii) Self-control is more often used when self-control conflicts are perceived than when these are not perceived. (iii) The stronger a temptation is the higher the likelihood that the tempting desire is enacted. (iv) The use of self-control reduces the likelihood of enacting the tempting desire.*

3. Design

To test our predictions we invited subjects to come to computer labs to participate in our study. The participants were informed about the estimated duration of the study, received written and verbal instructions, obtained information about the use of the data, and provided informed consent. They were also informed about how they would obtain their compensation for participating in the study. The study was approved by the School of Management Ethics Committee in the University of Stirling. The sessions took place between October 2014 and April 2015. Our sample consists of 144 subjects (64% female) recruited from the University of Stirling student and staff population. The participants are aged between 18 and 53 (M 22.80, SD 5.52). 49% have a college degree, and 53% are from the UK. The participants received a payment of £14.33 in the average.

The study contained three types of questions: Incentivized time and risk preference questions that determined the participants' compensation to elicit present bias β and impatience δ, general survey questions to elicit temptation T and self-control SC on the trait level, and day-specific questions about "yesterday" to elicit temptations T_t, self-control SC_t, self-control conflicts SCC_t, self-control successes SCS_t, and self-control failures SCF_t as they occur in everyday live. The time and risk preference questions and a personal diary that helped participants recalling yesterday were presented as part of a paper questionnaire and the general survey questions were answered on the computer. We provide more information about the tree types of measurements below.

3.1. Time preferences

To elicit participants' time preferences β and δ we used a variant of the Double Multiple Price List (DMPL) as suggested by Andersen et al. (2008) and described in Meier and Sprenger (2015). We presented participants with 21 choices divided into 3 choice sets. In each choice set, we asked participants to make 7 choices between a smaller sooner payment (decreasing from £15 to £9 in steps of £1) in period t and a larger later payment (fixed at £16) in period $t+\tau$. In the first choice set, participants chose between a smaller payment that day and a larger payment 1 month later ($t = 0, \tau = 1$); in the second choice set, they chose between a smaller payment that day and a larger payment 6 months later ($t = 0, \tau = 6$); and in the third choice set, they chose between a smaller payment in 6 months and a larger payment in 7 months ($t = 6, \tau = 1$).

Figure 1: Aggregated time preferences (n=143)

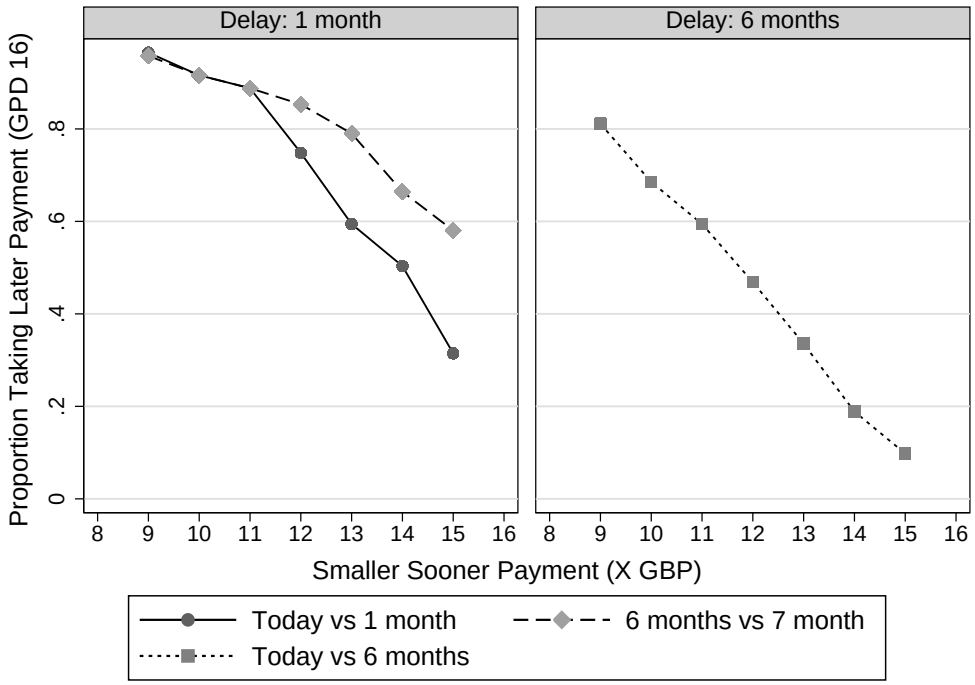


Figure 1 plots choice profiles for the aggregate sample of 143 individuals, dropping one observation with multiple switching points in the time preference measure. The proportion of participants choosing the larger later payment of £16 is graphed against the smaller sooner payment from £9 to £15. Both panels in Figure 1 show that the proportion of individuals choosing £16 is decreasing in the value of the smaller sooner payment. More than 95% of the participants chose £16 a month later over £9 a month earlier. The aggregate choices show also present bias indi-

cated by the difference between the two lines in the left panel. For example, around 80% of the sample prefers £16 over £13 when making the choices for the future, but only about 60% prefer £16 over £13 when making the choice without a front delay so that the earlier payment is due today. In this descriptive statistic, we find a relatively high degree of present bias which might be influenced by the MPL elicitation method we used. Some recent studies using convex time budgets and other ways of presenting multiple prize lists do not to find present bias (Andreoni and Sprenger, 2012; Andreoni et al., 2015; Augenblick et al., 2015).

To obtain individual time preference parameters we assume that individuals are indifferent between the lowest chosen sooner amount and the larger later amount. For example, if an individual prefers £13 today over £16 in 1 month, but prefers £16 in 1 month over £12 today, we assume that the individual is indifferent between £13 earlier and £16 later. This procedure is conservative as we obtain the highest possible values for the discount factors β and δ. If individuals prefer the later option in all 7 choices of a choice set, we set £16 as the indifference point.

As we have three choice sets, we observe three points of indifference for each individual. We define individuals as present biased if their point of indifference between "today" and "in 1 month" is lower than their point of indifference between "in 6 months" and "in 7 months". Present biased individuals are more patient in the future than in the present. Future biased individuals, to the contrary, are more patient in the present than in the future. Using this measure, 45% of the individuals are present biased, 21% are future biased, and the rest has dynamically consistent time preferences.

We calculate individual discount factors assuming quasi-hyperbolic discounting. Formally, we assume that at the point of indifference for each of the three choice sets for each individual i

$$U(X_{it\tau}) = \beta_i^{1|t=0}\delta_i^{\tau}U(Y) \tag{5}$$

holds, where $X_{it\tau}$ is the highest chosen smaller sooner payoff, $1|_{t=0}$ an indicator for present bias that is 1 if $t = 0$ and 0 otherwise, δ the exponential discount factor, τ the delay in months, and Y the larger later payoff (fixed at £16 in our study).

Assuming linear utility while in fact the utility function is concave creates a downward bias of the discount factors β and δ (Andersen et al., 2008). We assume that individuals' utility function can be described by constant relative risk aversion (CRRA) so that for the three choice sets that elicit time preferences the following indifference holds:

$$\frac{X_{it\tau}^{(1-r)}}{1-r} = \beta_i^{1|t=0}\delta_i^{\tau}\frac{Y^{(1-r)}}{1-r}. \tag{6}$$

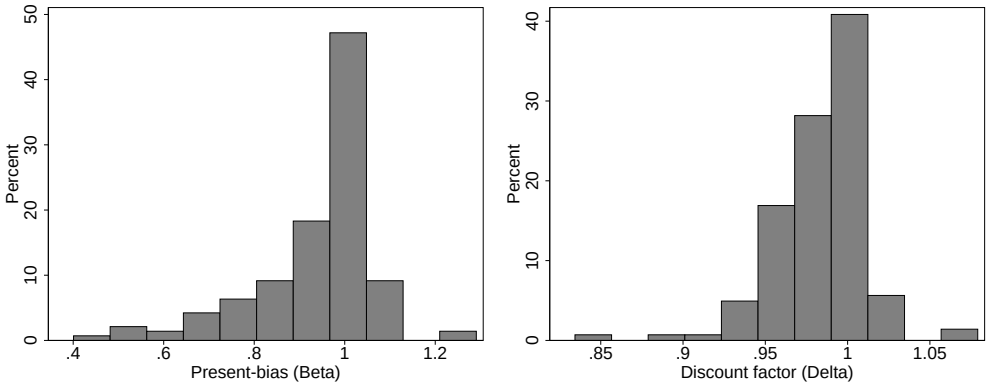
Rearranging and taking the logarithms leads to the system of equations

$$(1-r)log(\frac{X_{it\tau}}{Y}) = 1|_{t=0}log(\beta_i) + \tau log(\delta_i), \tag{7}$$

which is satisfied for each individual at each of the three choice sets. Least squares linear algebra provides the coefficient vector $[log(\beta_i), log(\delta_i)]$, which can be exponentiated to recover β_i and δ_i (for more details see Meier and Sprenger, 2015), assuming we have values for the CRRA parameter r. Disadvantages of this calculation are that we can not account for the possibility of decision errors and that we ignore the interval nature of the data.

In order to obtain individual values for r we elicited risk preferences using a Holt and Laury (2002) multiple prize list (MPL) with the safer choice between £4 and £5 and the riskier choice between £1 and £9 (see table 10 in the appendix). This risk elicitation procedure was also incentivized. One participant did not answer the risk elicitation questions and this observation was dropped from the dataset. Using this MPL, and assuming constant relative risk aversion, we obtain ranges of r. Table 11 in the appendix provides the distribution of answers that we obtained and the calculated ranges of values for r. We use the values shown in column 3 of table 11 from the appendix and insert these values into equation (7) to calculate the time preferences. Through these calculations we obtain a mean value of 0.94 (0.13) for β_i which is significantly lower than 1 as indicated by a single-sample t-test ($p<0.01$). The mean value of δ_i is 0.98 (0.03). Figure 2 shows the distributions of both discount factors.

Figure 2: Distribution of time preferences



The elicitation of time preferences is prone to several confounding factors (for reviews see Frederick et al., 2002; Meier and Sprenger, 2015). A particularly heated debate in economics deals with different ways to avoid discount factors being biased

as a result of not accounting for utility curvature (e.g. Andersen et al., 2008; Andreoni and Sprenger, 2012). In order to avoid biased discount factors, we accounted for the utility curvature measured in the risk elicitation procedure. Our results, however, do not depend on whether we control for utility curvature or not (see robustness checks in the appendix). Note also that we calculate, rather than estimate, the discount factors as we are interested in individual differences of present bias and have only 3 observations for each individual.

We also took several measures to avoid other confounds mentioned in the literature (Frederick et al., 2002; Sprenger, 2015). To make choices incentive-compatible we paid each participant according to one of the 31 choices (21 for time preferences and 10 for risk preferences) they made. For each individual, we randomly drew a number using an online random number generator which determined the choice according to which the participants were paid. We informed the participants about this procedure in detail before they answered the incentivized questions. To equate transaction costs for the sooner and the later payments, all payments were sent via email as gift certificates. An alternative would be to offer money incentives. However, UK students do not commonly use checks and postal addresses are likely to change more often than email addresses, and it is not possible to pay in cash without different transaction costs or the personal knowledge of their bank accounts.

To minimize problems related to a lack of trust and credibility, one author introduced himself at the beginning of each study session mentioning that he was personally responsible for sending the gift certificates on time. During the study, we also populated two "Payment agreement forms" that contained the full contact details of one author. One payment agreement form was for the participant and one for us to keep. On both forms, we wrote down the amount and date of the payment and one author signed both forms. On the form that we kept, we also asked participants to write down their email addresses. This procedure allowed us to decouple the questionnaire data from the participants' email addresses, guaranteeing anonymity while still maximizing the credibility of correct payment. Directly after the time and risk preference questions, we asked the participants to state reasons for their choices. These responses suggest that a majority of the participants considered their financial situation, did not consider the current interest rate, did not consider the current inflation rate, and understood the questions.

3.2. Trait measures

We measured temptation T and self-control SC on the trait level. To measure T we used the domain-specific trait temptation scale (Tsukayama and Duckworth, 2010). Participants were asked in 51 items to "rate how tempted you would be to do the following" on a scale from 1 (not tempted at all) to 5 (very tempting). The range of possible scores on the scale is 51-255 with higher scores indicating stronger temptations. The order of the items was randomized. The average score of the trait temptation measure across all temptations was 131.48 (Cronbach's $\alpha = 0.9376$). Since temptations are domain-specific (Tsukayama and Duckworth, 2010), we also analyzed temptations in the domain of finance. Items in the finance domain were "Buying things on impulse", and "Spending rather than saving my money". The average score in the finance domain was 17.12 (Cronbach's $\alpha = 0.9207$).

We elicited individuals' SC using the Brief Self-Control Scale (Tangney et al., 2004) which is a method used very often in psychological research. The scale is a 13-item questionnaire and asks participants to rate how well each item describes them on a scale from 1 (not like me at all) to 5 (very much like me). Items include "I have a hard time breaking bad habits", "I am good at resisting temptation", and "I blurt out whatever is on my mind". The range of possible scores on the scale is 13-65 with higher scores indicating better self-control. The average score on the trait self-control scale was 38.55 (SD = 9.17) with scores ranging from 17 to 59 (Cronbach's $\alpha = 0.8196$). The trait self-control scale is usually assumed to measure individuals' ability to resist existing temptations. However, recent research suggests that the scale also measures individuals' ability to avoid temptations by organizing their lives in ways that reduce the occurrence of intrapersonal conflicts that might lead to self-control failures (Ent et al., 2015).

3.3. Day-specific measures

We used a modified version of the Day Reconstruction Method (DRM) introduced by Kahneman et al. (2004) in order to obtain information about participants' self-control problems on the day before the study took place. While previous DRM research has tended to focus on eliciting individuals' emotions over their day, we also measured their motivations. That is, we focus on what individuals *wanted* yesterday (their decision utility) rather than on what individuals *liked* yesterday (their experienced utility).

As is typical in DRM studies, participants first completed a private time-usage

diary (on paper) in which they recalled and reported the previous day as a discrete set of episodes. Following Kahneman et al. (2004), we asked participants to think of their day as a film divided into multiple episodes. It was explicitly mentioned that participants could take their paper diary home after the completion of the questionnaire and that the diary was merely an aid to recalling what happened and how they felt yesterday. Participants reported 1749 episodes (M 12.31, SD 3.48) altogether.

After the participants had finished the diary, they went through each episode on the computer screen and answered questions about each one. Most importantly, we asked them several questions about the desires they felt during each episode using the questions proposed by Hofmann et al. (2012a) and Hofmann et al. (2012b). Hofmann and colleagues suggest that there are at least four key components of everyday desires and self-control failures, and these components fit well with the model we presented in section 2.3. These components are (i) desire strength, (ii) conflict strength (how strong the conflict between the desire and a higher order goal is), (iii) resistance (use of self-control), and (iv) enactment of desires. An example of the wording we used can be found in the appendix.

In our sample, the mean desire strength is 4.98 (Std. Dev. = 1.01) on a scale from 1 (barely existing) to 7 (irresistible) and the mean conflict strength is 3.29 (Std. Dev. = 2.07) on a scale from 1 (not at all) to 7 (very much). If the conflict strength is higher than 1, we assume that a self-control conflict is present so that the desire is a temptation. Individuals tried to resist 942 (or 46 %) of all desires and enacted 1196 (or 58 %) of the desires. In table 13 in the appendix, we provide further information about desires organized by the desire type. Self-control failures, for example, are most common in the domains of social media and postponing activities.

In line with the formal model we presented in section 2, we define a self-control success as a situation where a self-control conflict is present, the individual tries to resist the temptation, and succeeds so that there is no enactment of the desire. Self-control failures are situations in which individuals enact the desire although it involves a conflict with a higher order goal and they tried to resist enacting the desire. As shown in figure 3, we coded 1423 self-control conflicts, 512 self-control successes, and 286 self-control failures overall. Hence of the 2072 desires, about 13.80% lead to self-control failures. Table 2 provides an overview of the number of instances related to self-control.

Figure 3: From Desire to Enactment (n=142)

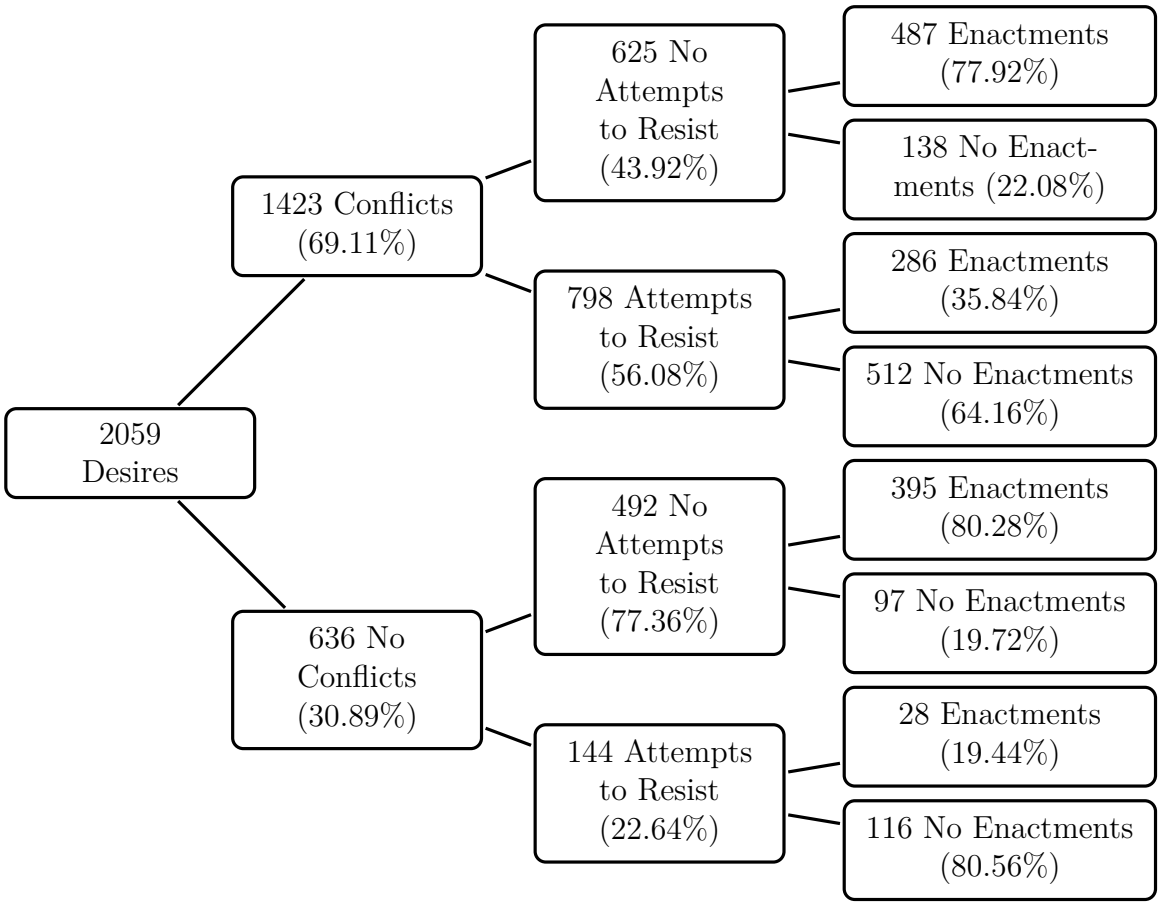


Table 2: Summary Statistics (day-specific)

Variable	Mean	Std. Dev.	Min.	Max.	N	SUM
# of Episodes	12.317	3.491	4	20	142	1749
# of Desires	14.5	7.719	3	48	142	2059
# of SCC	10.021	7.554	0	44	142	1423
# of Use of SC	6.634	5.559	0	37	142	942
# of Enactment	8.423	5.651	0	39	142	1196
# of SCS	3.606	3.311	0	16	142	512
# of SCF	2.014	3.661	0	37	142	286

z

Note: A self-control success (SCS) is a situation where an individual feels a self-control conflict (SCC) and tries to resist enacting the desire (Use of SC), and indeed does not enact the desire (Enactment). A self-control failure (SCF) is a situation where an individual feels a self-control conflict and tries to resist enacting the desire, but nevertheless enacts the desire.

4. Results

We present the results in four subsections. Firstly, we investigate whether experimentally elicited present bias predicts the number of instances related to self-control that the participants had during their day in question. Secondly, we distinguish between temptation and self-control and analyze whether present bias is associated with the trait measures of both components of self-control problems. Thirdly, we analyze the data on the desire level and investigate whether present bias predicts the strength of desires, the strength of self-control conflicts, whether participants try to resist conflicting desires, and whether these conflicting desires are enacted despite the self-control attempts. Finally, we also test the predictions made by our simple two goods model.

If not otherwise indicated we use 142 of the 144 observations because we dropped the observations for participants who did not provide unambiguous measures for their time and risk preferences. We present the results that use the β values calculated using the Double Multiple Prize List as suggested by Andersen et al. (2008) and descried by Meier and Sprenger (2015), additionally accounting for utility curvature. In the appendix we present the same regressions using other ways of calculating present bias (assuming linear utility and simply distinguishing between present bias, future bias, and consistent time preferences). Our results are robust to different ways of calculating present bias.

4.1. Does present bias predict the number of self-control failures on a day?

We first test hypothesis 1 by investigating whether present bias is associated with the number of self-control failures that individuals experienced on their day. Since many individuals have zero self-control failures, the dependent variable is overdispersed. We use negative binomial logit regressions to account for the structure of the dependent variable and control for age, gender, marital status, college degree, and income. Table 3 shows the results of five regression models with different dependent variables. Hypothesis 1 is tested in model (5). The present bias parameter does not predict the number of everyday self-control failures. It might be the case that present bias predicts an earlier aspect of the course of desires, e.g. how many desires are perceived or how often self-control is used. However, models (1) - (3) show that present bias does not predict the number of desires, the number of self-control conflicts, or the number of resistance attempts. Model (4) shows that present bias does not predict the number of self-control successes. Our main result is that present bias does not predict how many self-control failures individuals have during their everyday lives.

Table 3: Negative binomial logit regressions predicting the sum of desires, self-control conflicts, resistance attempts, self-control successes, and self-control failures by present bias and impatience.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Sum Desires	Sum SCC	Sum Resis	Sum SCS	Sum SCF
β	-0.00933	0.265	0.190	0.361	-0.0977
	(0.315)	(0.423)	(0.390)	(0.512)	(0.756)
δ	-1.013	-0.720	-0.502	-1.253	3.106
	(1.859)	(2.358)	(2.371)	(3.101)	(3.411)
Constant	3.661**	2.565	2.770	2.184	-1.003
	(1.780)	(2.296)	(2.227)	(2.994)	(3.285)
Observations	142	142	142	142	142
Demographics	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

4.2. Is present bias related to psychological trait measures?

We test hypothesis 2 on the trait level by investigating the relationship between present bias and trait self-control and trait temptation. Since temptations are domain specific, and we elicit present bias in the domain of finance using monetary incentives, we also use the trait temptation measure in finance. Table 17 in the appendix shows that the correlations between time preferences and the trait measures for temptation and self-control are low and not significant. We also use an OLS model to regress the individual-specific present bias on the trait measures of temptation in finance and self-control. Table 4 shows the results of this regression. In column 1 we only control for demographics, and in column 2 we add the interaction of trait temptation in finance and trait self-control (which is predicted to be positive by hypothesis 3) to the model. There is no significant relation between time preferences and trait measures of temptation and self-control, again suggesting that present bias is not associated with self-control failures.

Table 4: OLS models predicting the present bias parameter by trait measures of temptation and self-control.

	$\beta_{qh,CRRA}$	$\beta_{qh,CRRA}$
VARIABLES		
TTEMPfin	-0.00162	0.00394
	(0.00232)	(0.00712)
TSC	0.000863	0.00343
	(0.00154)	(0.00338)
TTEMPfin*TSC		-0.000145
		(0.000189)
Constant	0.979***	0.876***
	(0.116)	(0.166)
Observations	142	142
R-squared	0.126	0.131
Demographics	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

In a replication study with 283 workers on Amazon Mechanical Turk, we elicited trait temptation, trait self-control, and time and risk preferences using procedures similar to those in the current study. We asked participants to make hypothetical choices between smaller sooner payments ($30-$75) and larger later

payments (fixed at $80) with the same time structure as in this paper. In the Holt and Laury (2002) risk elicitation task, the safer choice was between $35 and $25 and the riskier choice between $65 and $1. We calculated the present bias parameter as described in section 3.1 and used an OLS model to regress present bias on the the trait measures of temptation in finance and self-control. As shown in the appendix in table 20, we again did not find any significant relationship between present bias and trait self control or trait temptation, replicating our findings on the trait level.

4.3. Is present bias related to the course of everyday desires?

Next we analyze whether present bias is associated with any of the key components of everyday desires and self-control failures suggested by Hofmann et al. (2012a). This analysis is on the desire level with 2072 observations. Desires are nested within 1779 episodes which are nested in the 142 participants for whom we have measures for time and risk preferences. We specify multilevel regression models with clusters at the individual level and at the episode level and regress desire strength, intrapersonal conflict, resistance (= use of self-control), and enactment of the desires in separate regressions on the present bias parameter. Depending on the type of the dependent variable we either use multilevel linear regressions (for desire strength and conflict strength) or multilevel logistic regressions (for resistance and enactment). In all regressions we control for demographics, trait self-control, trait temptation, as well as the situational variables location, whether the individual interacted with somebody, and the type of desire. We also control for earlier aspects of the course of desire and use these coefficients to test our two goods model (hypothesis 3) in the next subsection.

Table 5 shows that present bias does not predict any of the components of everyday desires. This is the third way in which we show that present bias is not associated with everyday self-control failures. Also, impatience (δ) is not associated with any aspect of everyday desires. The table also shows that an increase in trait self-control predicts a weaker desire strength. This is in line with recent research by Hofmann et al. (2012a) and Ent et al. (2015) which suggests that individuals high in trait self-control tend to avoid situations where strong temptations might lead to self-control failures. Trait self-control is also positively associated with the use of self-control, suggesting that individuals high in trait self-control use self-control more often in their everyday lives. Moreover, the table indicates that individuals high in trait temptation use self-control more often than individuals low in trait temptation.

Table 5: Desire level analysis: Multilevel linear regressions predicting desire strength, conflict strength, and multilevel logit regressions predicting resistance and enactment by time preferences and earlier desire-related variables.

VARIABLES	(1) Desire Strength	(2) Conflict Strength	(3) Resistance	(4) Enactment
β	0.143	0.0277	0.287	0.510
	(0.328)	(0.673)	(0.813)	(0.763)
δ	-0.546	3.358	-2.493	-0.686
	(1.585)	(3.244)	(3.924)	(3.736)
TSC	-0.0137**	-0.0202	0.0362**	0.00602
	(0.00670)	(0.0138)	(0.0166)	(0.0157)
TTempAllDom	-0.000337	-0.000549	0.0137***	-0.00515
	(0.00197)	(0.00405)	(0.00485)	(0.00455)
Desire Strength		0.186***	-0.395***	0.605***
		(0.0405)	(0.0684)	(0.0807)
Conflict Strength			0.288***	0.00228
			(0.0370)	(0.0389)
Resistance				-2.528***
				(0.190)
Drink	0.00568	-0.314**	-1.060***	1.009***
	(0.0832)	(0.152)	(0.298)	(0.305)
Drink alcohol	-0.176	0.906***	0.818**	0.475
	(0.135)	(0.248)	(0.397)	(0.444)
Smoke	-0.194	0.277	0.381	0.277
	(0.125)	(0.229)	(0.359)	(0.402)
Female	-0.0464	0.764***	1.893***	-1.373***
	(0.117)	(0.215)	(0.358)	(0.404)
Use media	-0.412***	0.868***	0.268	2.588***
	(0.0781)	(0.144)	(0.232)	(0.327)
Spend money	-0.0761	1.301***	1.022**	0.0981
	(0.149)	(0.273)	(0.446)	(0.457)
Social contact	-0.174**	0.0445	-0.494**	0.953***
	(0.0792)	(0.145)	(0.251)	(0.271)
Leisure	-0.131	0.800***	0.759***	-0.260
	(0.0804)	(0.147)	(0.240)	(0.259)
Postpone	-0.0429	1.828***	1.203***	0.868***
	(0.0797)	(0.146)	(0.248)	(0.258)
Work	0.192	0.0968	-0.340	-0.798*
	(0.134)	(0.245)	(0.429)	(0.411)
Sport	0.148	0.125	-0.401	-0.808**
	(0.128)	(0.234)	(0.408)	(0.388)
Sleep	0.0547	0.667***	2.426***	-1.374***
	(0.0677)	(0.124)	(0.237)	(0.244)
Other	0.471***	0.341	0.718*	-1.465***

	(0.132)	(0.242)	(0.389)	(0.415)
I was in the Uni	-0.112*	0.524***	0.986***	-0.442**
	(0.0615)	(0.114)	(0.188)	(0.191)
I was at another place	-0.0172	0.113	0.404**	-0.627***
	(0.0621)	(0.115)	(0.183)	(0.196)
Social interaction	-0.0686	0.00395	-0.238	0.311*
	(0.0531)	(0.0982)	(0.154)	(0.165)
Constant	6.290***	-2.039	0.243	-1.221
	(1.550)	(3.191)	(3.837)	(3.656)
Observations	2,059	2,059	2,059	2,059
Number of groups	142	142	142	142
Demographics	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

4.4. Does the simple two goods model predict the course of everyday desires?

Table 5 also shows our test of the simple two goods model. In line with hypothesis 3, the table shows that a higher desire strength increases the likelihood that individuals enact the desire in question. A higher desire strength also predicts higher conflict strength, and higher conflict strength predicts a higher likelihood that individuals use self-control. When individuals use self-control, the likelihood of enactment is reduced. The results also show a significant effect that we did not predict: the stronger a desire is, the less likely it is that individuals (will) try to resist it.

Moreover, table 5 shows that the components of self-control problems differ by desire type. The baseline desire in the table is for eating. For example, the desires to use social media and to postpone something are more conflicting and more often enacted than the desire to eat. This corresponds to table 13 in the appendix which shows that self-control failures are more likely in the domains of using social media and postponing something compared to the domain of eating. However, while individuals tried to resist the desire to postpone quite frequently, they did not try to resist the desire to use social media more often than the desire to eat. The reason for this is that desires to use social media were relatively week compared to desires to postpone something. Compared to being at home, being at the University is a situation with more conflicts, more use of self-control, and less desire enactment. Finally, social interactions do not influence the components of self-control problems in our data.

5. Discussion and contribution to the literature

This paper presents a novel integration of the economics and psychology of self-control. This integration takes place on a theoretical, empirical, as well as methodological level. Theoretically, we present the T-SC model which integrates psychological insights on self-control problems into an economic intertemporal choice framework. The T-SC model, best summarized in equation (4), formalizes psychological insights in a "useful, tractable, and (importantly) disciplined" (p. 273 O'Donoghue and Rabin, 2015) way. The model is useful as it provides hypotheses about self-control problems that we can confirm in our data. The model also makes an explicit distinction between the impact of discounting and the impact of visceral influences (Loewenstein, 1996) on decision-making. Other models that integrate visceral influences, temptation, and self-control into economics are suggested by Thaler and

Shefrin (1981), Gul and Pesendorfer (2001), Bernheim and Rangel (2004), and Fudenberg and Levine (2006). These models, however, do not build on the economic and psychological literatures on inconsistent time discounting and are thus less suitable to provide predictions about the relationship between present bias and self-control problems which is this paper's focus.

The T-SC model also suggests some specifications of economic concepts related to self-control. For example, the model allows differentiating between different qualities of sophistication and naivete (O'Donoghue and Rabin, 1999). Completely naive individuals believe that they will not encounter temptations at all. Partly sophisticated individuals expect temptations to occur, but believe that they will have sufficient self-control to neutralize them. Sophisticated individuals are aware of future temptations and of potential future self-control weaknesses. The more sophisticated individuals are, the weaker their average temptation strength should be as they engage in proactive activities to avoid the strongest temptations. This is related to a new research stream in psychology which suggests that individuals high in self-control are particularly good at avoiding, rather than resisting, temptations (Ent et al., 2015; Hofmann et al., 2012a).

A potential criticism of the T-SC model is that it adds variables typically measured on psychological scales to the $\beta\delta$ model. While it makes intuitive sense to understand present bias in terms of temptation and self-control, it is difficult - if not impossible - to transform the psychological scales into meaningful values that can be used in calculations. Scales do provide useful information about individual differences, but they do not provide cardinal information about the absolute strength of temptation, self-control, and present bias. As a result, the T-SC model can be used to analyze individual differences in self-control problems, but it is much harder to provide a meaningful quantification of these individual differences and of aggregated values for temptation and self-control. Future work on the edge of economics and psychology, possibly via the integration of neuroscience, might overcome such limitations.

Empirically, the paper shows that present bias is not associated with everyday self-control failures. This insight contributes to the recent trend in applied microeconomics to elicit individual-specific time preferences and use these to predict field behavior, such as cigarette smoking (Harrison et al., 2010), defaulting credits (Meier and Sprenger, 2010), becoming obese (Komlos et al., 2004), and exercising (Chabris et al., 2008). Our results suggest that everyday self-control failures are not the reason for the often significant (mostly weak) link between present bias and life outcomes. Assuming that our findings are replicated in larger and more diverse

samples, other mechanisms that explain why experimentally elicited present bias using monetary rewards predicts some field behaviors should be investigated. For example, background factors such as liquidity constraints might affect answers to delay discounting questions and be correlated with field behaviors too (Carvalho et al., 2014).

The lack of association between present bias and self-control failures in our data is also consistent with recent critiques of financial delay discounting tasks as a means to elicit time preferences. These critics argue that heuristics are better at predicting the responses that people give in time preference elicitation tasks than in delay discounting models (Ericson et al., 2015), and that if subjects have access to even modest amounts of liquidity, researchers should be surprised to find any present bias in experiments with monetary rewards at all (O'Donoghue and Rabin, 2015). Another criticism is that present bias in the models operates on the timing of utility and not on the timing of obtaining the payments (O'Donoghue and Rabin, 2015), and we do not know when participants use the gift certificates they get in our study. A solution is to elicit present bias using consumption itself in domains such as snacks (Read and Van Leeuwen, 1998), movies (Read et al., 1999), beverages (McClure et al., 2007), effort (Augenblick et al., 2015), and survey choices (Carvalho et al., 2014). Future work should investigate whether present bias in non-financial domains predicts self-control failures in everyday life.

Also, methodologically, we integrate the economics and psychology of self-control by utilizing up-to-date measurement tools from both disciplines. Our elicitation of present bias as an economic measure of self-control is very clean and we controlled for potentially confounding factors such as hypothetical bias, lack of trust, curvature of the utility function, and different transaction costs. To elicit everyday self-control failures we used a novel application of the Day Reconstruction Method (DRM) widely known from happiness research. In happiness research, the DRM is typically used to elicit what individuals *feel* in their everyday lives. We measured what individuals *want* in their everyday lives, making this the best elicitation technique of everyday self-control problems we know of while obtaining the data in a laboratory setting. In essence, we introduced the DRM as a tool for measuring everyday decision-making outside the laboratory context.

The DRM has been designed to minimize recall bias in order to obtain unbiased measures of experienced utility (Diener and Tay, 2014; Kahneman et al., 2004). The method has been shown to provide reliable and valid estimates of individual subjective well-being ratings (Dockray et al., 2010; Krueger and Schkade, 2008; Larson and Csikszentmihalyi, 1983). However, it has not yet been tested whether

the DRM also provides unbiased estimates of decision utility and motivations as they occurred "yesterday". Future work should validate the DRM as a tool to measure everyday decision-making, for example by comparing DRM data with experience sampling measures (Larson and Csikszentmihalyi, 1983). When comparing our data with the data gathered by Hofmann et al. (2012a) and Hofmann et al. (2012b), we see some similarities but also differences. In general, we see great potential for future research using the DRM as a tool to measure everyday decision-making. The DRM is simple for subjects to use, relatively easy to administer, and it can be used in the field. Shorter versions of the DRM should be developed and new hypotheses tested in larger and more diverse samples.

Our study has a few limitations. The sample consists mainly of students and the analysis uses only 142 independent observations. Future work should test whether present bias is indeed not related to everyday self-control in larger and more diverse samples. It is also possible that a selection effect was in operation, in that only those students who either needed money, or had high levels of self-control agreed to spend up to 2 hours participating in the study. About 20% of the participants are "future biased" in that they are more impatient in the future than in the present. This is consistent with various other studies that find future bias, also called increasing impatience, hypobolic preferences, or reverse time inconsistency (Dohmen et al., 2012), but might also be the result of decision making errors which would signal low data quality. The final limitation concerns the way we programmed the questionnaire which may have induced a downward bias of the number of desires that the participants mentioned. We programmed the DRM in a way that incentivized participants to indicate fewer desires than they actually had, because this reduced the number of follow-up questions they had to answer.

6. Conclusion

In this paper we integrated recent theoretical and methodological developments from psychological self-control research into the economic analysis of present bias. We presented the T-SC model of intertemporal choice which is a modification of the quasi-hyperbolic discounting model and suggests that present bias is the outcome of the intraindividual conflict between temptation (T) and self-control (SC). We tested predictions generated by this model in a study using state of the art measurement techniques for present bias, trait temptation, and trait self-control, as well as a novel day reconstruction technique to elicit components of self-control problems as they

occur in everyday life.

The results suggest that there is no association between experimentally elicited present bias and self-control failures, neither when measured on the trait level nor when measured in everyday life. This suggests that experimentally elicited present bias using monetary rewards does not provide a good measure for self-control problems, which might explain the typically weak associations between experimentally elicited present bias and field behaviors that are potentially influenced by self-control problems. However, our results do suggest that using temptation and self-control to explain present bias is a useful theoretical modification of the quasi-hyperbolic discounting model as the new T-SC model provides several predictions about self-control problems that we can confirm with our everyday data.

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Online Appendix to accompany "Present Bias and Everyday Self-Control Failures" by Delaney and Lades

Not intended for publication.

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A. Descriptive statistics

A.1. Sample statistics

Table 6: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Age	22.764	5.51	18	53	144
Female	0.646	0.48	0	1	144
College degree	0.493	0.502	0	1	144
From the UK	0.535	0.501	0	1	144
Present biased	0.465	0.501	0	1	144
Future biased	0.208	0.408	0	1	144

Table 7: Summary statistics income

	Frequency
under £10.000	61
£10.000 - £14.999	9
£15.000 - £19.999	7
£20.000 - £24.999	10
£25.000 - £29.999	7
£30.000 - £39.999	7
£40.000 - £49.999	4
£50.000 - £59.999	8
Over £60.000	6
Rather not say	23
Total	142

Table 8: Summary statistics country of origin

	Frequency
Australia	1
Brazil	2
Bulgaria	3
Canada	1
China	2
Czech Republic	3
Finland	2
Germany	15
Greece	1
Hungary	4
Indonesia	1
Ireland	6
Italy	1
Korea South	1
Latvia	1
Lithuania	5
Namibia	1
The Netherlands	1
Norway	2
Poland	2
Portugal	1
Romania	2
Slovakia	1
Slovenia	1
Spain	1
Sweden	1
United Kingdom	75
United States of America	4
Total	141

Table 9: Summary statistics education

	Frequency
Some High School	4
High School graduate	54
Some college, no degree	14
College graduate	19
Bachelor's degree	24
Graduate degree - Masters	12
Graduate degree - Doctorate	3
Other	12
Total	142

A.2. Time and risk preferences

Figure 4: Time Preferences (grouped)

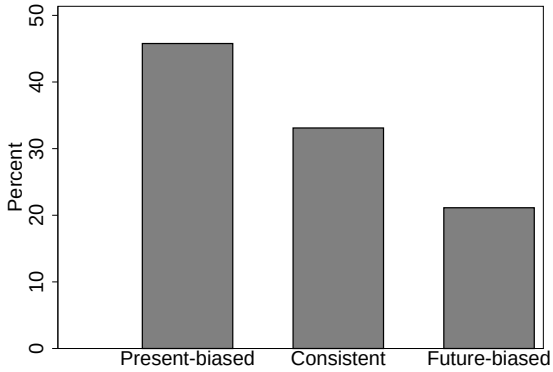


Table 10: The Holt and Laury(2002) risk elicitation procedure we used.

Option A				Option B						
p(£5)		p(£4)		p(£9)		p(£1)		EV A	EV B	Difference
0.1	5	0.9	4	0.1	9	0.9	1	4.1	1.8	2.3
0.2	5	0.8	4	0.2	9	0.8	1	4.2	2.6	1.6
0.3	5	0.7	4	0.3	9	0.7	1	4.3	3.4	0.9
0.4	5	0.6	4	0.4	9	0.6	1	4.4	4.2	0.2
0.5	5	0.5	4	0.5	9	0.5	1	4.5	5	-0.5
0.6	5	0.4	4	0.6	9	0.4	1	4.6	5.8	-1.2
0.7	5	0.3	4	0.7	9	0.3	1	4.7	6.6	-1.9
0.8	5	0.2	4	0.8	9	0.2	1	4.8	7.4	-2.6
0.9	5	0.1	4	0.9	9	0.1	1	4.9	8.2	-3.3
1	5	0	4	1	9	0	1	5	9	-4

The last three columns in this table, showing the expected values of the lotteries, were not shown to subjects.

Table 11: The results of the MPL risk elicitation

NSC	Range of CRRA	r we used	Classification	Frequency
0-1	$r \leq -1.07$	-1.10	highly risk loving	3
2	$-1.07 \leq r \leq -0.53$	-0.80	very risk loving	3
3	$-0.53 \leq r \leq -0.11$	-0.32	risk loving	12
4	$-0.11 \leq r \leq 0.26$	0	risk neutral	33
5	$0.26 \leq r \leq 0.62$	0.44	slightly risk averse	37
6	$0.62 \leq r \leq 0.99$	0.80	risk averse	34
7	$0.99 \leq r \leq 1.43$	1.20	very risk averse	11
8	$1.43 \leq r \leq 2.05$	1.74	highly risk averse	6
9-10	$2.05 \leq r$	2.10	stay in bed	4

We assume $U(x) = x^{1-r}/(1-r)$ as the utility function. One person did not fill out the risk preferences so we have 143 observations.

Figure 5: Time preferences (linear utility) assuming that $U(x) = x$.

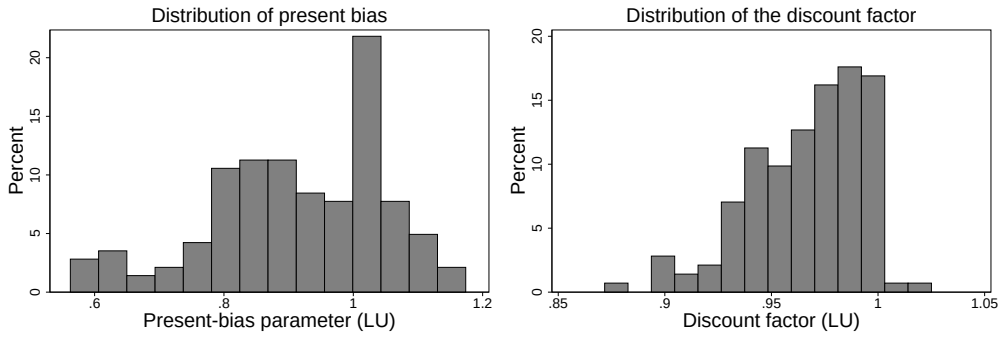


Figure 6: Present bias assuming CRRA versus linear utility

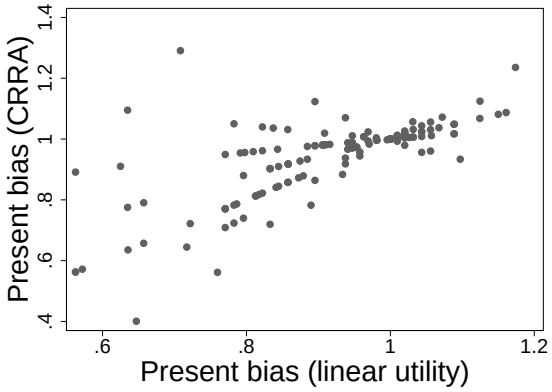
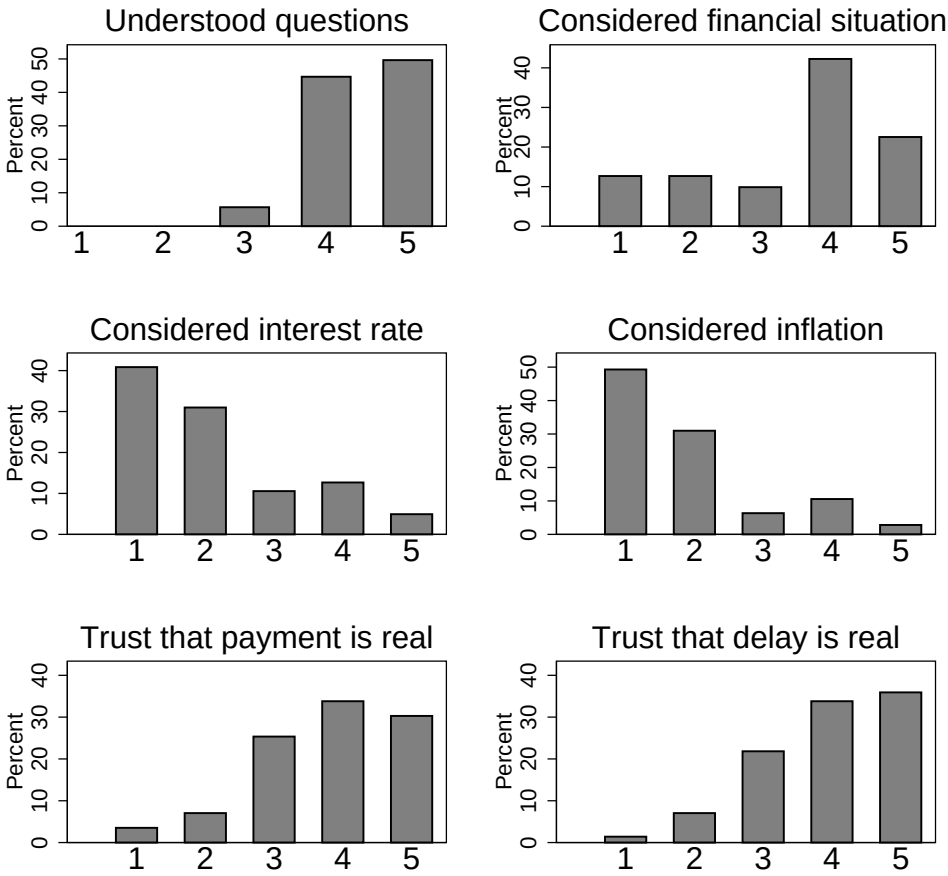
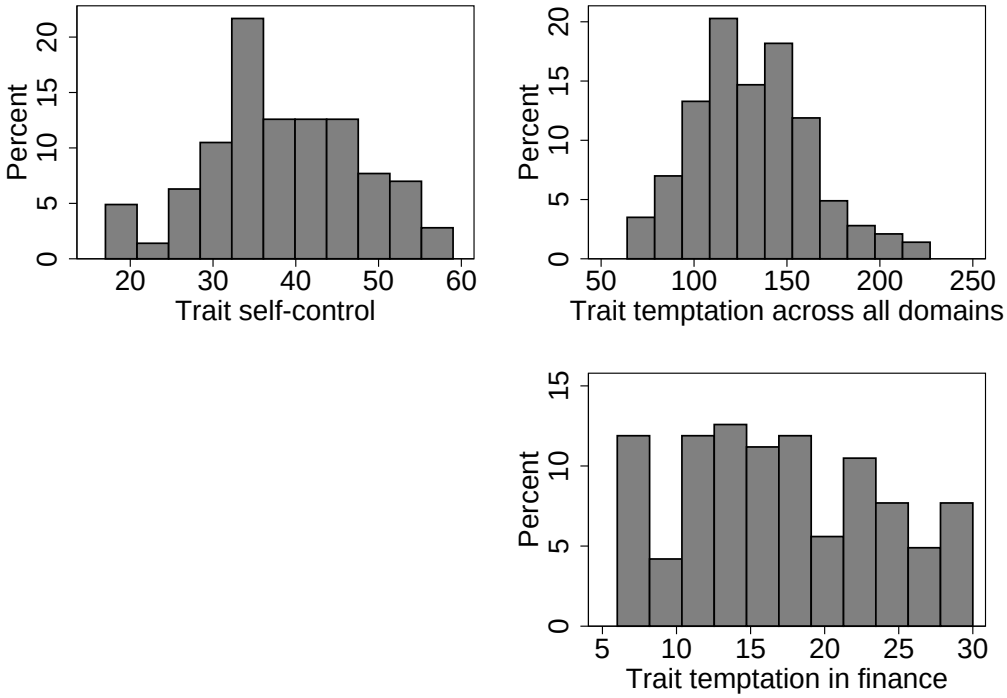


Figure 7: Post time preference questions (from 1 = "Strongly disagree" to 5 = "Strongly agree")



A.3. Trait temptation and trait self-control

Figure 8: Trait Measures



A.4. Day-specific measures

Table 12: Summary statistics (day-specific)

Variable	Mean	Std. Dev.	Min.	Max.	N	SUM
Number of episodes	12.317	3.491	4	20	142	1749
Number of desires	14.5	7.719	3	48	142	2059
Number of enacted desires	8.423	5.651	0	39	142	1196
Number of self-control conflicts	10.021	7.554	0	44	142	1423
Number of resistance attempts	6.634	5.559	0	37	142	942
Number of self-control successes	3.606	3.311	0	16	142	512
Number of self-control failures	2.014	3.661	0	37	142	286

Figure 9: Distributions of the numbers of desires, self-control conflicts, uses of self-control, and self-control failures on one day.

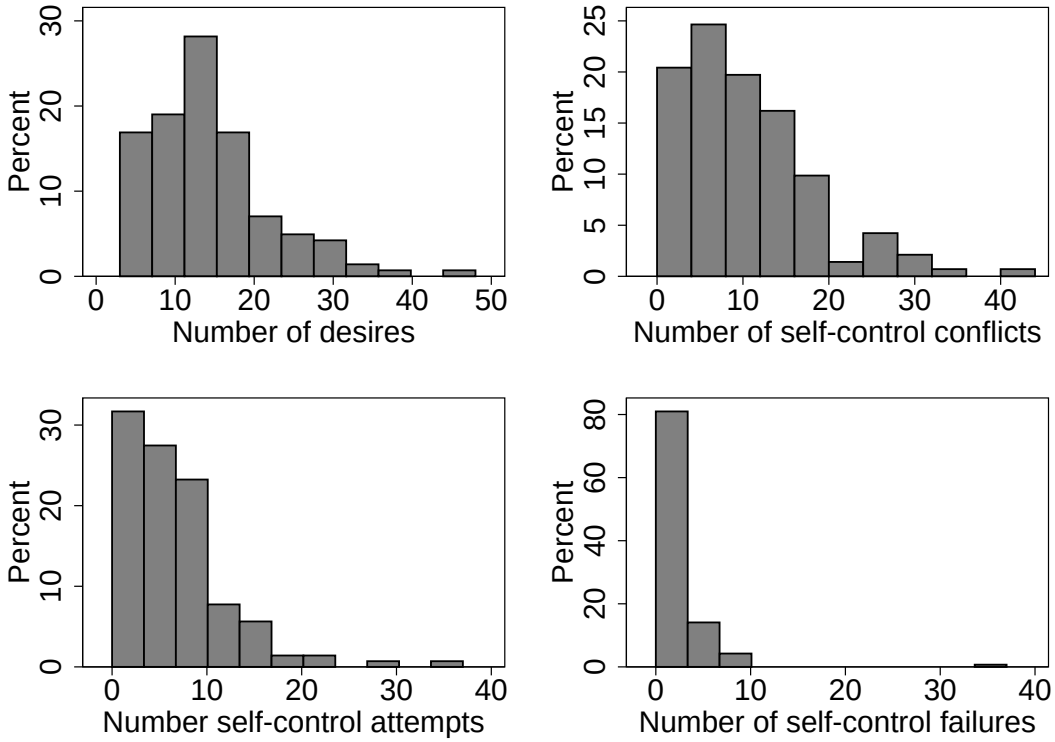
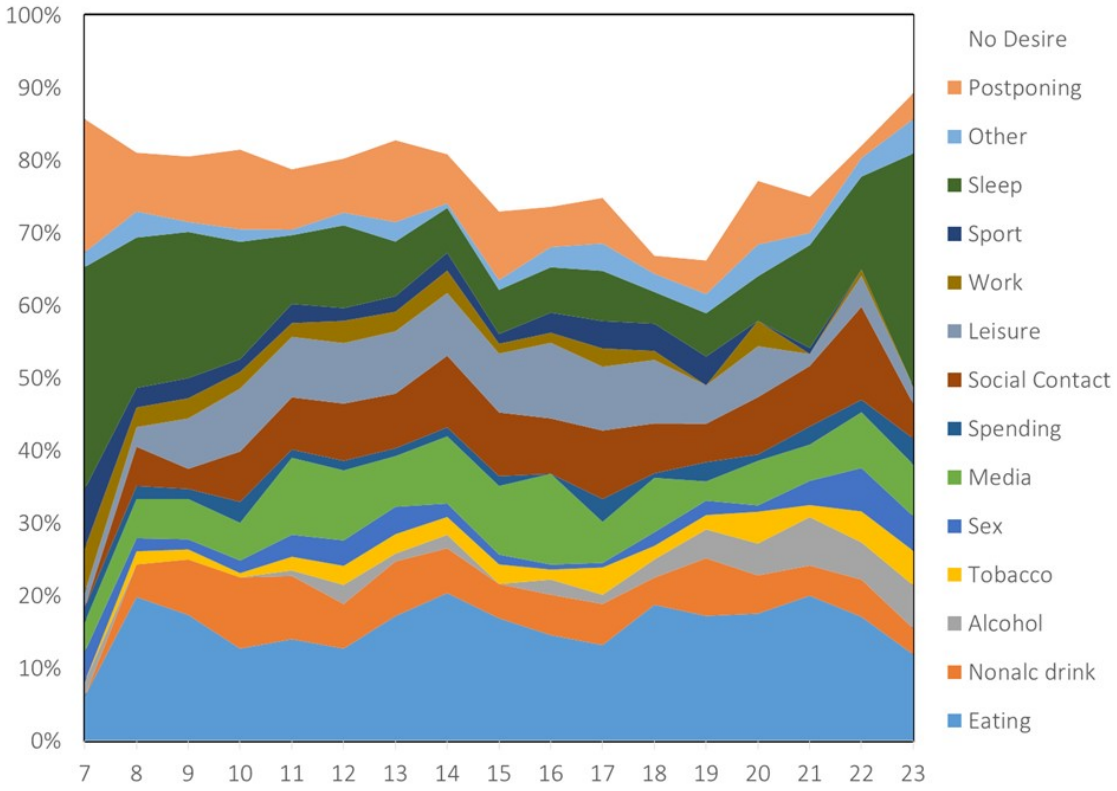


Table 13: Summary of desires by type

	Mean Values				Count Values			
	Strength Strength (1-7)	Conflict Conflict (1-7)	Res. Res. (0 or 1)	Enact. Enact. (0 or 1)	Desire Desire (1-∞)	Conflict Conflict (1-∞)	SCS SCS (1-∞)	SCF SCF (1-∞)
Postpone	5.02	4.93	0.66	0.61	194	185	49	74
Media	4.64	3.62	0.48	0.87	200	156	20	69
Eat	5.00	2.72	0.32	0.63	414	237	74	32
Sleep	5.15	3.42	0.74	0.26	325	243	167	27
Social	4.87	2.82	0.26	0.77	190	113	13	26
Leisure	4.88	3.65	0.53	0.48	185	151	66	19
Smoke	5.06	3.45	0.42	0.60	65	53	18	8
Spend	4.79	4.23	0.60	0.51	43	36	16	7
Drink alc	4.83	3.35	0.43	0.65	54	43	14	7
Sex	4.97	3.62	0.62	0.30	71	52	29	6
Drink	4.92	2.21	0.16	0.81	158	70	13	5
Sport	5.26	2.67	0.25	0.56	61	30	7	3
Other	5.41	3.19	0.41	0.41	58	41	19	3
Work	4.96	2.48	0.26	0.54	54	26	10	0
Av|Sum	4.97	3.29	0.46	0.58	2059	1423	512	286

Figure 10: Desires from 7am to 11pm



B. Robustness checks

B.1. Does present bias predict the number of self-control failures on a day?

Table 14: Negative binomial logit regressions predicting the sum of desires, self-control conflicts, resistance attempts, and self-control failures by present bias (linear utility) and impatience (linear utility).

VARIABLES	Sum Desires	Sum SCC	Sum Resis	Sum SCS	Sum SCF
$\beta(LU)$	0.290	0.638	0.591	0.233	1.263
	(0.322)	(0.447)	(0.446)	(0.592)	(0.806)
$\delta(LU)$	0.0835	1.313	0.635	0.944	0.0172
	(1.730)	(2.430)	(2.648)	(3.659)	(4.048)
Constant	2.319	0.270	1.303	0.197	0.787
	(1.760)	(2.485)	(2.660)	(3.703)	(4.062)
Observations	142	142	142	142	142
Demographics	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 15: Negative binomial logit regressions predicting the sum of desires, self-control conflicts, resistance attempts, and self-control failures by time preference groups (base = consistent).

VARIABLES	Sum Desires	Sum SCC	Sum Resis	Sum SCS	Sum SCF
Present-biased	0.0518	0.0204	0.0932	0.0901	-0.106
	(0.101)	(0.149)	(0.158)	(0.201)	(0.286)
Future-biased	0.147	0.120	0.114	-0.0354	0.305
	(0.139)	(0.196)	(0.197)	(0.260)	(0.278)
Constant	2.586***	2.065***	2.394***	1.316***	1.821***
	(0.232)	(0.269)	(0.314)	(0.384)	(0.608)
Observations	142	142	142	142	142
Demographics	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 16: Bonus: Negative binomial logit regressions predicting the sum of desires, self-control conflicts, resistance attempts, and self-control failures by trait self-control.

	(1)	(3)	(5)	(7)	(9)
VARIABLES	Sum Desires	Sum SCC	Sum Resis	Sum SCS	Sum SCF
TSC	-0.0107**	-0.0222***	-0.0193***	-0.0200***	-0.0295***
	(0.00423)	(0.00567)	(0.00619)	(0.00752)	(0.0103)
Constant	3.014***	2.850***	3.071***	1.958***	2.779***
	(0.254)	(0.299)	(0.357)	(0.443)	(0.658)
Observations	142	142	142	142	142
Demographic Controls					Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 17: Correlation matrix

	(1)						
	$\beta_{qh,CRRA}$	$\beta_{qh,LU}$	$\delta_{qh,CRRA}$	$\delta_{qh,LU}$	TSC	TTEMPall	TTEMPfin
$\beta_{qh,CRRA}$	1						
$\beta_{qh,LU}$	0.713***	1					
$\delta_{qh,CRRA}$	0.114	-0.0637	1				
$\delta_{qh,LU}$	-0.221**	-0.260**	0.477***	1			
TSC	0.0874	-0.0000593	0.0431	-0.0216	1		
TTEMPall	-0.0430	-0.0486	0.0716	0.0688	-0.697***	1	
TTEMPfin	-0.0783	-0.204*	0.156	0.0943	-0.393***	0.664***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.2. Is present bias related to psychological trait measures?

Table 18: OLS models predicting present bias (Linear Utility) by trait measures of temptation and self-control.

VARIABLES	$\beta_{qh,LU}$
TTEMPfin	-0.00395*
	(0.00210)
TSC	-0.00176
	(0.00138)
Constant	1.042***
	(0.0957)
Observations	142
R-squared	0.206
Demographic Controls	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 19: Bonus: OLS models predicting the various impatience parameters by trait measures of temptation and self-control.

VARIABLES	$\delta_{qh,CRRA}$	$\delta_{qh,LU}$	$\delta_{EXP,LU}$	$\delta_{EXP,CRRA}$
TTEMPfin	0.000824**	0.000590	-0.000270	0.000419
	(0.000396)	(0.000408)	(0.000547)	(0.000719)
TSC	0.000273	5.45e-05	-0.000322	0.000431
	(0.000255)	(0.000259)	(0.000365)	(0.000493)
Constant	0.950***	0.945***	0.957***	0.949***
	(0.0188)	(0.0164)	(0.0252)	(0.0368)
Observations	142	142	142	142
R-squared	0.176	0.145	0.155	0.111
Demographic Controls	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 20: Replication with 283 participants from Amazon Mechanical Turk. OLS models predicting present bias (CRRA and Linear Utility) by trait measures of temptation and self-control using similar measures.

VARIABLES	$\beta_{qh,CRRA}$	$\beta_{qh,LU}$
TTEMPfin	0.000833	-0.000485
	(0.000898)	(0.00118)
TSC	-1.26e-05	-0.000749
	(0.000643)	(0.000929)
Constant	0.808***	0.807***
	(0.0862)	(0.0845)
Observations	283	283
R-squared	0.141	0.177

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, education, income, gender, ethnicity, and employment status.

B.3. Is present bias related to the course of everyday desires and does the simple two goods model predict the course of everyday desires?

Table 21: Multilevel linear regressions predicting desire stength, conflict strength, and multilevel logit regressions predicting resistance and enactment by time preferences (linear utility) and earlier desire-related variables.

	(1)	(2)	(3)	(4)
VARIABLES	Desire Strength	Conflict Strength	Resistance	Enactment
$\beta_{qh,LU}$	-0.329	0.144	0.274	1.497*
	(0.347)	(0.711)	(0.862)	(0.815)
$\delta_{qh,LU}$	-0.660	4.051	-3.619	-2.603
	(1.639)	(3.367)	(4.071)	(3.791)
TSC	-0.0140**	-0.0189	0.0362**	0.00832
	(0.00665)	(0.0137)	(0.0165)	(0.0153)
TTEMPall	-0.000367	-0.000381	0.0137***	-0.00488
	(0.00196)	(0.00403)	(0.00481)	(0.00444)
Desire Strength		0.186***	-0.395***	0.606***
		(0.0406)	(0.0684)	(0.0806)
Conflict Strength			0.289***	0.00522
			(0.0371)	(0.0389)
Resistance				-2.535***
				(0.190)
Constant	6.853***	-2.817	1.303	-0.411
	(1.743)	(3.591)	(4.338)	(4.067)
Observations	2,059	2,059	2,059	2,059
Number of groups	142	142	142	142
Demographics	Yes	Yes	Yes	Yes
Type of desire	Yes	Yes	Yes	Yes
Location	Yes	Yes	Yes	Yes
Interaction	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 22: Multilevel linear regressions predicting desire stength, conflict strength, and multilevel logit regressions predicting resistance and enactment by time preference groups (with consistent as the baseline) and earlier desire-related variables.

	(1)	(2)	(3)	(4)
VARIABLES	Desire Strength	Conflict Strength	Resistance	Enactment
Present-biased	0.0278	0.0209	-0.0540	-0.337
	(0.101)	(0.207)	(0.250)	(0.227)
Future-biased	-0.00942	-0.0668	-0.0621	0.510*
	(0.119)	(0.244)	(0.295)	(0.268)
TSC	-0.0138**	-0.0191	0.0358**	0.00734
	(0.00668)	(0.0137)	(0.0166)	(0.0149)
TTEMPall	-0.000418	-0.000191	0.0135***	-0.00460
	(0.00197)	(0.00406)	(0.00485)	(0.00431)
Desire Strength		0.186***	-0.394***	0.597***
		(0.0406)	(0.0684)	(0.0800)
Conflict Strength			0.287***	0.00515
			(0.0370)	(0.0385)
Resistance				-2.518***
				(0.189)
Constant	5.907***	1.184	-1.820	-1.579
	(0.499)	(1.053)	(1.292)	(1.204)
Observations	2,059	2,059	2,059	2,059
Number of groups	142	142	142	142
Demographics	Yes	Yes	Yes	Yes
Type of desire	Yes	Yes	Yes	Yes
Location	Yes	Yes	Yes	Yes
Interaction	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 23: Multilevel linear regressions predicting desire stength, conflict strength, and multilevel logit regressions predicting resistance and enactment by time preferences (CRRA) and earlier desire-related variables. Here we drop those paths we are not interested in (i.e. when there is no conflict and when individuals did not try to resist).

	(1)	(2)	(3)	(4)
VARIABLES	Desire Strength	Conflict Strength	Resistance	Enactment
β	0.143	0.0277	-0.0693	-0.629
	(0.328)	(0.673)	(0.877)	(1.382)
δ	-0.546	3.358	-0.621	6.322
	(1.585)	(3.244)	(4.125)	(6.848)
TSC	-0.0137**	-0.0202	0.0498***	-0.0199
	(0.00670)	(0.0138)	(0.0174)	(0.0279)
TTEMPall	-0.000337	-0.000549	0.0159***	-0.00532
	(0.00197)	(0.00405)	(0.00497)	(0.00797)
Desire Strength		0.186***	-0.335***	0.543***
		(0.0405)	(0.0801)	(0.153)
Conflict Strength			0.136***	-0.0341
			(0.0503)	(0.0893)
Constant	6.290***	-2.039	-1.347	-5.920
	(1.550)	(3.191)	(4.033)	(6.677)
Observations	2,059	2,059	1,423	798
Number of groups	142	142	137	129
Demographics	Yes	Yes	Yes	Yes
Type of desire	Yes	Yes	Yes	Yes
Location	Yes	Yes	Yes	Yes
Interaction	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

Table 24: Multilevel logit regressions predicting enactment by time preferences (CRRA) and earlier desire-related variables (stepwise).

VARIABLES	(1) enactment	(2) enactment	(3) enactment	(4) enactment	(5) enactment
β	0.285	0.288	0.193	0.186	0.510
	(0.681)	(0.666)	(0.715)	(0.710)	(0.763)
δ	-0.968	-0.144	0.238	0.460	-0.686
	(3.337)	(3.281)	(3.527)	(3.494)	(3.736)
TSC		-0.0120	-0.00546	-0.00756	0.00602
		(0.0136)	(0.0147)	(0.0146)	(0.0157)
TTEMPall		-0.00923**	-0.00951**	-0.00943**	-0.00515
		(0.00399)	(0.00429)	(0.00425)	(0.00455)
Desire Strength			0.650***	0.673***	0.605***
			(0.0750)	(0.0757)	(0.0807)
Conflict Strength				-0.107***	0.00228
				(0.0356)	(0.0389)
Resistance					-2.528***
					(0.190)
Constant	1.133	1.907	-2.035	-2.135	-1.221
	(3.209)	(3.170)	(3.434)	(3.401)	(3.656)
Observations	2,059	2,059	2,059	2,059	2,059
Number of groups	142	142	142	142	142
Demographics	Yes	Yes	Yes	Yes	Yes
Type of desire	Yes	Yes	Yes	Yes	Yes
Location	Yes	Yes	Yes	Yes	Yes
Interaction	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Demographic variables are age, gender, marital status, college degree, income, and whether participants are from the UK.

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C. Study materials

C.1. Time and risk preferences

Compensation

Getting paid

On the following pages, we will determine **how much** money you will receive for completing this study, and **when** you will receive the money.

All payments will come to you as Amazon.co.uk Gift Certificates. We will send you the certificates in emails. Hence, we need to know your email address.

To guarantee your anonymity, we will ask you to provide your email address on two separate pieces of paper (the "Payment agreements"). Using this procedure, we will not be able to relate your email address to your answers in the questionnaire. Please feel free to have a look at the **Payment Agreements** now.

Your Identity

Please insert your Study ID as you just generated it on the computer in the box below. (First two initials of the place you were born + Date of the month you born + Last letter of your first name.)

Instructions

On the next pages, you will be presented with 31 decision-problems. These problems are real! You will be paid according to one of the 31 decisions you make. We will call this decision the 'decision-that-counts'.

To determine the 'decision-that-counts' for your payment, together with a member of our staff you will randomly draw one number between 1 and 31 from the website www.random.org. We will pay you according to your answer to the question indicated by the randomly drawn number.

The decision-problems are not designed to test you. There is no right or wrong answer. However, as your answers will directly determine your payment, you will benefit from carefully reading through the instructions and answer according to your true preferences.

In section 3, you will make 21 decisions about payments over time. In section 4, you will make 10 decisions about payments under risk. The detailed instructions will be given in the respective sections.

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Payments over time

On the next page, you will make 21 choices about when to receive your payment. If the random number drawn from www.random.org is from 1 to 21, your payment will be determined by the respective answer on the next page. You can receive your payment today, in 1 month, in 6 months, or in 7 months. The more you wait, the larger the payment will be.

Below is an example of a decision dealing with payment over time.

No	Payment in 6 months	OR		Payment in 7 months
15	£15 guaranteed in 6 months	O	O	£16 guaranteed in 7 months

In this example, you have the choice between getting £15 in 6 months or £16 in 7 months. If you prefer receiving the £15 in 6 months, you would mark the left circle with an X. If you prefer receiving the £16 in 7 months, you would mark the right circle with an X. On the next page, you will make 21 choices of this kind.

Remember that each choice could be the decision-that-counts. It is in your interest to treat each decision as if it could be the one that determines your payment.

Moreover, we will really pay you later if this is indicated by your choice. In the case that you will be paid later, we will send you an email today indicating your personal payment details.

On the next page you will make the following choices:

- Choices 1 - 7: Getting paid **today** or in **1 month**.
- Choices 8 - 14: Getting paid **today** or in **6 months**.
- Choices 15 - 21: Getting paid in **6 months** or in **7 months**.

In case that there are any questions, please raise your hand and wait for a member of staff to come to your desk.

Now, please have a look at the 21 questions on the next page and select in each row the payment option that you prefer.

Please indicate for each of the following 7 decisions, whether you would prefer **a smaller payment today OR a bigger payment in 1 month**.

No	Payment today	OR		Payment in 1 month
1	£15 guaranteed today	O	O	£16 guaranteed in 1 month
2	£14 guaranteed today	O	O	£16 guaranteed in 1 month
3	£13 guaranteed today	O	O	£16 guaranteed in 1 month
4	£12 guaranteed today	O	O	£16 guaranteed in 1 month
5	£11 guaranteed today	O	O	£16 guaranteed in 1 month
6	£10 guaranteed today	O	O	£16 guaranteed in 1 month
7	£09 guaranteed today	O	O	£16 guaranteed in 1 month

Please indicate for each of the following 7 decisions, whether you would prefer **a smaller payment today OR a bigger payment in 6 months**.

No	Payment today	OR		Payment in 6 months
8	£15 guaranteed today	O	O	£16 guaranteed in 6 months
9	£14 guaranteed today	O	O	£16 guaranteed in 6 months
10	£13 guaranteed today	O	O	£16 guaranteed in 6 months
11	£12 guaranteed today	O	O	£16 guaranteed in 6 months
12	£11 guaranteed today	O	O	£16 guaranteed in 6 months
13	£10 guaranteed today	O	O	£16 guaranteed in 6 months
14	£09 guaranteed today	O	O	£16 guaranteed in 6 months

Please indicate for each of the following 7 decisions, whether you would prefer a **smaller payment in 6 months OR a bigger payment in 7 months**.

No	Payment in 6 months	OR		Payment in 7 months
15	£15 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
16	£14 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
17	£13 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
18	£12 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
19	£11 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
20	£10 guaranteed in 6 months	O	O	£16 guaranteed in 7 months
21	£09 guaranteed in 6 months	O	O	£16 guaranteed in 7 months

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Payments under risk

On the next page, you will make choices 22 - 31. These 10 choices deal with obtaining your payment under various risk conditions. If the randomly drawn number from www.random.org is from 22 to 31, your payment will be determined by the respective answer on the next page. All payments under risk will be paid today.

Each of the 10 decisions on the next page is a choice between "Option A" and "Option B". You are asked for each comparison to say which you prefer by ticking the boxes.

To help you understand the decision-problems under risk imagine the following situation:

You are presented with two closed bags, each containing 10 balls. You are asked to blindly draw a ball from one of the two bags and told that you will be paid the amount of money shown on the ball which you draw.

Your task is to **choose the bag** from which you wish to draw a ball. Although you cannot see the balls, you know the value of the ten balls contained in each bag.

Below is an example of how the two bags could look like.

No	**Option A**	**OR**	**Option B**
22	**5** **4** **4** **4** **4** **4** **4** **4** **4** **4** **4**	O O	**9** **1** **1** **1** **1** **1** **1** **1** **1** **1**

In the bag on the left (Option A), the first ball is worth £5 and the rest of the balls are worth £4. In the right bag (Option B), the first ball is worth £9 and the rest of the balls are worth £1.

If you prefer Option A, you would mark the left circle with an X. If you prefer Option B, you would mark the right circle with an X. On the next page, you will make 10 choices of this kind.

If your payment will be determined by one of the 10 decisions on the next page, we will use www.random.org a second time and draw a random number from 1 to 10. This number will indicate one ball from the bag you chose at the respective question. In the above example, if number "22" was drawn and you had chosen Option A, a randomly drawn "1" would depict the first ball worth £5, and every other number (2-10) would indicate a payment of £4.

In case there are any questions, please raise your hand and wait for a member of staff to come to your desk.

Please complete the 10 questions on the next page now.

For each row, choose the bag from which you wish to draw one ball to get paid the ball's value in US Dollars.

No	Option A	OR	Option B
22	5 4 4 4 4 4 4 4 4 4	O O	9 1 1 1 1 1 1 1 1 1
23	5 5 4 4 4 4 4 4 4 4	O O	9 9 1 1 1 1 1 1 1 1
24	5 5 5 4 4 4 4 4 4 4	O O	9 9 9 1 1 1 1 1 1 1
25	5 5 5 5 4 4 4 4 4 4	O O	9 9 9 9 1 1 1 1 1 1
26	5 5 5 5 5 4 4 4 4 4	O O	9 9 9 9 9 1 1 1 1 1
27	5 5 5 5 5 5 4 4 4 4	O O	9 9 9 9 9 9 1 1 1 1
28	5 5 5 5 5 5 5 4 4 4	O O	9 9 9 9 9 9 9 1 1 1
29	5 5 5 5 5 5 5 5 4 4	O O	9 9 9 9 9 9 9 9 1 1
30	5 5 5 5 5 5 5 5 5 4	O O	9 9 9 9 9 9 9 9 9 1
31	5 5 5 5 5 5 5 5 5 5	O O	9 9 9 9 9 9 9 9 9 9

We will add £7 to the values of the balls indicated above in order to make the payments similar between payments under risk and payments over time.

Please look over your 31 decisions once more. Are you happy with any single decision or do you like to revise something? If so, please make the necessary adjustments now.

In the next few minutes, a member of staff will approach you to draw the decision that counts and fill out the payment agreements with you.

In the meantime, please proceed in the questionnaire by clicking on the "I completed the Earning Money part" button on the screen.

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C.2. Payment agreement forms

Payment agreement I - Participant's copy

(To be populated after the decision that counts has been drawn)

Dr Leonhard Lades (Stirling Behavioural Science Centre) will send Amazon.co.uk Gift Certificates[1] to the participant's email address as indicated below to compensate the participant for his/her time. The date of the email and the amount of the certificate are indicated below.

Date of payment:

Amount of payment in £:

Signature of Dr Leonhard Lades:

Below are the contact details for Dr Leonhard Lades. Please keep this in a safe place. If one of your payments is not received you should immediately contact Dr Leonhard Lades, and we will make sure that you receive your payment.

Dr Leonhard K. Lades
Behavioural Science Centre and Division of Economics
Stirling Management School, University of Stirling
Room 3B57, Cottrell Building, Stirling, FK9 4LA, UK
Email: l.k.lades@stir.ac.uk

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Payment agreement II - University's copy

(To be populated after the decision that counts has been drawn)

Dr Leonhard Lades (Stirling Behavioural Science Centre) will send Amazon.co.uk Gift Certificates[2] to the participant's email address as indicated below to compensate the participant for his/her time. The date of the email and the amount of the certificate are indicated below.

Date of payment:

Amount of payment in £:

Participant's email address:

By entering the email address, the participant acknowledges the payment conditions.

Signature of Dr Leonhard Lades:

Below are the contact details for Dr Leonhard Lades. Please keep this in a safe place. If one of your payments is not received you should immediately contact Dr Leonhard Lades, and we will make sure that you receive your payment.

Dr Leonhard K. Lades
Behavioural Science Centre and Division of Economics
Stirling Management School, University of Stirling
Room 3B57, Cottrell Building, Stirling, FK9 4LA, UK
Email: l.k.lades@stir.ac.uk

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C.3. Personal diary

Diary Pages for Yesterday

To begin, please circle the day of the week that YESTERDAY was:

Monday Tuesday Wednesday Thursday Friday Saturday Sunday

About what time did you wake up yesterday?

And when did you go to sleep?

On the next three pages, please describe your day. **Think of your day as a continuous series of scenes or episodes in a film**. Give each episode a brief name that will help you remember it (for example, "driving to the University", or "at lunch with B", where B is a person or a group of people). Write down the approximate times at which each episode began and ended. The episodes people identify usually last between 15 minutes and 2 hours. Indications of the end of an episode might be going to a different location, ending one activity and starting another, or a change in the people you are interacting with. There is one page for each part of the day - Morning (from waking up until noon), Afternoon (from noon to 6:00 pm) and Evening (from 6:00 pm until you went to bed). There is room to list 10 episodes for each part of the day, although you may not need that many, depending on your day. It is not necessary to fill up all of the spaces - use the breakdown of your day that makes the most sense to you and best captures what you did and how you felt. **Please do not list more than 20 episodes for your whole day**.
Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. For each episode, try to remember

- what your mood was like (e.g. happy, exited, frustrated, angry, anxious, lonely),
- how you felt (e.g. tired, hungry, drunken, focused, and enjoying yourself),
- whether you felt desires (e.g. to eat, sleep, drink, use social media), and
- whether the desires conflicted with general lifetime goals or plans which you have made before.

What you write only has to make sense to you. It will help you remember what happened when you are answering the questions in the computer survey.
Remember, what you write in your diary will not be seen by anybody else. This diary is yours to keep - you don't have to hand it in at the end of the survey.

Morning

(from waking up until just before lunch)

	Episode Name	Time it Began	Time it Ended	Notes to yourself: What happened? How did you feel?
1M				
2M				
3M				
4M				
5M				
6M				
7M				
8M				
9M				
10M				

Afternoon

(from lunch until just before dinner)

	Episode Name	Time it Began	Time it Ended	Notes to yourself: What happened? How did you feel?
1A				
2A				
3A				
4A				
5A				
6A				
7A				
8A				
9A				
10A				

Evening

(from dinnertime until just before you went to sleep)

	Episode Name	Time it Began	Time it Ended	Notes to yourself: What happened? How did you feel?
1E				
2E				
3E				
4E				
5E				
6E				
7E				
8E				
9E				
10E				

Please look over your diary once more. Are there any other episodes that you'd like to revise or add more notes to? Is there an episode that you would want to break up into two parts or would you like to combine two episodes? If so, please go back and make the necessary adjustments.
How many episodes (Morning, Afternoon, and Evening combined) did you record? (Please add a number ≤ 20.)

Thank You!

Now, we will ask you specific questions about the episodes you had yesterday. In answering these questions, we'd like you to consult your diary and the notes you made to remind you of what you did and how you felt.

You may now go back to the computer.

C.4. Questions about desires

For each episode, we asked participants on the computer screen whether they felt and desires during this episode and some follow-up questions. The follow-up questions differed slightly across desires and below we present screen-shots with the follow-up questions related to the desire "Eating" as an example.

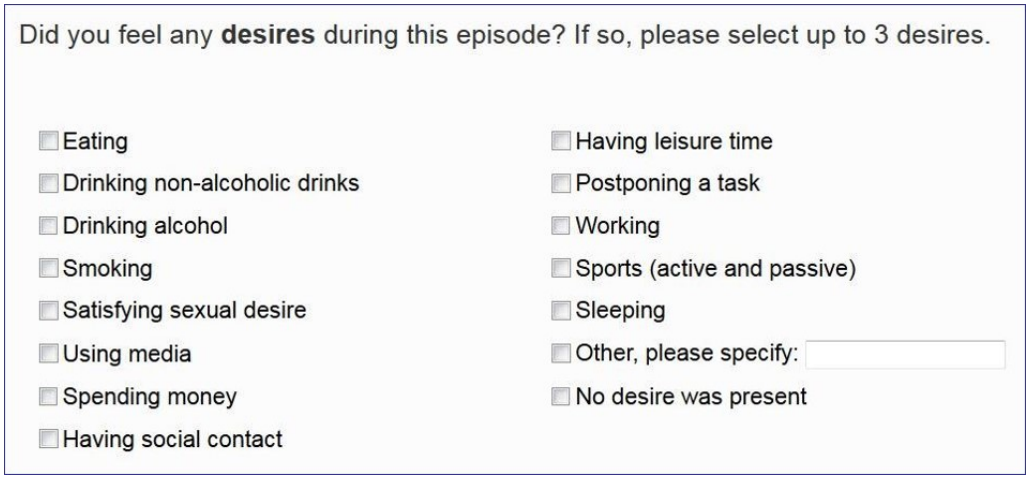

Figure 11: For every episode, participants could chose from these desires.

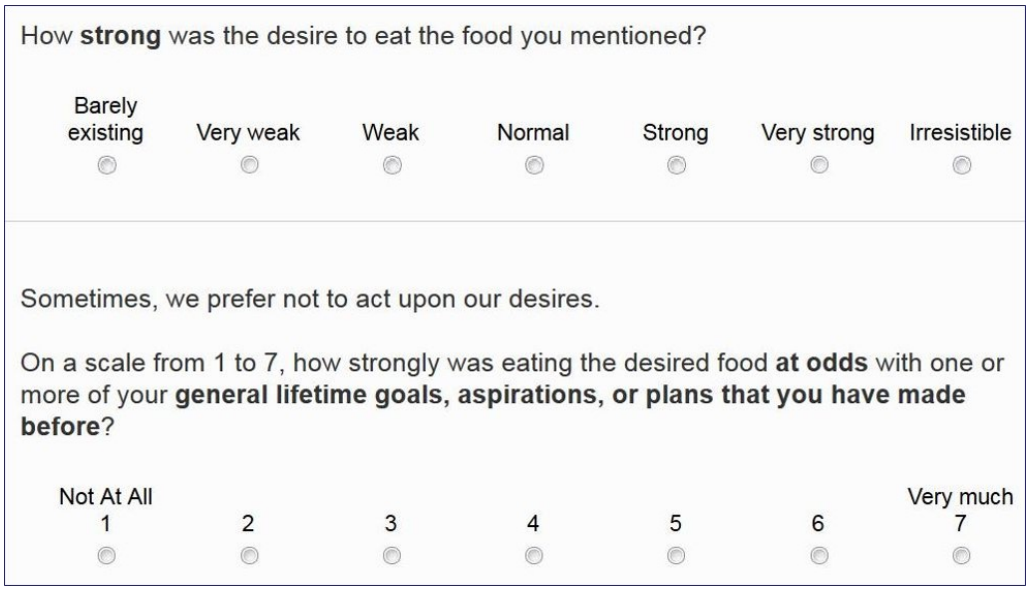

Figure 12: If participants selected the desire "Eating", they were asked these questions (1/2).

Figure 13: If participants selected the desire "Eating", they were asked these questions (2/2).