Happiness and Time Preference: The Effect of Positive Affect in a Random-Assignment Experiment

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Abstract

We conduct a random-assignment experiment to investigate whether positive affect impacts time preference, where time preference denotes a preference for present over future utility. Our result indicates that, compared to neutral affect, mild positive affect significantly reduces subjects' time preference. Affects were induced using short film clips. Our result has implications for the effect of happiness on time preference and the role of emotions in economic decision making in general. Finally, we reconfirm the ubiquity of time preference and start to explore its determinants.

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Keywords: positive affect, happiness, time preference, random-assignment experiment, mood-inducement

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Initially ignored—and subsequently thought to be disruptive—emotions have historically received a bum rap from decision researchers (Isen 2008; and Loewenstein and Lerner 2003). A great deal of recent research, however, has shown that emotions—and in particular mild positive affect—can have important, and often salutary, effects (Isen 2008). For example, positive affect has been shown to increase cognitive flexibility (Isen 2008); reciprocity in "gift-exchange" games (Kirchsteiger et al 2006); work effort and productivity (Erez and Isen 2005; and Oswald et al 2008); loss aversion (Isen et al 1988); and risk-aversion (Isen and Geva 1987); and to decrease spending and willingness to pay (Cryder et al 2008; and Lerner et al 2004). We conduct a random-assignment experiment to investigate whether positive affect impacts time preference, where time preference denotes a preference for present over future utility (Frederick et al 2002). Our results indicate that mild positive affect significantly reduces subjects' time preference.

This is important in economics, which has a large literature devoted to modeling and estimating parameters of time preference (Andersen et al 2008; Benhabib and Bisin 2005; Coller and Williams 1999; Coller et al 2003; Gul and Pesendorfer 2001; Harrison and Lau 2005; Harrison et al 2002; Laibson 1997; Loewenstein and Prelec 1992; O'Donoghue and Rabin 1999; Rubinstein 2003; Shapiro 2005; Thaler and Shefrin 1981; and Warner and Pleeter 2001). Further, time preference has been shown to be commonplace, is believed to lead to self-control problems, and may increase the likelihood of negative outcomes—for example, overconsumption, obesity, addiction, reduced human capital accumulation, and diminished retirement saving (Ameriks et al 2007; Benhabib et al 2007; Bernheim and Rangel 2004; Frederick et al 2002; and Kirby et al 1999). Further, Mischel et al (1989) found that preschoolers' ability to delay gratification was a strong predictor of SAT scores over a decade later.

Initial empirical evidence for our hypothesis comes from the General Social Survey (GSS), which in three waves (1973, 1974, and 1976) includes both a measure of self-reported happiness ("Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?") and time preference (agreement or disagreement with the statement, "Nowadays, a person has to live pretty much for today and let tomorrow take care of itself.”). We find that happier respondents are less likely to agree with the “live for today” statement than are less happy respondents. This holds even after controlling for covariates that have been shown to be related to happiness (see Appendix A for regression results). While this empirical evidence provides loose support for our result, it has a number of shortcomings. Most notably, the direction of causation cannot be identified. Further, this measure of time preference is imperfect at best. While in this paper we will study the impact of mild positive affect—rather than happiness—on time preference, our methodology will address both of these shortcomings.[1]

To explore the relationship between mild positive affect and time preference, we run a random-assignment experiment in which subjects’ time preference is measured after their mood has been manipulated. Specifically, subjects are randomly assigned to the treatment group—positive affect—or the control group—neutral affect. The appropriate affect is induced using short video clips. Time preference is measured using a standard matching procedure, in which subjects report the present value of a future payment and truthful responses are incentivized.

Our results indicate that subjects in the treatment group exhibit significantly lower time preference than do subjects in the control group. This result is robust to various specification checks. The next section of this paper provides a brief overview of the literature; the third and fourth sections describe the experimental design and the econometric specifications, respectively; and the fifth and sixth sections present and discuss the results.

Literature Review

The impact of mild positive affect on decision making has been extensively studied over the past 20 years. Researchers, most notably Alice Isen, have conducted random-assignment experiments which demonstrate that mild positive affect can have beneficial

[1] The degree to which one can generalize from our result to the effect of happiness on time preference is explored in the discussion.

effects on decision making, increasing cognitive flexibility, work effort, helpfulness, and creativity (recent reviews include Isen 2008; and Lyubomirsky et al 2005). Moreover, mild positive affect does not appear to impede decision making as many would expect it to. For example, there is no experimental evidence that mild positive affect causes individuals to be impulsive, thoughtless, or overly optimistic (Isen 2007).

Research that explores the impact of positive affect on self-control is most relevant to our study, since the psychological concept of a lack of self-control overlaps with the economic concept of time preference. For example, Tice and Bratslavsky (2000) reported that psychologists generally understand a lack of self-control to be distinguished by a proclivity toward short-term gains, even in the face of long-term costs. Three recent psychological studies are of particular interest: First, Baumeister et al (1998) found that mild positive (negative) affect increases (decreases) the proportion of time subjects spent studying for a non-incentivized test in the laboratory; second, Isen and Reeve (2005) demonstrated that mild positive affect increases intrinsic motivation for interesting tasks; and third, Isen (2007) reported that mild positive affect replenishes will power.[2] These results are taken to indicate that mild positive affect increases forward-looking thinking, the ability to stay on task, and self-control. In summary, this line of research is far smaller and less well corroborated than other research regarding the impact of mild positive affect on decision making, leading Isen and Reeve (2005) to conclude that, "the topic of the role of positive affect in development of self-control seems a promising one for investigation."

A related strand of economic literature considers the effect of self-control on subjective well-being. This research attempts to identify the impact of poor self-control by comparing the happiness of individuals who make decisions that are thought to result from a lack of self-control to those who do not make such decisions. For example, Frey et al (2007) found that heavy TV watchers report being less happy; and Stutzer (2007)

[2] Six more studies considering the effect of affect on self-control have been conducted exclusively with young children (Fry 1975; Mischel et al 1968; Mischel et al 1973; Schwarz and Pollack 1977; Seeman and Schwarz 1974; and Underwood et al 1973). For developmental reasons, the results of these papers cannot be generalized to adults (Bucciol et al 2009).

found that obesity reduces the subjective well-being of individuals who report having limited self-control. Further, Gruber and Mullainathan (2005) found that cigarette taxes increase happiness among individuals prone to smoke. The authors interpreted the tax as a self-control device, which suggests that a lack of self-control may cause unhappiness. These studies appear to indicate that a lack of self-control reduces happiness. By extension this suggests that time preference may affect positive affect. While this direction of causation—the opposite of that which will be tested in this study—may hold, it is outside of the scope of the paper to explore this possibility.[3]

Finally, this research also adds to a small literature regarding the determinants of time preference. The two most well-established results in this literature are that (a) the magnitude of the future payment, and (b) the length of time over which discounting occurs are important determinants of time preference (Kirby and Marakovic 1996; and Thaler 1981). More recently, it has been shown (a) that high cognitive load increases time preference (Benjamin et al 2006; and Hinson et al 1999); and (b) that individuals with greater cognitive skills, as measured by IQ tests, exhibit lower time preference (Burks et al 2009). Thus, this study also adds to the literature by identifying a new determinant of time preference.

Experimental Design

We examined the effect of positive affect on time preference in a laboratory experiment conducted at Santa Clara University. In brief the experimental procedure was as follows (additional details are provided below): First, subjects read and signed an informed consent form. Second, subjects were instructed (a) that they would be answering 30 time-preference questions, (b) that their payment would be based on one of these questions, (c) that the payment question would be determined randomly at the end of the session, and (d) that a mechanism would be used to provide an incentive for truthful responses. Third, the mood inducement procedure was administered. Fourth, subjects

[3] An additional paper, Wertheim and Schwarz (1983), found that self-reported depression was correlated with a preference for immediate (delayed) benefits (costs). This study is correlational and does not provide any evidence regarding a causal relationship in either direction.

answered the 30 time-preference questions. Fifth, subjects answered questions regarding their subjective well-being. Sixth, payments were determined. Seventh, subjects answered questions regarding their mood and demographic characteristics. In total, the experiment lasted approximately 45 minutes, and subjects received an average of $24 for their participation.

Participants

Sixty-nine undergraduate students were recruited from introductory English courses that all Santa Clara students are required to take; these courses were chosen in an attempt to avoid potential disciplinary bias.

Participant instructions

After completing the informed consent form, subjects received detailed written instructions, which were also read aloud by the experimenter. The instructions introduced the time-preference questions and informed the subjects that the experimental procedure had been designed to encourage truthful responses. Specifically, subjects were told that the 30 time-preference questions would be of the following form: "What amount of money, $\$p$, if paid to you today would make you indifferent to $\$m$ paid to you in t days?" Five values of m, {$11.34, $18.31, $24.28, $32.84, $51.71}, and six values of t, {1 day, 3 days, 7 days, 14 days, 28 days, 56 days}, were used. We chose abstruse values for m to discourage the use of heuristics, such as answering one-half of m for each p. The questions were randomized so that there was no pattern in the order of the values of m or t; this was done to avoid anchoring. The time-delay, t, was not extended beyond two months so that all possible payouts would occur within the academic term. Also, values of t were chosen to avoid weekends and school holidays.

Subjects were informed that their payment would be based on one of the 30 time-preference questions, that the payment-question would be determined randomly at the end of the session, and thus, that they should answer each question as if their payment depended on it. Subjects were then introduced to the Becker-DeGroot-Marschak (BDM) mechanism and informed that it would be used to provide an incentive for truthfully answering the 30 time-preference questions (Becker et al 1964; and Benhabib et al 2007).[4] Finally, subjects were guided through numerous examples in an attempt to ensure that they understood the process.[5]

Subjects were also informed of the payment-pickup process, which was designed carefully in an attempt to prevent subjects from preferring payment on the day of the session simply because it was easier or less risky. Specifically, subjects were informed that they would have to walk across campus to retrieve their payment regardless of the payment date; the session was conducted on the south end of campus, and the payment-pickup location was on the north end of campus. This was done in an attempt to ensure that decisions were not impacted by "transaction costs" or relative doubt about the legitimacy of future pickups.[6] Next, subjects were informed of the anonymous and blind nature of the payment-process. They were told (a) that one person would prepare the payment-envelopes, (b) that a second person would distribute the sealed payment-envelopes, (c) that neither would know their identify, only their subject identification number, and (d) that the envelope-distributor would not know the payment amount. This procedure was implemented in an attempt to minimize the potentially confounding role of subject-experimenter reciprocity.

Mood-inducement procedure

We attempted to manipulate subjects' mood by showing them a short film clip. The use of film clips to induce moods is common in psychological and, increasingly, economic

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[4] Using the BDM mechanism, the amount and timing of the payment were determined as follows: m balls numbered 1 through m were placed in a spinner, and one was chosen. If the number R on the drawn ball was less than or equal to p, then the subject was paid \$$m$ in t days. If the number drawn exceeded p, the subject was paid \$$R$ on the day of the experimental session. Finally, note that since the values of m were fractional, the number of balls placed in the spinner was rounded to the next highest integer. For example, if m = \$11.34, then balls numbered 1 through 12 were placed in the spinner.

[5] Subjects did not answer the 30 time-preference questions at this time. Rather, they answered them immediately following the mood inducement procedure. This order of events eliminated the possibility that the induced mood could have been moderated, if not nullified, by reading the participant instructions.

[6] These same two concerns were addressed in Andreoni and Sprenger (2010) in a different manner. To equalize "transaction costs," the authors only used subjects who had a campus mail address and delivered all payments through the campus mail system. Further, they made an arrangement with the campus mail staff to ensure that all payments arrived on the scheduled date. To minimize concerns about not getting paid, subjects received Professor Jim Andreoni's business card and were encouraged to contact him if there was any problem with their payment. Finally, subjects were paid with a personal check from Professor Jim Andreoni that was drawn from the university credit union.

experiments (Gross and Levenson 1995; Kirchsteiger et al 2006; Oswald et al 2008; and Rottenberg et al 2007). Westerman et al (1996) evaluated eleven mood-inducement procedures. They found that the use of film or story was the most effective means of inducing positive affect.

In our experiment, half of the subjects (34 of 69) were randomly assigned to the treatment group and watched a film clip intended to induce positive affect. The other half of the subjects (35 of 69) were assigned to the control group and watched a film clip intended to induce neutral affect. Except for the variant film clip, the experimental protocol was identical for the control and treatment groups.

Our choice of film clips followed Gross and Levenson (1995). There, over 200 film clips were evaluated for their efficacy in inducing each of seven different affects. Nearly 500 subjects were asked to rate on a scale from 0 to 8 the greatest intensity of each affect they felt during the course of the film clip. The strongest affect felt during the clip was dubbed the target affect for that film. The authors then reported the two most effective clips for inducing each of the affects.

In our experiment, the positive-affect film clip was a short montage of stand-up comedy bits from the 2002 "Robin Williams – Live on Broadway." This choice followed directly from Gross and Levenson (1995), in which one of the two most successful positive-affect-inducing film clips was Robin Williams's 1986 "A Night at the Met." We opted for the 2002 montage primarily because it was more current and put to rest any concerns of the humor being out-dated. The neutral-affect film clip was also one commonly used by psychologists and featured tranquil images of landscapes and wildlife in Denali National Park, Alaska (for example, Rottenberg et al 2007).

Time-preference questions and completing the session

Immediately following the mood-inducement procedure, subjects answered the 30 time-preference questions. Then, subjects answered questions about their subjective well-being. Next, the payment question was determined, and the BDM mechanism was implemented. Finally, subjects answered questions regarding their mood and demographic characteristics. When all surveys were completed, subjects received instructions for retrieving their payments and exited the experimental session; the instructions indicated the payment amount, and when and where to pick up the payment-envelope.

Econometric Specifications

In analyzing the relationship between positive affect and time preference, we consider a model of the form:

$$p = \beta H + \sum_m \delta_m I_M(m) + \sum_t \alpha_t I_T(t) + \sum_m \sum_t \phi_{mt} I_M(m) \times I_T(t) + \sum_K \sum_k \lambda_{Kk} I_K(k) + \varepsilon \quad (1)$$

where H is a dummy for the positive-affect treatment, M is the set of all future payment amounts m, T is the set of all time delays t (in days), and p is the subjective present value of \$$m$ in t days. The indicator functions $I_M(m)$ and $I_T(t)$ take the value of one for a given m and t, respectively, and zero otherwise; this specification allows for all possible linear and interacted effects of time-delay and future payments on discounting. The model also includes demographic controls. K denotes the set of controls, and for a given control, k is the set of possible values. For example, for $K = gender$, $k \in \{male, female\}$, and $I_{Gender}(male)$ equals one if the subject is male, and zero otherwise.

In this specification, the amount \$$p$ necessary today to be indifferent to \$$m$ in t days is considered to be a function of m, t, and $m*t$; that is, the regression is fully saturated with respect to the effect of time and future payments on present value. The appeal of this econometric specification is that it imposes minimal ex ante structure and does not depend on the distribution of p. Thus, this parametrization does not restrict us to a specific model of discounting and fits the conditional expectation function for p perfectly (Angrist and Pischke 2009).

Our choice of the fully-saturated model follows from the underwhelming support we found for the exponential, fixed-cost, and hyperbolic models of discounting, which we estimated and tested using the techniques described in Benhabib et al (2007).[7] Those authors also rejected the exponential and hyperbolic models, though they found support for fixed-cost discounting.

Finally, OLS is used to estimate equation (1). Corrected standard errors are calculated by clustering observations by subject; this is necessary since subjects answered 30 questions and their responses are unlikely to be independent.

Results

Demographic characteristics of subjects

There is no significant difference between the values of any of the demographic characteristics for the treatment and control groups, so random assignment is valid ex post (see Table 1). Roughly half of the subjects are female. The division of students across colleges roughly mimics the university's population. Santa Clara University has three colleges: arts and sciences, business, and engineering. Only a small number of subjects are in the engineering college, the rest are evenly split between arts and sciences and business. Roughly half of the subjects report that they practice a religion. Given that Santa Clara is a Jesuit university, it is not surprising that the most heavily represented religion is Christianity, accounting for three-quarters of the subjects. Almost all other subjects consider themselves Atheists, with only two students identifying a different religion. The next demographic factor we control for is race. Almost all of the subjects consider themselves white (63%), Asian (20%), or Hispanic (14%), with only two subjects identifying with other racial/ethnic categories. Finally, subjectswere asked to give their best estimate of their family income. The mean response falls in the $100,000 - $150,000 category, while the median is in $150,000 - $200,000 category. Few students report family income of less than $80,000 or greater than $500,000.

The measure of long-term happiness comes from the question, "Taken all together, how would you say things are these days—would you say that you are…," where possible

[7] Please contact the authors for complete results.

responses ranged from 1 (completely unhappy) to 7 (completely happy). This measure is similar to the ones used in the GSS and the World Values Survey (WVS), each of which has been used extensively in the happiness-economics literature as a measure of long-term happiness. The GSS, however, uses a 3-point scale and the WVS a 4-point scale. We expanded the scale to 7 points to increase sensitivity. This question was asked after mood-inducement and the time-preference questions, but because of its broad scope, is hypothesized to be unaffected by mood-inducement (Kahneman et al 1999). Indeed, there is no statistical difference in happiness for the treatment and control groups. Mean responses, reported with other descriptive statistics in Table 1, are indistinguishable (*t-test p-value* = 0.923), as is the response-distribution (*chi-square p-value* = 0.353). Thus, it appears that long-term happiness is independent of short-term affective shocks.

Subjects exhibit time preference

As in Benhabib et al (2007), discounting will be represented by D, the factor that when multiplied by m yields the dollar amount p necessary today to make one indifferent to \$$m$ in t days: $D = p/m$. Discounting may itself depend on the levels of m and t, so $D = D(m, t)$. Without this structure, comparisons of p across different values of m would be meaningless, since p's domain is defined by m. This structure will be relinquished in the regression analysis, where equation (1) will be estimated using the absolute level of p as the dependent variable. Table 2 presents observed values of D for all (m, t)-combinations; panel (a) pools all subjects, and panels (b) and (c) present the treatment and control groups, respectively.

Subjects consistently discount the distant future more heavily than they do the near future. Holding m constant, D clearly trends downward in all panels; this is visualized in Figure 1(a) for the pooled data. In panels (a) and (c) of Table 2, there are few exceptions to the downward trend. The monotonicity of the negative relationship between D and t is violated more frequently in the positive-affect treatment (see panel (b)), but in general the relationship holds.

The relationship between future payment *m* and the discount factor *D*, holding *t* constant, does not follow so consistent a pattern. For virtually no time-delay *t* is there monotonicity in *D* with respect to *m*. Nor is there a clear non-monotonic trend (for example, in panel (a), for $t = 1$, *D* has two interior peaks, for $t = 14$, there appears to be an inverted U-shape, and for $t = 56$, a U-shape).

Mood-inducement is successful

Mood-inducement had the intended effect on affect. In the final questionnaire before leaving the experimental session, subjects were asked whether watching the film clip made them happier, sadder, or neither happier nor sadder. Controlling for payment, watching the positive-affect clip made subjects significantly more likely to answer happier.[8]

Positive affect reduces time preference

Preliminary support for positive affect reducing time preference can be seen in panel (d) of Table 2, which reports the difference between $D_{Treatment}(m, t)$ and $D_{Control}(m, t)$. This difference is positive for each (*m*, *t*)-combination; the positive-affect inducement unambiguously reduces time preference. This is visualized in panel (b) of Figure 1, which separately illustrates the discount factors for the control and treatment groups over time-delay *t*; the average discount factor for each group is emphasized.

Estimating equation (1) without demographic controls, we see further evidence that positive affect reduces time preference. Controlling for future-payment and time-delay, watching a positive- instead of neutral-affect film clip increases the present value of future payments by $2.20 on average (see column (1) of Table 3). This result is marginally statistically significant, with a *p-value* = 0.054. Further, the magnitude is

[8] We included this simple check to confirm that the film clips had the intended impact; however, the use of film clips in general and our choice of clips in particular is well-established and -tested in the literature (Gross and Levenson 1995; Rottenberg et al 2007; and Westerman et al 1996). Thus, the affect check in corroboration with prior research provides strong evidence of successful mood-inducement. Our affect check does, however, suffer from the following shortcoming: it was administered after subjects answered the 30 time-preference questions and after the payments were determined. The alternative—administering the affect check immediately following the film clip—was even less attractive, since the induced affect could have been dampened, or nullified, by the affect check itself (Isen and Gorgoglione 1983).

quite substantial. Even for the largest value of *m*, \$51.71, the increase in the present value of the future payment is over four percent. Since we are not studying the effects of time and monetary sums on time preference, the coefficients of the *m* and *t* dummies and their interactions are not presented.

In column (2), controls are added for gender, race, family income, religion, regular religious service attendance, and college. Treatment is now statistically significant, increasing present value by \$2.01 on average. In columns (3) and (4), the analyses of columns (1) and (2), respectively, are repeated controlling for self-reported, long-term happiness. The main effect is stable regardless of the specification; thus, the results appear to be robust. Finally, we estimate equation (1) conditional on $p < m$; that is, we exclude observations in which subjects did not discount. With the restricted sample, the magnitude and the significance of the treatment effect increase (see Columns (5) through (8) of Table 1). The positive-affect inducement now increases the present value of a future payment by an average of \$3.00 in each of the four restricted specifications.

In summary, our experiment demonstrates that mild positive affect significantly increases the present value of a future payment, a result that is robust to a number of econometric specification-checks. The magnitude of the increase depends on the value of the future payment and the specification, ranging from 4% of the future payment (specification (4), m = \$51.71) to 27% (specification (8), m = \$11.56).

Discussion

Our findings indicate that mild positive affect significantly reduces time preference, that is, increases the present value of a future payment. Since this result is derived from a random-assignment experiment, the relationship between positive affect and time preference is presumably causal with positive affect reducing time preference. Below, we discuss, in turn, mechanisms that may explain the result and its external validity.

Potential mechanisms

A possible economic explanation of our result is that positive affect substitutes for material income today. At first glance, this may seem plausible, but not upon closer inspection. Our measure of time preference is the amount of money today that produces indifference to a future payment. According to the hypothesis above, positive affect would substitute for money today; hence subjects in the positive-affect treatment should require less money today to be indifferent to a future payment, assuming neutralized expected future affect. However, subjects in the positive-affect group require more, not less, money today to be indifferent to a future payment.

The psychological literature, where the bulk of affect-research has been reported, discusses two additional potential mechanisms that may explain why mild positive affect decreases time preference. First, Isen (2008) states that mild positive affect increases cognitive flexibility by broadening focus and attention, promoting openness to information, and enabling improved integration of information. Thus, the observed reduction in time preference may result from a more thorough consideration of broader (including future) net benefits. In addition, support for this mechanism comes from what the psychological literature dubs the “dopamine hypothesis”: that the release of dopamine (the neurotransmitter linked to rewards) in areas of the brain responsible for cognitive flexibility is the mediating factor in the effect of positive affect on behavior (Ashby et al 1999; and Isen 2008).

Second, the depletion and/or replenishment of will power may help explain our result. As mentioned in the literature review, mild positive affect has been shown to replenish will power (Isen 2007). Further, evidence abounds that exercising self-control negatively impacts one’s ability to exert self-control in subsequent tasks (see Vohs and Heatherton 2000). Thus, if watching the neutral-affect clip required more will power than watching the positive-affect clip, then the neutral-affect inducement should deplete subjects’ will power more than the positive-affect inducement. Consequently, post-inducement, subjects in the treatment group should have their will power replenished and subjects in the control group should have their will power depleted. This might explain why subjects in the treatment group exhibit greater patience for a future payment.

External validity

In this section, we will discuss what can and cannot be extrapolated from our result and then turn to policy implications. To understand what can be extrapolated, it is important to recognize that the effects of affect do not lie on a continuum from intense positive affect to intense negative affect. In particular, the "continuum" is violated in three significant ways. First, the effect of intense positive affect is not necessarily an amplification of the effect of mild positive affect (Isen 2007). Thus, we cannot assume that intense positive affect would result in a further reduction of time preference. Second, negative affect does not necessarily have the opposite effect of positive affect. The independence of positive and negative affect is well-established in psychology (Bradburn 1969; Diener and Emmons 1984; Isen 2007; Lyubomirsky et al 2005; and Watson et al 1988). Moreover, neural research suggests the two are unrelated. Each is associated with a distinct neurotransmitter: dopamine with positive affect and serotonin with negative affect. In other words, it should not be inferred from our result that negative affect would necessarily increase time preference. Third, two affects may have variant effects, even if they are both positive or negative. For example, anger and sadness, while both negative affects, may have different effects on decision making. In general, negative affects are more likely to have variant effects and positive affects are less likely to have variant effects (Isen 1987).[9] Thus, our result may not be specific to the particular positive affect induced—amusement—and may apply to a wide range of positive affects.

We now turn to the relationship between positive affect and happiness, that is, the relationship between *being in a happy mood* and *being happy*. In our experiment, we successfully improved subjects' mood, but were unable—not surprisingly—to change subjects' underlying, long-term happiness. Thus, can we validly claim that *happier* individuals should exhibit lower time preference?

[9] We are considering the effect of negative affects on time preference in a separate paper, specifically focusing on the effects of sadness, anger, and fear. Of these treatments, we have already conducted the sadness-inducement and are now turning to the others.

The distinction between positive affect and happiness, and what this distinction means for studying the impact of happiness, have been considered by Konow and Earley (2008) and Lyubomirsky et al (2005). In the latter, four possible strategies for identifying the impact of happiness are discussed. The least valid is a correlational study due to the inherent difficulty of demonstrating causation. Conversely, the ideal would be a random-assignment experiment, in which underlying happiness is manipulated. Such an experiment, however, is neither feasible nor ethical. Hence, Lyubomirsky and her colleagues argue that the best feasible approach is a random-assignment experiment in which positive affect is induced. They argue that such an approach is a valid way to identify the impact of *being happy* since happier individuals experience more frequent positive affect (Diener and Seligman 2002; and Lyubomirsky et al 2005). In fact, Diener, Sandvik, and Pavot (1991) state that, “frequent positive affect is both necessary and sufficient to produce the state we call happiness, whereas intense positive experience is not.” Thus, our result suggests that happier individuals should exhibit less time preference.

Even though frequent mild positive affect likely has important long-term consequences, a natural question arises: How long does a one-time affective shock last? Isen et al (1976) and Isen and Gorgoglione (1983) estimate that the positive affect induced by a free gift, or by reading statements with a positive valence, lasts between 10 and 20 minutes. Further, Isen and Gorgoglione (1983) state that positive affect induced by film may last longer.

While the effect of a one-time affective shock may be brief, there are still important policy implications that arise from our research. For example, our affect-inducement procedure mimics an “every day experience,” namely, viewing enjoyable or amusing audio-visual media. The ubiquity of such media—as well as other stimuli that may induce mild positive affect—implies that individuals’ time preference may be perturbed regularly. Further, individuals may not even be aware of the affective shocks, let alone the impact that such shocks are having on decision making. For example, in the post-experiment survey no subject suspected a link between the film clip and the time-preference questions. Lastly, an important implication for other researchers is that affect should be neutralized at the beginning of time preference experiments. Indeed, uncontrolled affect may be partially responsible for the highly variant estimates of discount rates reported in the time preference literature (Frederick et al 2002).

Interestingly, our result implies that others can use affective shocks to affect our time preferences. In fact, the popular book *Nudge* argues that the government should act with "libertarian paternalism" when behavior can be easily manipulated for the better (Thaler and Sunstein 2008); clearly, such tactics may also be used by parties with less benevolent motives.

Finally, evidence from the positive psychology literature suggests that people can increase their own positive affect (Snyder and Lopez 2005). Insofar as self-induced positive affect has the same influence on time preference as a positive affective shock, our results suggest that people may be able to control their own time preference, which could lead to improved decision-making.

In summary, our experiment adds to the mounting evidence that positive affect influences behavior in economically important ways. However, we can only speculate upon how this effect comes to be. In addition, this study adds to the behavioral economics literature by identifying a determinant of time preference.

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Table 1. Demographic Characteristics			
	Control (*Neutral-Affect Inducement*)	*Treatment* (*Positive-Affect Inducement*)	*All subjects*
N	35	34	69
Female	0.51 (0.09)	0.47 (0.09)	0.49 (0.06)
College: Arts & Sciences	0.49 (0.09)	0.41 (0.09)	0.45 (0.06)
Business	0.43 (0.08)	0.41 (0.09)	0.42 (0.06)
Engineering	0.09 (0.05)	0.18 (0.07)	0.13 (0.04)
Practicing a Religion	0.49 (0.09)	0.44 (0.09)	0.46 (0.06)
Religion: Atheist	0.26 (0.07)	0.18 (0.07)	0.22 (0.05)
Christian	0.71 (0.08)	0.74 (0.08)	0.73 (0.05)
Other Religions	0.03 (0.03)	0.09 (0.05)	0.06 0.03)
Race: White	0.57 (0.08)	0.68 (0.08)	0.63 (0.06)
Hispanic	0.17 (0.06)	0.12 (0.06)	0.14 (0.04)
Asian	0.23 (0.07)	0.18 (0.07)	0.20 (0.05)
Other	0.03 (0.03)	0.03 (0.03)	0.03 (0.02)

Family Income < $100,000	0.24+ (0.07)	0.15 (0.06)	0.19+ (0.05)
Family Income between $100,000 *and* $200,000	0.35+ (0.08)	0.38 (0.08)	0.37+ (0.06)
Family Income > $200,000	0.41+ (0.09)	0.47 (0.09)	0.44+ (0.06)
Happiness	5 (0.21)	4.97 (0.22)	4.99 (0.15)
Standard errors reported in parentheses +One missing observation Note: difference of means test reveals that none of the means are significantly different			

Table 2.a. ***D*(*m*, *t*), pooled data, 69 subjects, 30 questions (n = 2,065)**								
		t (*Days*)						
		1	3	7	14	28	56	*Mean*
m (*Dollars*)	$11.34	.910 (.215)	.890 (.171)	.846 (.203)	.814 (.210)	.795 (.238)	.785 (.305)	.840 (.153)
	$18.31	.928 (.200)	.889 (.195)	.856 (.217)	.833 (.207)	.786 (.235)	.752 (.272)	.841 (.172)
	$24.28	.914 (.219)	.893 (.201)	.853 (.227)	.838 (.209)	.847 (.169)	.757 (.253)	.849 (.171)
	$32.84	.915 (.211)	.898 (.177)	.851 (.219)	.860 (.161)	.775 (.252)	.778 (.244)	.846 (.169)
	$51.71	.931 (.212)	.882 (.241)	.889 (.248)	.840 (.258)	.823 (.246)	.779 (.265)	.857 (.209)
	Avg	.919 (.191)	.890 (.175)	.859 (.193)	.837 (.174)	.805 (.193)	.770 (.220)	.845 (.163)

* significant at <0.1, **significant at <0.05, ***significant at <0.01

standard errors reported in parentheses

Table 2.b. *D*(*m*, *t*), treatment group, 34 subjects, 30 questions (n = 1,017)								
		t (*Days*)						
		1	3	7	14	28	56	*Mean*
m (*Dollars*)	$11.34	.941 (.167)	.909 (.123)	.874 (.159)	.837 (.214)	.841 (.198)	.806 (.247)	.868 (.125)
	$18.31	.947 (.157)	.906 (.184)	.910 (.131)	.875 (.149)	.813 (.232)	.786 (.258)	.873 (.133)
	$24.28	.971 (.071)	.936 (.115)	.892 (.160)	.901 (.114)	.895 (.131)	.832 (.203)	.904 (.100)
	$32.84	.933 (.173)	.928 (.107)	.889 (.159)	.893 (.130)	.813 (.224)	.839 (.213)	.883 (.125)
	$51.71	.963 (.171)	.903 (.211)	.964 (.053)	.871 (.209)	.851 (.231)	.840 (.222)	.899 (.144)
	Mean	.951 (.114)	.917 (.133)	.906 (.122)	.876 (.128)	.843 (.169)	.821 (.197)	.885 (.116)

* significant at <0.1, **significant at <0.05, ***significant at <0.01

standard errors reported in parentheses

Table 2.c. *D*(*m*, *t*), control group, 35 subjects, 30 questions (n = 1,048)								
		t (*Days*)						
		1	3	7	14	28	56	*Mean*
m (*Dollars*)	$11.34	.880 (.252)	.871 (.208)	.819 (.237	.792 (.208)	.751 (.268)	.765 (.356)	.813 (.175)
	$18.31	.909 (.235)	.873 (.206)	.803 (.268)	.792 (.246)	.760 (0.239)	.719 (.284)	.809 (.200)
	$24.28	.856 (.292)	.852 (.253)	.816 (.274)	.777 (.258)	.800 (.190)	.684 (.277)	.793 (.207)
	$32.84	.897 (.243)	.869 (.223)	.815 (.261)	.828 (.182)	.738 (.274)	.718 (.259)	.811 (.198)
	$51.71	.899 (.244)	.861 (.268)	.816 (.330)	.810 (.299)	.795 (.260)	.720 (.293)	.817 (.253)
	Mean	.886 (.244)	.865 (.207)	.814 (.237)	.800 (.204)	.769 (.210)	.721 (.234)	.805 (.193)

* significant at <0.1, **significant at <0.05, ***significant at <0.01

standard errors reported in parentheses

Table 2.d. { $D_{Treatment}(m, t) - D_{Control}(m, t)$}, n = 2,065								
		t (*Days*)						
		1	3	7	14	28	56	*Mean*
m (*Dollars*)	$11.34	.061 (.052)	.039 (.041)	.055 (.049)	.045 (.051)	.091 (.057)	.041 (.074)	.055 (.037)
	$18.31	.038 (.048)	.034 (.047)	.107** (.051)	.082* (.049)	.053 (.057)	.067 (.065)	.063 (.041)
	$24.28	.115** (.051)	.083* (.047)	.076 (.054)	.125** (.048)	.094** (.039)	.149** (.059)	.111*** (.039)
	$32.84	.036 (.050)	.059 (.042)	.066* (.038)	.061 (.062)	.074 (.060)	.122** (.057)	.072* (.040)
	$51.71	.064 (.051)	.043 (.058)	.074 (.053)	.149** (.057)	.055 (.059)	.120* (.063)	.082 (.050)
	Mean	.065 (.046)	.051 (.042)	.092 ** (.046)	.076* (.041)	.073 (.046)	.099* (.052)	.081** (.039)

* significant at <0.1, **significant at <0.05, ***significant at <0.01

standard errors reported in parentheses

Table 3. Results of estimating equation (1), dependent variable is present value, *p*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	2.202* (1.124)	2.012** (0.958)	2.216** (1.112)	2.078** (0.958)	2.997** (1.353)	3.027** (1.159)	3.002** (1.332)	3.133*** (1.160)
Only discounter included	-	-	-	-	*Yes*	*Yes*	*Yes*	*Yes*
College	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Gender	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Race	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Religion	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Practicing	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Income	-	*Yes*	-	*Yes*	-	*Yes*	-	*Yes*
Self-Reported Happiness	-	-	*Yes*	*Yes*	-	-	*Yes*	*Yes*
Excludes observations where p =m	-	-	-	-	*Yes*	*Yes*	*Yes*	*Yes*
R^2	0.748	0.794	0.751	0.795	0.680	0.744	0.683	0.745
N	2065	2035	2065	2035	1471	1447	1471	1447
Clusters	69	68	69	68	58	57	58	57

* significant at <0.1, **significant at <0.05, ***significant at <0.01. Robust standard errors reported in parentheses. For 5 observations, the reported value of *p* was unintelligible and thus excluded from all specifications. Columns (2), (4), (6), and (8) have one fewer cluster, and up to 30 fewer observations, than columns (1), (3), (5), and (7), respectively, because one subject had unreported demographic characteristics. Columns (5)-(8) exclude observations where *p=m;* ten subjects had *p=m* for all observations, thus there are ten fewer clusters in (5)-(8) than in (1)-(4).

Figure 1.a. *D*(*m*, *t*), holding *m* constant, pooled data

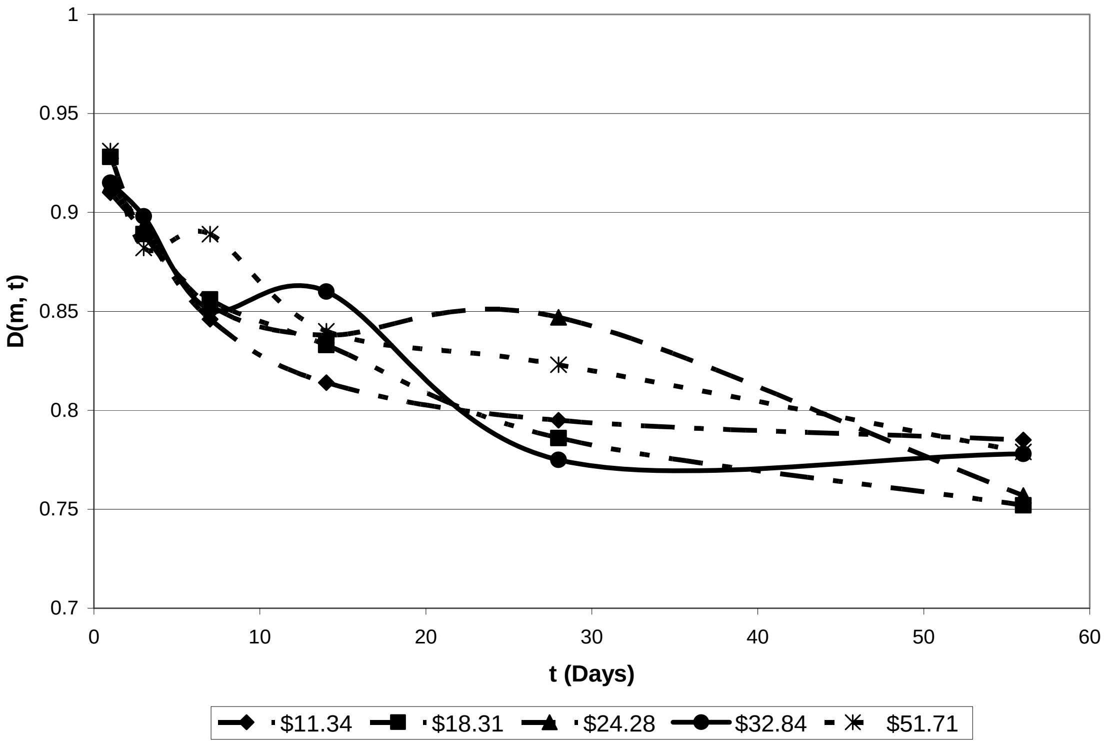
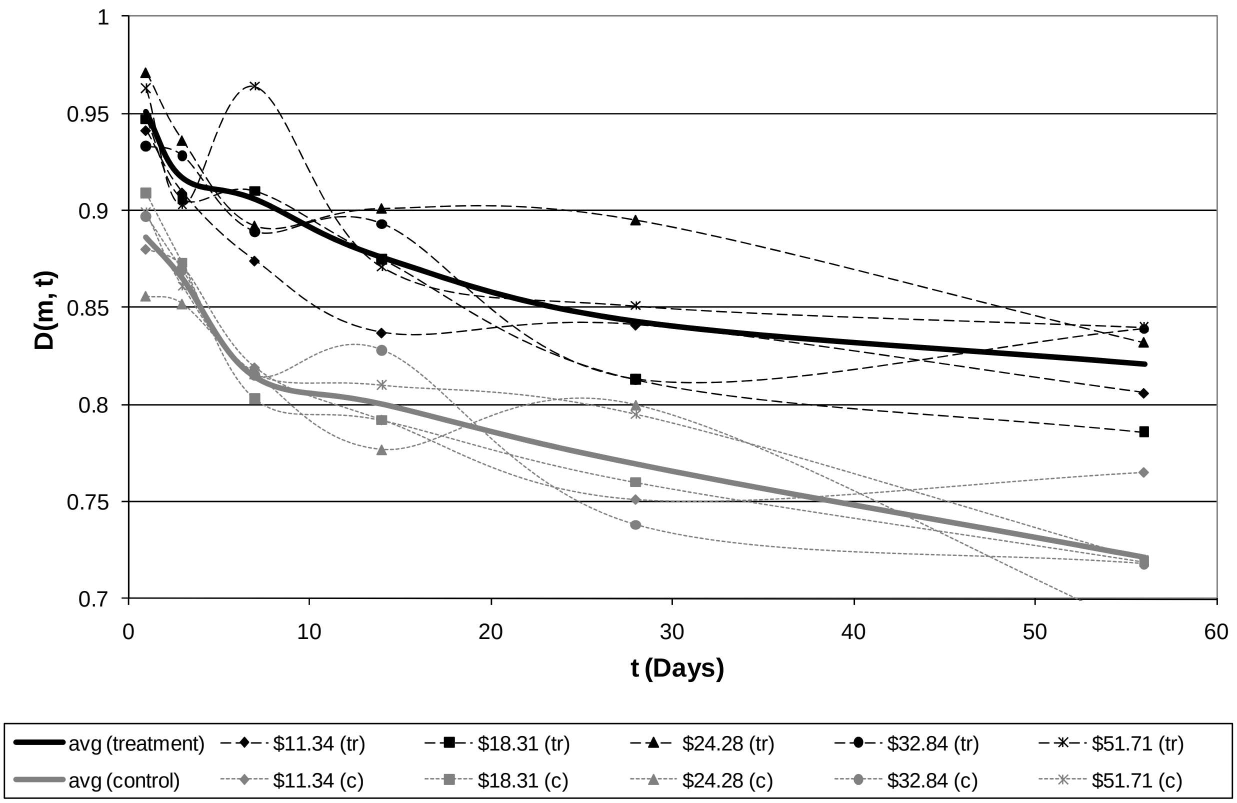


Figure 1.b. ***D*(*m*, *t*), averaging over *m*, by treatment**



where avg = average, tr = treatment, and c = control

Appendix A. Results from regressing 'live for today' on self-reported happiness

Dependent variable: Live for today (1 = '*agree' and* 0 = '*disagree*')		
	(1)	(2)
Happiness (3 = 'very happy,' 2 = 'pretty happy', and 1 = 'not too happy')	-0.048*** (0.012)	-0.042** (0.021)
Age	-	-0.006 (0.006)
Age squared	-	0.000 (0.000)
Attend religious services at least once per month	-	0.010 (0.026)
Female	-	0.062** (0.028)
Income below median (<$15,000)	-	0.073** (0.035)
Low education (<11 years)	-	0.216*** (0.032)
Nonwhite	-	0.123*** (0.045)
Poor or fair health	-	0.073** (0.036)
N	1636	1636

* significant at <0.1, **significant at <0.05, ***significant at <0.01

standard errors reported in parentheses