A Psychophysical Approach to Discounting: Sex and Money

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Introduction

Discounting has been defined as a decrease in the subjective value of an outcome as the delay to or uncertainty of receiving the outcome increases. Previous research on discounting indicates that when outcomes are delayed, money (a generalized conditioned reinforcer) retains its value longer than drugs and food which are consumable primary reinforcers (Estle, Green, Myerson, & Holt, 2007; Madden, Petry, Badger, and Bickel, 1997; Odum & Rainaud, 2003). For example, Madden et al. studied how opioid-dependant participants discount delayed money and delayed heroin and found that money retained its value longer than heroin for the opioid-dependant group. Estle et al. found a similar pattern of results with delay discounting when outcomes were not potential substances of abuse (e.g., soda). Interestingly, Estle et al. found no reliable differences between outcome types when they were uncertain (probability discounting).

Previous research has not quantified primary and conditioned reinforcers in similar units. For example, Estle et al. (2007) asked participants to choose between monetary outcomes expressed as dollars and, in different conditions, food outcomes expressed in units (e.g., number of candy bars). Furthermore, there is relatively little discounting research on primary reinforcers other than food and drugs. One notable exception is research conducted by Chapman and colleagues (1995, 1996) where the discounting of "health" was measured. In the Chapman studies, the units of health were established by participants reporting the amount of "health" they found equivalent to a specified dollar amount.

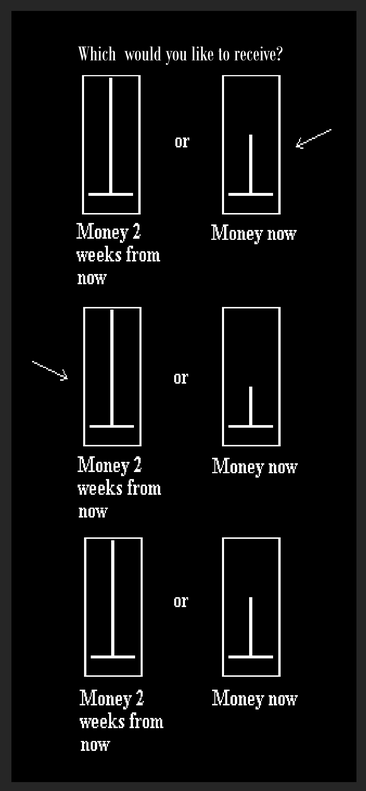
Methods used in previous studies comparing primary and conditioned reinforcers potentially limit the types of outcomes studied because the outcomes differ both quantitatively and qualitatively. The present study extends previous research by using a psychophysical approach to examine how a primary reinforcer (sex) is discounted relative to a generalized conditioned reinforcer (money). The present study also extends the generality of previous research by using a non-food related primary reinforcer. All outcomes were quantified in terms of vertical lines of different length, as opposed to numerical values, to allow for the comparison of qualitatively different outcomes on a quantitatively similar scale.

Method

58 participants accessed a web-based choice task where they were presented with vertical lines whose length was meant to represent the "value" of each available hypothetical outcome. When money was the outcome, participants were asked to consider a full line as an ideal financial situation. When sex was the outcome, "sex" was defined broadly as a maximum intimate situation in which a full line represented a maximum ideal sexual experience. A line at half the maximum length represented half of what the participant would consider to be an ideal situation for that specific outcome.

A repeated measures design was used where each participant experienced both delay and probability discounting tasks for each outcome type (money and sex) at both smaller and larger amounts.

After each successive choice, the length of the line representing the value of the immediate or certain hypothetical outcome was adjusted in such a way that when the greater, less probable or more delayed outcome was chosen, the value of the certain or immediate outcome was increased in an attempt to elicit a change in preference. If the certain outcome was chosen, its value was decreased in an attempt to elicit a change in preference. By the fourth decision in each choice situation, an indifference point between the two lines was reached, which served as an estimate of the subjective value of the outcome.



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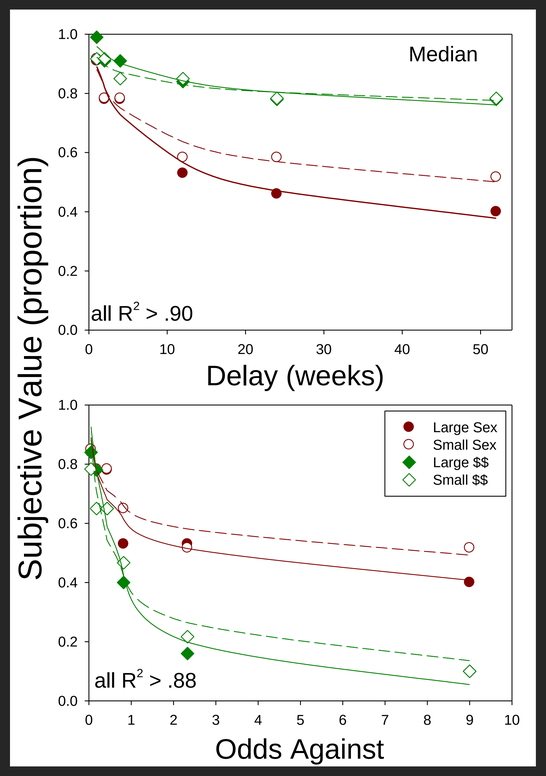
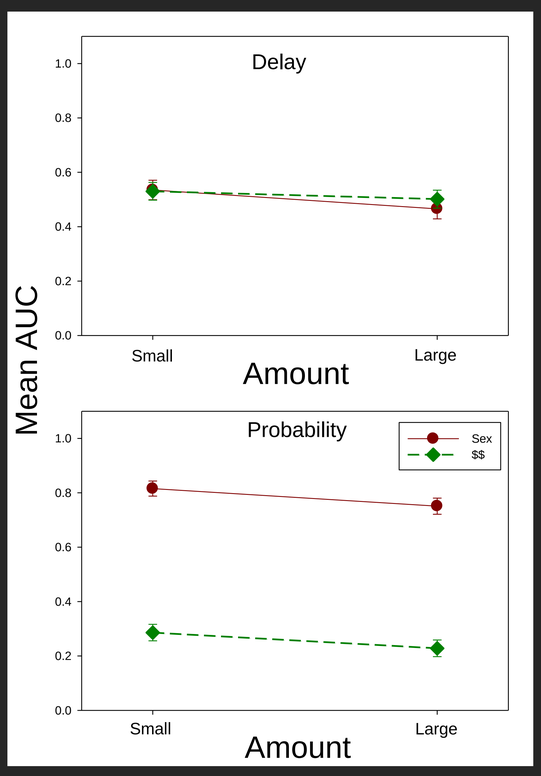
Results



The top panel shows the median subjective values when the outcomes were delayed. A hyperboloid function [$V = A / (1 + kX)^S$] provided a good fit to the obtained data (best fitting lines are shown). All of the R-squared values were greater than .90.

The bottom panel shows the median subjective values and best fitting lines when the outcomes were uncertain (all R-squared values >.88).



The figure shows the mean area under the curve for both delayed and probabilistic outcomes. A larger area under the curve represents shallower discounting, whereas a smaller area under the curve represents steeper discounting. For delayed outcomes there was a reliable effect of amount ($p < 0.01$) and no reliable effect of type or type x amount interaction (2x2 repeated measures ANOVA). For probabilistic outcomes there was a reliable effect of both amount and type ($p < 0.01$) and no interaction (2x2 repeated measures ANOVA).

Discussion

The subjective value of both money and sex decreased as a function of the delay to and probability of its receipt. To our knowledge, this is the first study to show both delay and probability discounting of a primary reinforcer that is not a food or drug.

With delay discounting there were no reliable differences between the outcome types. Previous research has found primary reinforcers to be discounted more steeply than conditioned reinforcers when outcomes were delayed. We also found no reliable amount effects, which may be due to the fact that an ideal situation and even 60% of an ideal situation may both be large amounts, especially for money.

With probability discounting there were reliable differences between the outcome types. We found sex (a primary reinforcer) to be discounted less steeply than money (a generalized conditioned reinforcer). That is, participants were more willing to forgo a certain, but less than ideal, sexual experience in order to have a chance at an ideal sexual experience than they were to forgo a certain, but less than ideal, financial situation in order to have a chance at an ideal financial situation. Previous research has found primary reinforcers were not discounted more steeply than conditioned reinforcers when outcomes were uncertain.

We did not find a difference between outcome types when they were delayed but we did when they were uncertain, which is the opposite of what past research on primary and conditioned reinforcers has found. The current results suggest that primary reinforcers may not all be treated equally.