Discounting of Delayed and Probabilistic Rewards in Gambling and Non-gambling College Students

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Introduction

Individuals make decisions that involve delayed and/or uncertain outcomes on a daily basis. For instance, whether to cash their paycheck and spend it all right away or take some of the paycheck and put it into a retirement account to accrue interest. This choice situation is analogous to the type of situation a contestant on a game show (e.g. NBC's *Deal or No Deal*) may encounter when deciding between taking a certain, smaller amount of prize money or the chance of a much larger sum of money.

Previous research has found that instituting a delay to receiving a reward systematically decreases the subjective value of that reward. Similarly, instituting uncertainty of receipt also decreases the subjective value. A hyperbolic function has been found to be a good descriptor of the relation between the subjective value of a reward and the delay/probability to receiving the reward. For both delayed and uncertain rewards the function is:

$$V = A / (1 + b X), \quad \text{Eq. 1}$$

where *V* equals the subjective value of some reward of amount *A* with *X* delay to (or odds against) its receipt and *b* is the discount rate parameter (Green & Myerson, 2004).

Researchers have not only evaluated how individuals devalue rewards after delays (or under uncertainty), but also losses or payments. The fact that individuals discount losses indicates a preference to pay a larger amount later (or the possibility of a larger payment) than a smaller amount now (or certain).

Because gambling has been labeled an impulsivity disorder, previous researchers have compared the discounting of gamblers and matched controls. Results suggest that although gamblers were more willing to forgo a smaller certain reward for the chance at a larger reward; in terms of ability to delay gratification there was no significant difference (Holt, Green, & Myerson, 2003).

A portion of the definition of pathological gambling given by the DSM-IV is the continuation of gambling behavior despite adverse financial or interpersonal consequences. Previous researchers have posited that pathological gamblers persist in gambling due to steep discounting of delayed (and shallow discounting of probabilistic) losses, stating that many adverse consequences are both delayed and probabilistic (Madden et al., 2007). The current researchers seek to determine the degree of discounting of losses of problem-gambling college students compared to matched controls.

Method

In sum, 14 students identified as gamblers completed the gains portion and 12 completed the losses portion. Also Identified in each task were 26 non-gamblers in the gains portion and 24 in the loss portion. All participants were asked to make choices between immediate and delayed rewards and losses as well as between certain and uncertain rewards and losses. Gamblers were defined as any participant with a South Oaks Gambling Screen (SOGS) score of 4 or higher (scores have a possible range of 0 to 20). Non-gamblers were defined as any participant with a SOGS score of 0.

For the gains condition participants were presented with the choice between smaller, sooner (or for sure) monetary rewards or larger, delayed (or uncertain) rewards. In the losses condition participants were asked to choose between paying a smaller amount immediately (or for sure) or a larger amount after some delay (or under uncertainty). All conditions were accessed via a web-based application. The immediate (or certain) reward (or payment) adjusted after each choice in order to elicit a change in preference. After four choices an indifference point was determined as the equivalent immediate (or certain) value of the delayed (or uncertain) reward.

Results
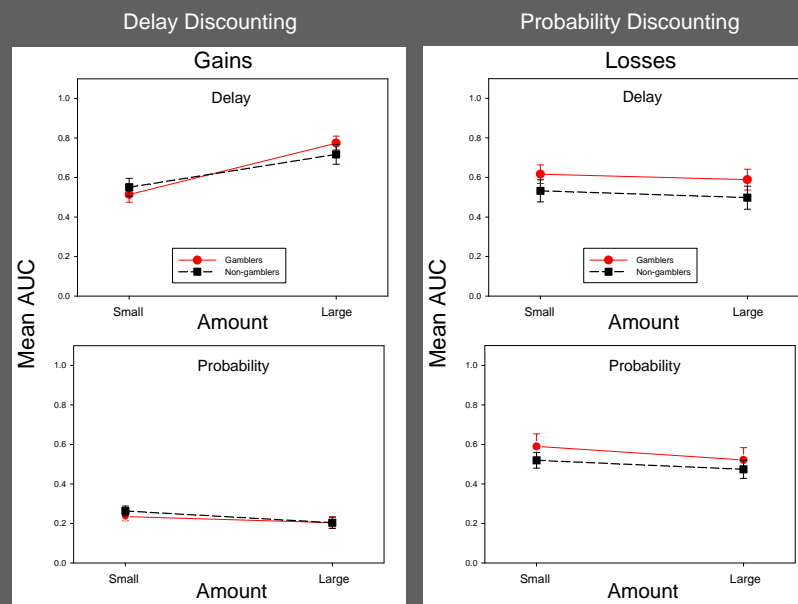
The figures show the mean area under the curve for both delayed gains and losses and uncertain gains and losses. A larger area under the curve represents shallower discounting, whereas a smaller area under the curve represents steeper discounting.

Delay Discounting: With *Gains* there was an overall effect of amount where smaller amounts were discounted more steeply than larger amounts whereas with *Losses* there was no effect of amount (a pattern consistent with previous research). For both Gains and Losses there was no significant difference between the discounting of Gamblers and Non-Gamblers, although there was a slight tendency for Gamblers to discount Losses less steeply.

Probability Discounting: With *Gains* and *Losses* there was no overall effect of amount. This is somewhat consistent with past research where either an opposite effect of amount from Delay Discounting or no effect is typically found. Here too there were no significant differences between the Gamblers and Non-Gamblers although a slight tendency for Gamblers to discount *Losses* less steeply was observed.

Discussion

When making choices that involve delayed rewards, Holt et al. (2003) found college-aged gamblers and non-gamblers to be indistinguishable. That is, the Holt et al. data suggests that college-aged gamblers and non-gamblers are similar in their ability to delay gratification. Holt et al. (2003) found gamblers to discount uncertain rewards less steeply than non-gamblers, showing that gamblers were more risk-taking than were non-gamblers.

Although previous research has found differences between individuals with gambling problems and those without, the present study found no significant differences. This may be due to the fact that the participants were not matched according to age, and thus the gamblers may have discounted more steeply than individuals the same age, but similarly to younger individuals.

Future research will match participants according to age in order to further understand how gamblers handle delayed/uncertain losses.