Loss aversion and its effects on delay discounting

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Background & Purpose

- Delay discounting (DD) describes the decrease in subjective value of a consequence as the delay to its receipt increases.[1]
- Individual differences in DD rate can be measured using an adjusting-immediate-amount (AIA) procedure.[2]
- In the AIA, adjustment direction (i.e. descending or ascending) systematically influences estimates of DD rate. This is termed the sequencing effect (see center, top).[3]
- Prospect Theory predicts framing effects influence choices, and sensitivity to framing effects may be estimated by measuring loss aversion (LA) in a mixed-gamble (MG) task. [4][5]
- The present study seeks to explain the sequencing effect by individual differences in LA.

Methods & Measures

Repeated-measures design

- All participants (predicted N = 80) will complete:
  - The AIA task twice – once in ascending sequence, and again in descending sequence; and
  - A mixed-gamble LA task.
  - All tasks will be presented in counterbalanced order.

Adjusting-Immediate-Amount (AIA) DD Task

- Participants choose between immediate vs. delayed hypothetical amounts of money.
- The delayed amount is held constant at $1,000.
- The immediate amount is adjusted in ascending or descending sequence (see center, bottom).
- The outcome variables is the *indifference point* (IP), or the subjective value of the delayed $1,000. IPs are obtained for seven delays and are modeled as in Figure 1.

Mixed-Gamble Loss Aversion Task (MG)

- Participants indicate whether they would accept or reject each of 255 gambles where there is a 50% chance of winning some amount of money and a 50% chance of losing some amount of money.

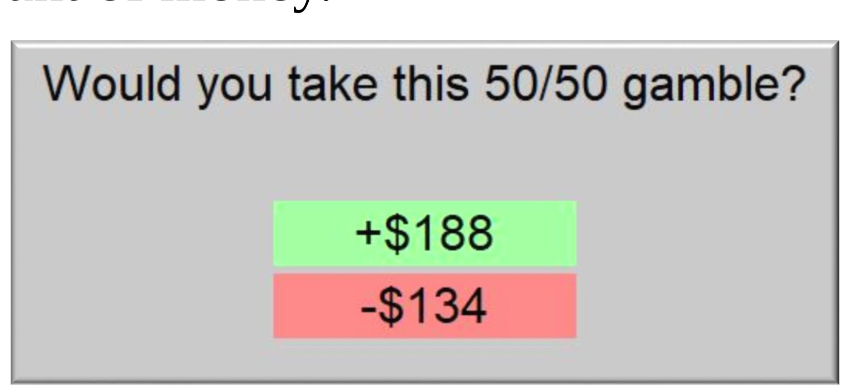

Figure 2. The MG Task. Participants accept or reject mixed gambles, and their results indicate how sensitive they are to losses.

The Sequencing Effect

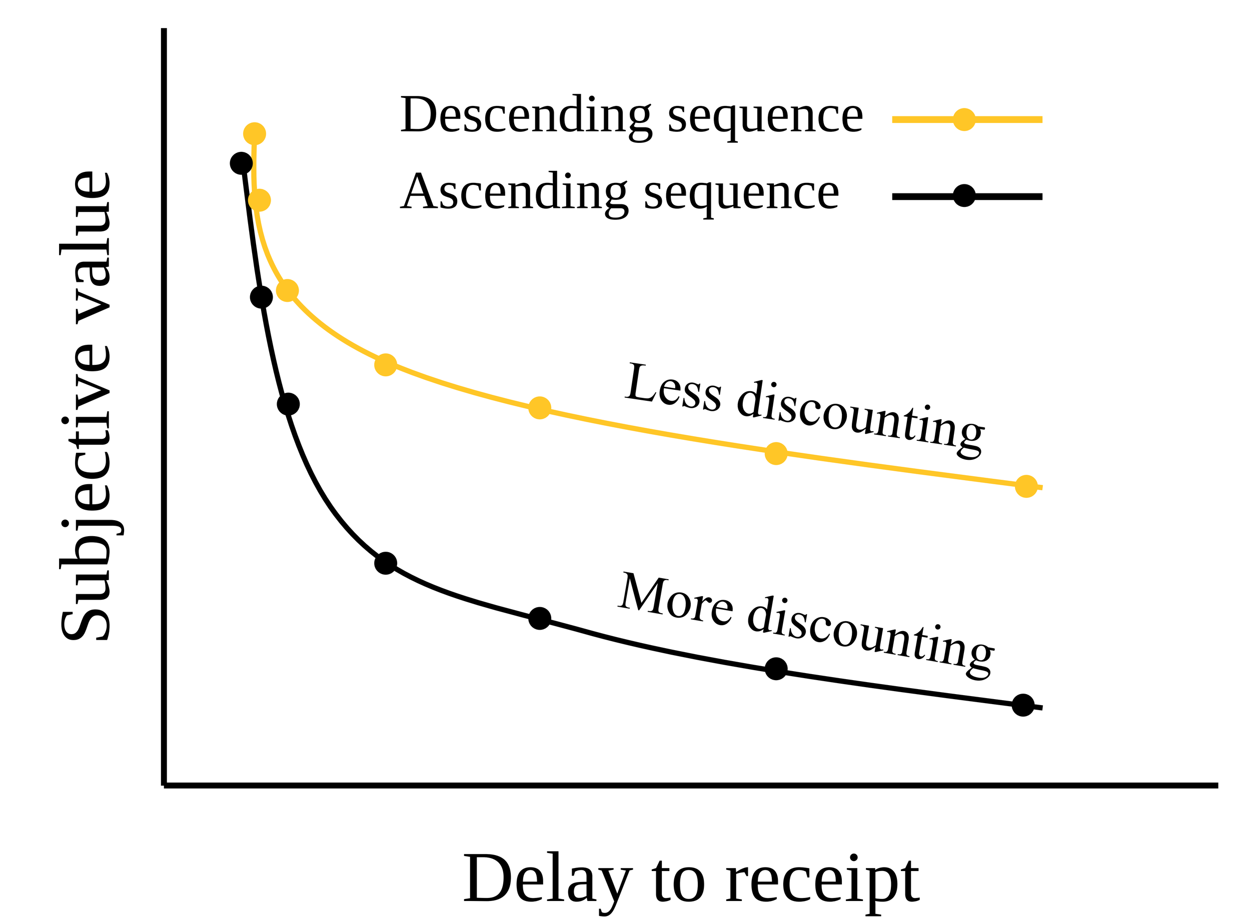

Figure 1. Hypothetical DD curves and indifference points. Value decreases as the delay to receipt of a consequence increases. This effect is more pronounced in the AIA when immediate values are adjusted upwards compared to downwards.

The AIA Task

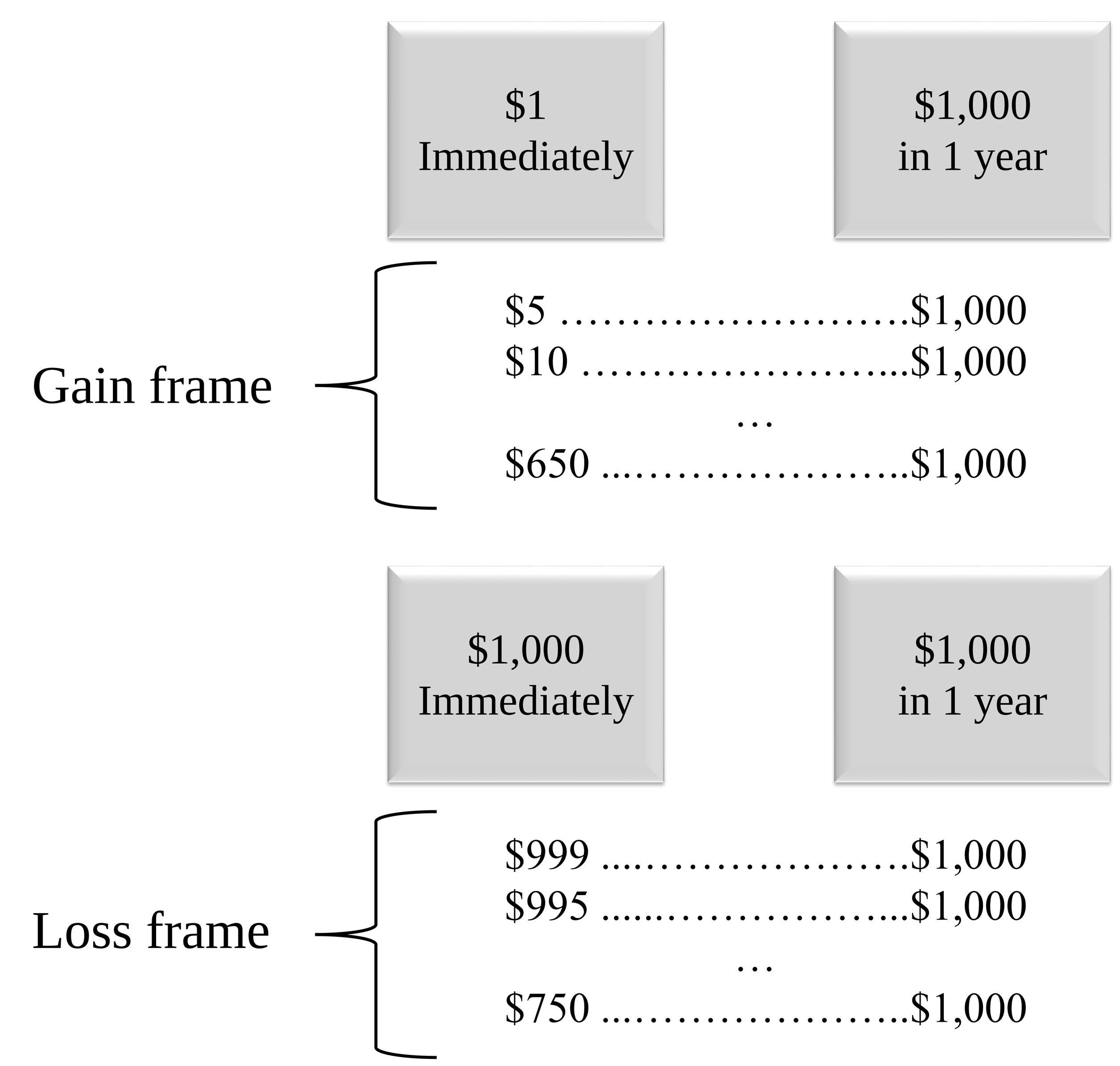

Figure 3. The AIA task. Participants indicate their preference between an immediate and a delayed reward. In the ascending sequence (top), the immediate value starts at the minimum ($1) and increases with each choice; in the descending sequence (bottom), it starts at the maximum ($1,000) and decreases.

Data Analysis & Hypothesis

Analysis of AIA Task data

- Each participant will produce 14 IPs: 7 in AS, and 7 in DS
- All IPs will be plotted, and two area-under-the-curve (AUC) measures will be calculated; one for each set of IPs.[5]
- AUC is a measure of DD rate, with lower values indicating more discounting (i.e., more impulsive choices).

Analysis of MG Task data

- Participants' choices to accept or reject gambles will be entered into a logistic regression model with each gambles' gain and loss amounts as predictors:

$$\ln\left(\frac{P(accept)}{1-P(accept)}\right) = \beta_{\text{gain}} \cdot \text{gain} + \beta_{\text{loss}} \cdot \text{loss}$$

- Next, LA will be estimated from the above model:

$$\lambda = \frac{|\beta_{\text{loss}}|}{\beta_{\text{gain}}}$$

which indexes an individual's differential sensitivity to losses relative to gains.

Hypothesis

- AUC will be smaller in the ascending sequence than in the descending sequence, and this will be mediated by λ:

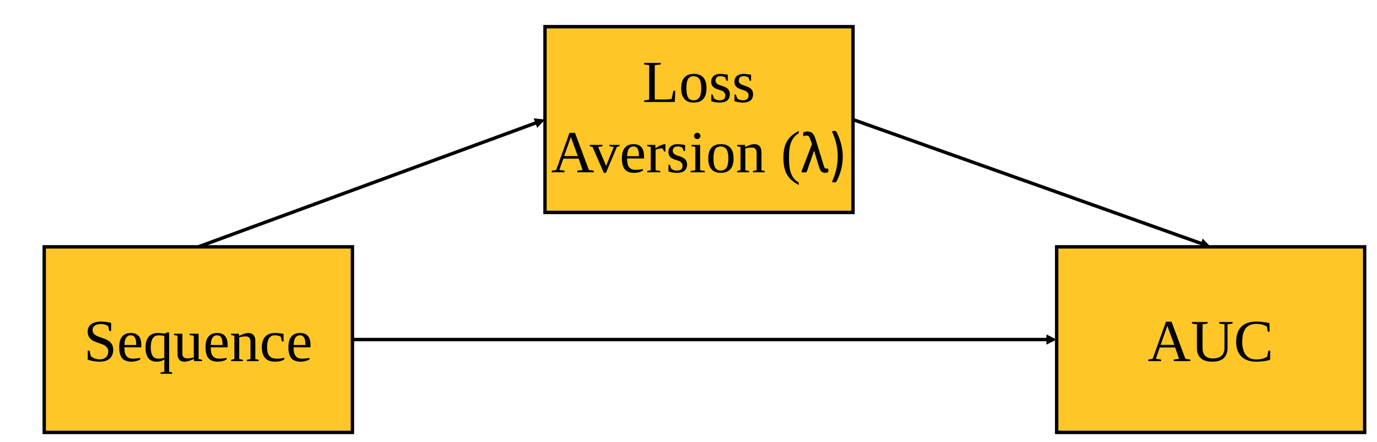

Figure 4. Proposed mediation of the relationship between sequence and AUC by LA (λ).

Implications

- Individual differences in DD rate are predictive of health-related behavioral outcomes such as drug use, cigarette smoking, and risky sex.[1]
- Support for the proposed hypothesis would indicate a mediating role of LA for not only DD, but potentially other psychometrically measured constructs as well.
- Characterizing the relationship between intertemporal choice and LA may lead to the development of a more valid and reliable measure of DD.

References. [1]Reynolds, B. (2006). *Behav. Pharmacol.*, *17*(8), 651–667. [2]Rachlin, H., Raineri, A., & Cross, D. (1991). *J Exp Anal Behav*, *55*(2), 233–44. [3] Robles, E., Vargas, P. A., & Bejarano, R. (2009). *Behav. Proc.*, *81*(2), 260–263. [4]Tversky, A., & Kahneman, D. (1992). *J Risk Uncertain* 5(4), 297–323. [5] Tom, S. M., Fox, C. R., Trepel, C., & Poldrack, R. a. (2007). *Science (New York, N.Y.)*, *315*(5811), 515–518.