



Temporal Discounting and Behavior

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Background

Monetary Delay Discounting is a technique used in economics, psychology and business to measure tradeoffs over time. It is solicited by finding an individuals' **indifference point** by asking them a series of "now or later" questions about money, and assessing the point at which participants value both options equally.

However, because discount rates can be calculated many different ways, and discounting questions can be asked many ways, it is unclear which method is most efficient to assess behavior.

Specific Aims

Temporal discounting has been associated with a large number of behaviors in the past, sometimes with conflicting results. This survey intended to offer confirmatory evidence for established behaviors, exploratory evidence for newly established behaviors, and explore which method is the strongest predictor of behavior. Overall, participants were measured on 39 confirmatory behaviors.

Table 1. Measures of Temporal Discounting

Discounting Task	Sooner Payment	Later Payment	Maximum Payment
Speedup large future	1 month	7 months	300
Speedup large present	today	6 months	300
Speedup small future	1 month	7 months	30
Speedup small present	today	6 months	30
Time discounting large future	1 month	7 months	300
Time discounting large present	today	6 months	300
Time discounting small future	1 month	7 months	30
Time discounting small present	today	6 months	30

Methods

Participants Data were collected via Amazon mTurk. We had a final sample of 846 (483 males, 357 females; ages 18-67) participants used in the analysis.

Discounting A total of eight different methods were used to elicit discounting, each with a six month delay between the sooner and the later payments. These eight different methods can be divided into two categories (speed-up and binary time discounting) that varied by both size of payment, and delay of first payment. In the speed-up measure, participants stated how much they would be willing to pay to speed up delivery of a later payment to a sooner time period. In the binary time discounting measure, participants simply chose if they would prefer the sooner or later payment. A total of 16 questions were used for each method (for a total of 128 discounting questions). **Table 1** summarizes the 8 methods used to elicit discounting.

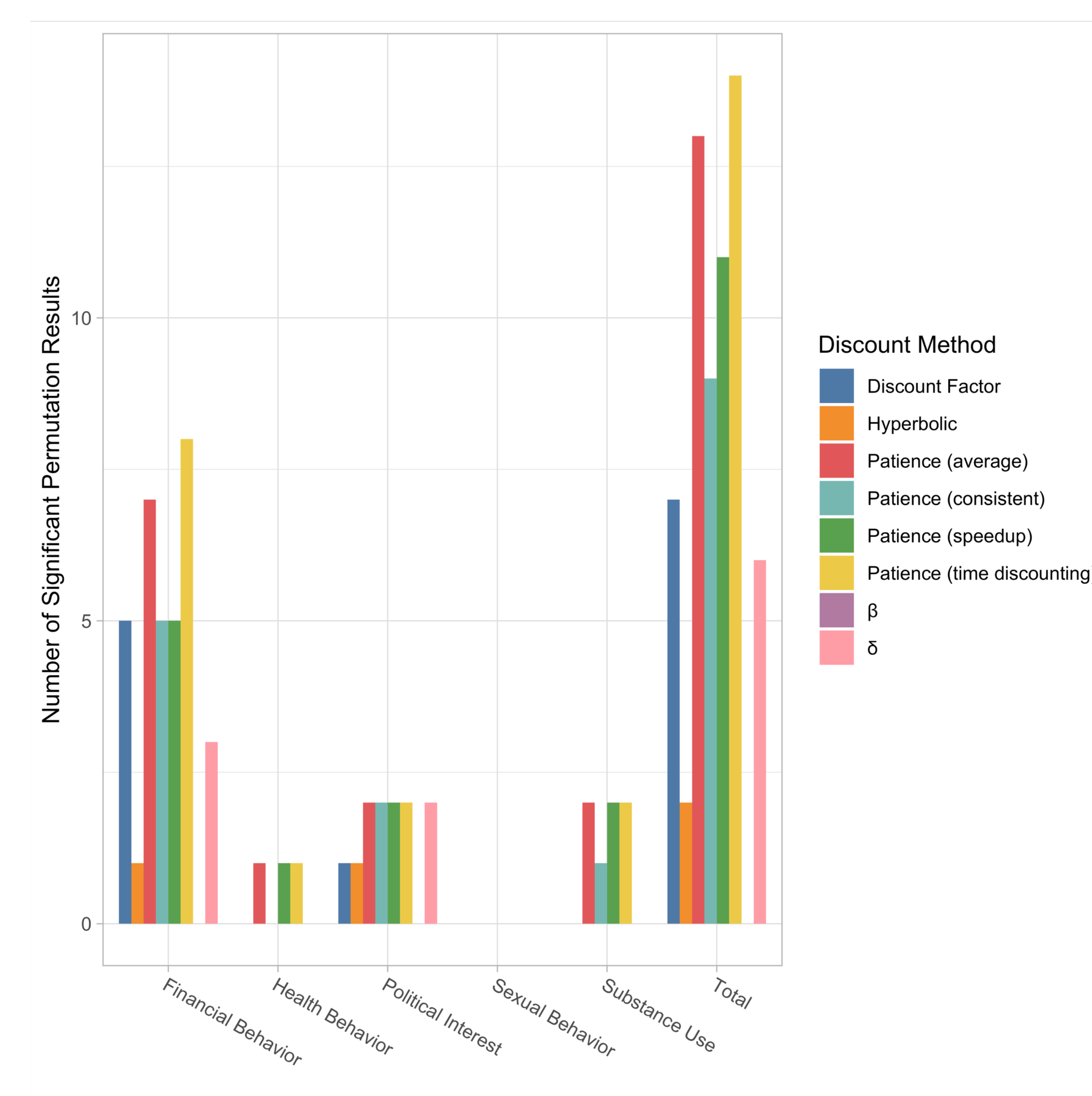
Once the indifference points were established, discount rates were measured via hyperbolic (k), exponential, beta-delta (quasi-hyperbolic), patience (proportion of later but larger choices), and discount factors (indifference / later but larger).

Analysis For any given continuously measured behavior, responses were reverted to ± 3 SDs from the question mean. Due to concerns about multiple testing, permutation tests were used as the most stringent form of p -value testing, where false distributions were created by randomly mixing outcomes 10,000-times and the probability of our actual result was tested within this distribution.

Results - Figure 1. Confirmatory Findings



Results – Figure 2. Significant Findings by Category



Conclusions

The results presented consistently indicate that the non-theoretical (non-parametric) discounting measures (patience scores, discount factors) are more strongly related to behaviors than the parameters from the theoretical models (hyperbolic, quasi-hyperbolic). It is therefore recommended that future studies continue the use of non-parametric studies. The study also fails to replicate several well established findings (e.g., BMI and time discounting). It is therefore recommended to exercise caution when evaluating time discounting studies with behaviors when measured in an online setting.

Limitations

The survey was limited to Amazon mTurk workers; behaviors were not measured in the lab. All discounting questions were hypothetical rather than using real payments. Because the later and sooner payments were only one month apart, quasi-hyperbolic estimates were likely underpowered. The survey was relatively long, with the 80th percentile at just under 20 minutes – possibly causing survey takers to be affected by fatigue.

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