



Amount and time exert independent influences on intertemporal choice

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Many personal finance decisions incorporate intertemporal trade-offs in which individuals must choose between different outcomes that are available at different times. They may face a trade-off between receiving a smaller monetary amount in the near term and receiving a larger monetary amount further in the future. Saving, investing and planning for retirement are just a few examples of intertemporal decisions.

Psychologists have traditionally modeled intertemporal decisions as involving exertion of self-control to overcome the temptation of an immediate reward. Researchers from Duke University performed experiments to understand how individuals process information to make these decisions, with implications for how interventions could be designed to influence intertemporal decision making.

RESEARCH QUESTION

The researchers assessed how individuals process choices between a monetary amount that will be received today and a monetary amount to be received in the future.¹ Since each choice provided options that differed along two key dimensions (monetary amount and payment timing), the researchers studied whether those two pieces of information were processed together (i.e., combined to determine the time-discounted value of each option) or separately (i.e., separately comparing the amounts across options and timing across options). Utilizing eye-tracking methods, the researchers also assessed whether individuals who made different decisions differed in how they prioritized and focused on information about amounts and timing.

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WHAT IS TIME DISCOUNTING?

The economic framework for assessing intertemporal decisions assumes that when individuals choose between receiving an outcome today versus in the future, the perceived value of the future outcome is reduced (“discounted”) relative to what the outcome’s perceived value would be if it were received today. In this way, the economic framework assumes that individuals combine time and amount information to make intertemporal decisions, rather than considering the two pieces of information separately. The more time that an individual must wait to receive an outcome, the more the individual discounts the outcome’s value.

When individuals discount future outcomes, economic theory interprets the discount as the application of a “discount factor” to the future outcome. An individual with a higher discount factor steeply devalues rewards received in the future, leading them to choose smaller rewards that are available sooner. In contrast, an individual with a low discount factor does not view future rewards as losing as much value, leading them to choose to wait longer for larger rewards.

¹ Future rewards were always offered within 365 days.

STUDY FRAMEWORK

The study recruited 117 participants in the primary research group and 100 participants in a replication sample (a sample used to replicate the primary results). Participants made a series of 141 intertemporal financial decisions, each requiring a choice between receiving an amount of \$0.50–\$10 today or \$10 on a date one to 365 days in the future. These options vary by two attributes: amount (monetary value) and time (timing of payment). While participants made these intertemporal choices, an eye-tracking device captured where each participant focused their attention and for how long. Each participant received \$6 cash on the day of the study and, for one of the intertemporal choices made in the study, also received an Amazon gift card reflecting the amount and timing of the participant's choice (e.g., if, for the relevant choice, the participant chose to receive \$10 at a date 15 days in the future, the participant received a \$10 Amazon gift card 15 days after participating in the study).

DESIGN

Participants were presented with intertemporal choices on a computer screen display. The display systematically presented each choice so that amount and time information were always shown in the same sections of the display, allowing an eye-tracking device to determine when the participant was focusing on certain pieces of information and for how long.² Researchers used this data to determine how participants prioritized and fixated on information, and whether participants processed amount and time information together or separately while making their decisions. Using data on each study participant's choices, the researchers estimated each participant's discount factor and compared how information was processed by individuals with higher versus lower discount factors (see the "What is Time Discounting?" info box for an explanation of discount factors).

RESULTS

The researchers found that participants who were more likely to choose options with larger rewards further in the future over receiving smaller rewards today (i.e., participants with lower discount factors) tend to place more weight on information about reward amounts than on time information. When incorporating amount and time information into their decisions, participants with lower discount factors tended to primarily compare amount information across their options. By contrast, participants who were more likely to choose options with smaller rewards today (i.e., participants with higher discount factors) tended to incorporate both the time and reward amount information into their decisions but placed more weight on time information.

TAKEAWAYS

Heuristics as a "Nudge" in Intertemporal Decisions

The researchers found that participants who were more likely to choose larger rewards further in the future (i.e., had lower discount factors) seemed to use a basic heuristic when making their decisions: they compared the amount information and chose the larger amount. This heuristic resulted in faster decision-making times than the time spent by individuals who appeared to incorporate all available amount and time information when making decisions. Though more research is needed, this finding suggests that interventions encouraging individuals to prioritize comparing reward amounts rather than time could reduce the effort involved in making intertemporal decisions and help individuals decide to wait for larger rewards further in the future when making intertemporal choices. Note, however, that this study focuses on short-term decisions over small dollar values where all options provide a reward within a year. Decisions over longer time horizons or different types of payments may be more complicated, and this heuristic may be too simple for such situations. There also may be situations where this heuristic does not align with an individual's goals or circumstances and therefore should not be applied.

²To check that the results of the study were not driven by individuals' predisposition to focus on certain parts of a computer screen, the researchers changed the orientation of the amount and time information in their replication study.

Revisiting Classic Economic Models

Duke University researchers found that most individuals make intertemporal decisions by processing reward and time information separately. This is in contrast with classic economic models that assume intertemporal decisions are made by combining information about time and reward amounts to arrive at the perceived discounted value of each option. The researchers also found that individuals with different discount factors tended to process information differently. For example, those who were more likely to be willing to wait for larger rewards tended to place more weight on amount information, spent more time looking at and comparing amount information, and processed amount information more quickly than individuals who preferred smaller, more immediate rewards.

IDEAS FOR FURTHER RESEARCH

Cognitive neuroscience is a field that shows promise in studying aspects of the personal finance ecosystem. Building upon this study's findings that individuals who are more willing to wait for larger rewards process intertemporal decisions differently, NEFE offers some suggestions for future research.

- **Additional Interventions:** More research remains to understand whether interventions that call attention to amount information can encourage individuals to wait for larger rewards, or if the causal mechanism for such choices requires deeper interventions.
- **Other factors or characteristics that may interact with time preferences:** Questions related to this research include whether and how other factors, such as an individual's available financial resources, culture, and financial socialization impact their intertemporal choices and may present in data as lower or higher discount factors. Understanding these factors will help to inform research into effective interventions.

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