# THINKING FAST AND SLOW:
# GENEROSITY OVER TIME

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ABSTRACT

Are individuals consistent when deciding whether to be generous? In this paper, we bring a new experimental method to the ongoing debate about whether a dual-system model is appropriate for describing generous behavior. Our design allows us to observe both (early) intuitive and (later) deliberate choices of the same individual and to see if these choices differ. We find that, rather than being intuitively selfish or intuitively generous, individuals become more selfish or more generous over time as a function of the efficiency of the generous act available. This result suggests that dual-system models with one selfish and one generous system are not appropriate for explaining generosity, but a dual-system model with one system that is particularly motivated by social efficiency might be appropriate. Our results call into question the use of revealed preference for welfare in the charitable domain and provide guidance to charities and policy makers.

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## I. INTRODUCTION

Significant attention in behavioral economics has been devoted to explaining why the same individual, faced with the same set of options, might make different choices at different times. Such models include projection bias (Loewenstein, O'Donoghue and Rabin, 2003), theories of consumption that depend on cues or emotions (Laibson, 2001), and hyperbolic discounting (Strotz, 1956; Laibson, 1997; O'Donoghue and Rabin, 1999, 2001).[1] Many of these models rely on differences in the environment or mental state (e.g., making choices about bundles today compared to tomorrow; making choices while happy or angry), even as the set of choices remain the same.[2] A more recent literature in psychology and behavioral economics has posited that even if there are no extraneous changes in environments or mental states, individuals may make predictably different choices when they take more time to make a decision. These dual-system or dual-process models suggest that a fast and intuitive system (or hot, instinctive, or automatic system) may make systematically different choices than a slower and more calculating system (or a cold, reflective, or controlled system), see Kahneman (2003, 2011, 2013).[3] In economics, dual-self models operate under a similar premise, although they often incorporate a strategic interaction between the two selves, as in Bernheim and Rangel (2004), Benhabib and Bisin (2005), and Fudenberg and Levine (2006).

Specific attention has been paid to whether the intuitive and fast system is more altruistic — that is, whether individuals show more generosity when choices are made quickly.[4] The recent Social Heuristics Hypothesis (see Rand et al., 2014 and Bears and Rand, 2016) argues that fast, intuitive responses are shaped by past experience and prescribe behavior that is typically advantageous in daily life social interactions. In these interactions, which are often repeated, cooperative behavior may be optimal and so the intuitive system adopts cooperative or altruistic tendencies. In contrast, deliberation allows a decision to adjust to the specific social situation, such as being selfish in response to an anonymous, one-shot

[1] For empirical validation of these models, see e.g. Conlin et al. (2007); Simonsohn (2010); Schwarz and Clore (1983); Lerner, Small and Loewenstein (2004); Kirchsteiger, Rigotti and Rustichini (2006); Frederick, Loewenstein, and O'Donoghue (2002); Augenblick, Niederle and Sprenger (2015); Kessler, McClellan and Schotter (2016). Additional very recent models and evidence include work on attribution bias (Haggag and Pope, 2016) and learning with misattribution of preferences (Bushong and Gagnon-Bartsch, 2016a, 2016b).

[2] For example, Grimm and Mengel (2011) show that rejections in the ultimatum game are reduced if the responder has a few minutes to "cool down" before deciding whether to accept or reject an offer.

[3] In psychology, dual process theories have their origins in the 1970's (Wason and Evans, 1975; Posner and Snyder, 1975; and Schneider and Shiffrin, 1977). For more recent work see Sloman (1996); Gilovich, Griffin and Kahneman (2002); and Sanfey, Loewenstein, McClure and Cohen (2006) as well as overviews by Evans (2008), Weber and Johnson (2009), and Evans and Stanovich (2013).

[4] Interestingly, the fast and intuitive system was initially thought to be more selfish (see, e.g., DeWall et al., 2008), as a common view was that the fast and intuitive system is shared with animals that are generally considered to be selfish and aggressive (Dawkins, 1976). More recently, the view that the intuitive system is more generous has become more popular. For a discussion on this change, see Zaki and Mitchell (2013).

giving opportunity. The evidence for showing that earlier, faster choices are more generous consists of results in two paradigms. In the first paradigm, researchers correlate response times with choices (Rand, Greene and Nowak, 2012). In the second paradigm, researchers aim to experimentally manipulate the system or process that makes a decision, for instance by requiring subjects to either answer quickly or slowly (Rand, Greene and Nowak, 2012). Both these paradigms have come under considerable attack, casting doubt on whether — within an individual — an early, fast, intuitive choice is predictably more generous than a later more deliberate choice.[5] Indeed, there is no satisfactory evidence ruling out the standard story that individuals exhibit stable choices in situations where they decide between a selfish or generous act; and, hence, there is no satisfactory evidence on whether dual-system models have empirical value for generous behavior.

In this paper, we directly test whether an individual's generosity reliably changes the longer the individual deliberates on a decision. We use an experimental technique introduced by Caplin, Dean and Martin (2011), which incentivizes choices of agents over time. Subjects face 10 prisoner's dilemmas and 10 dictator games. In each question, subjects decide whether or not to transfer $1 to give $X to another subject, where X ranges from $0 to $10 across questions. For each question, subjects have 60 seconds during which they can record an initial answer and then subsequently change their answer if they would like to do so. For the specific question that is chosen for payment, one of the 60 seconds is randomly selected, and the choice recorded by the subject at that second is the choice implemented for payment. If no choice is made at the randomly chosen second, both the decision maker and the other subject earn nothing. The subject is therefore incentivized to make a fast initial choice and also to change the choice as soon as possible whenever the subject considers a different choice to be optimal.

We find that most subjects change their choices in at least some questions. Our main result is that at low exchange rates, subjects become less generous over time, consistent with the previous literature. In contrast, however, at high exchange rates — when being generous is more efficient — subjects become more generous over time. We have several robustness tests and control treatments to confirm that these changes are not due to subjects providing first choices that are random or reasonless and later correcting those choices. Another alternative explanation for our results is that first choices, while not completely random, are still only imperfect implementations of fixed underlying preferences because subjects need time to process exchange rate information. We explicitly test this alternative hypothesis and can rule it

[5] We discuss in Section III how the work of Rubinstein (2016), Recalde, Riedl and Vesterlund (2014), Krajbich et al. (2015), Tinghög et al. (2013), and Bouwmeester et al. (2017), among others, cast doubt on the conclusions based on the existing evidence from these paradigms.

out. We conclude that subjects reliably change their preferences, responding more to exchange rates over time when deciding whether to be generous and becoming systematically less generous at low exchange rates and more generous at high exchange rates.

We therefore provide direct evidence that choices in decisions involving generosity predictably change when comparing early choices to later choices made after deliberation. Our findings support modeling generous behavior with a dual-system or dual-process model. However, we should not consider one of the systems to be generous and the other to be selfish. Instead, we may want to model the slow and deliberate system as caring more about social efficiency than the intuitive system. As such, our results lend support for the dual-process model of Loewenstein and Small (2007), which posits one immature and irrational process, called "sympathy," and another rational but more uncaring process, called "deliberate."[6] Note that our experiment is not designed to address whether there is an inherent strategic conflict between the two systems (as in most dual-self models) or whether different systems simply differ in their preferred choices.

Our results imply that welfare considerations based on revealed preference may be complicated when analyzing decisions involving generosity. With conflicting preferences between systems, it may not be obvious which system prefers the selected choice, and it may also not be clear which preferences we should honor for welfare analysis. Our results also speak to how individuals can be encouraged to donate to charity or to provide other public goods. The findings of our experiments suggest that less-efficient charities should encourage fast donation decisions (for example, by asking for donations in time-sensitive situations) while efficient charities should encourage potential donors to deliberate about giving. We discuss these implications in the conclusion.

The rest of the paper proceeds as follows. Section II describes the experimental design. Section III outlines hypotheses for behavior that motivated our design. Section IV presents our main results. Section V presents robustness tests. Section VI introduces an additional control treatment showing that our results are due to changing preferences rather than computational difficulties. Section VII discusses how our results speak to the literature on fast and slow choices and the drift diffusion model. Section VIII concludes.

[6] Our results are aligned with a recent investigation that uses a technique similar to the one employed in this paper. Dyrkacz and Krawczyk (2015) ask subjects to answer the questions from Charness and Rabin (2002) and allow them to change their choice at most once within 60 seconds. They find evidence that more deliberation leads to less pronounced disadvantageous inequality aversion, but their results include data consistent with more deliberation leading to more efficient outcomes.

## II. EXPERIMENTAL DESIGN

### II.1. Games

Our main set of experimental subjects play 10 dictator games and 10 prisoner's dilemmas. In each of these 20 questions, subjects face a binary decision: either give-up $1 to transfer $X to another subject, or keep the $1 and transfer $0. For each game type (dictator game and prisoner's dilemma) each subject saw 10 different X values: 0, ½, 1, 2, 3, 4, 5, 6, 8, and 10, in random order.

In each prisoner's dilemma (denoted "PD X" where X is the exchange rate), the subject is endowed with $1. Her payoff depends on her decision as well as the decision of another subject who has the same opportunity to give up $1 in order to transfer $X. Each prisoner's dilemma has a corresponding dictator game (denoted "DG X" where X is the exchange rate) in which the dictator is endowed with $X+1, which is the amount of money the subject would have if she were playing in the corresponding PD X and the other player decided to transfer the $1. For a given exchange rate X, the payoffs PD X and DG X are given by Table 1.

**Table 1**: Payoffs in the games for a given exchange rate X

| | DG X | PDX | |
|---|---|---|---|
| Subject's Decision | | Other subject's decision | |
| | | Transfer | Do not Transfer |
| Transfer | X, X | X, X | 0, X+1 |
| Do not Transfer | X+1, 0 | X+1, 0 | 1, 1 |

### II.2. Choices over Time

We employ an experimental technique introduced by Caplin, Dean and Martin (2011) that incentivizes choices of agents over time.[7] Before each question, subjects are shown a screen for 10 seconds that describes the question they are about to answer but withholds information about the exchange rate X. Subjects are then shown the relevant parameter (i.e., the exchange rate X) and have 60 seconds on the decision screen.[8] At each point during those 60 seconds, subjects can record an initial answer or change their answer. As shown in Figure 1, the decision screen reminds subjects of their current choice, lists their previous choices, and has a timer indicating how many of the 60 seconds remain. For the question that is chosen for payment, one of the 60 seconds is randomly selected and the choice recorded by the subject at

[7] Agranov, Caplin and Tergiman (2015) uses the same technique to study behavior in guessing games.

[8] To ensure subjects are ready for a question to begin, subjects see a waiting screen that required them to press a button to advance to the next question. Only after they press this button do they see the instructions for 10 seconds, followed by the decision screen for 60 seconds.

that second is implemented for payment. If subjects have not yet made an initial decision at the randomly chosen second, they receive no payment for that question (and neither does the other subject). We call these "timed" questions to distinguish them from questions answered in the standard way (i.e., in which a subject takes as much time as she wants to record one answer), which we call "untimed" questions.

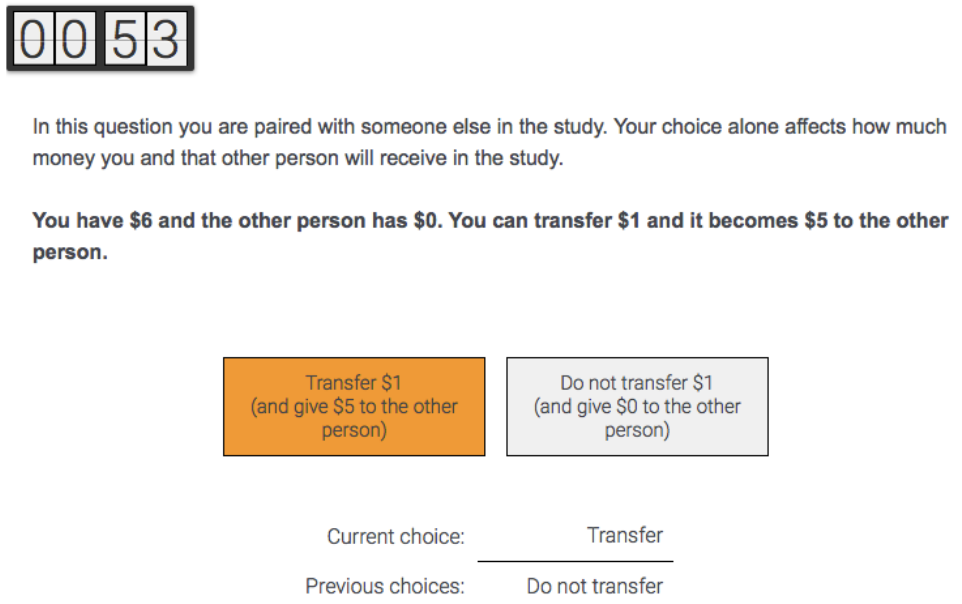


**Figure 1:** The decision screen for timed questions.

*Notes*: Figure 1 shows how the decision screen would look in the DG 5 question if a subject first made a choice of "Do not transfer $1" and then switched to "Transfer $1" at some point in the first 7 seconds of the minute. A subject who has not yet made a choice would see both buttons in light gray, just like the "Do not transfer $1" button appears here.

While the payments in the dictator game are straightforward, the payment of a subject in the prisoner's dilemma also depends on the choice of the other subject. Specifically, we tell subjects that their earnings will depend on what the other subject choses at second 15 (or 45).[9] The number 15 or 45 was randomly selected at the subject level, and the same number was used for all the prisoner's dilemma questions that subject answered. Even though our decision maker of interest is being given the opportunity to potentially change her choice over time, we fix the second for the other subject's choice to rule out changes in behavior arising from decision makers who want to match the choice of the other subject and believe that

[9] Specifically, before each of the 10 dictator games, the instructions read: "In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study." Before each of the 10 prisoner's dilemmas the instructions read: "In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you. Your earnings will depend on what they choose at second [15/45]."

the other subject is getting more selfish or more generous over time. Our design guarantees that each decision maker is facing a static choice from the other subject over the course of the 60 seconds.

This experimental paradigm allows us to observe choices of subjects over time. That is we have the potential to observe an early "intuitive" choice and a different, later "deliberate" choice. Because subjects receive no payment if there is no answer recorded at the randomly chosen second, subjects have an incentive to answer quickly. This feature makes us optimistic that initial answers recorded by subjects will be intuitive rather than deliberate choices. One concern, however, is that the experimental paradigm might also lead subjects to initially record a random or immediate choice (i.e., a choice made before the subject has even read the question or had time to generate an intuitive answer), which we call a "reasonless" choice. Recording a random answer may in fact be rational depending on a subject's beliefs about the likelihood that some answers are associated with negative payoffs and/or the extent to which recording a random choice slows down a subsequent choice that is a function of the parameter. In Section II.3, we describe the control treatments we use to determine to what extent initial choices are reasonless. In addition, in Section V, we use data from the main experiment to once more evaluate the extent of reasonless choices. The structure of the incentives in timed questions also guarantees that as soon as a subject would like to make a different choice, she should implement the new choice as quickly as possible, thereby increasing the probability it will be recorded at the second randomly selected for payment. Specifically, at each moment, a subject should have recorded the choice that she considers optimal. Consequently, later answers should reflect deliberate choices.

**II.3. Control Treatments**

To measure how long subjects take to make a choice in dictator games and prisoner's dilemmas when they are not under time pressure to record a first choice, we ran two control treatments in which subjects answered questions in the standard "untimed" way. In those, subjects answered 10 timed questions of one game type and then answered 10 untimed questions of the other game type.[10] Subjects answering untimed questions saw the same decisions screen as in Figure 1 but without the timer or table of choices (see Figure A1 in the Appendix). Subjects had as many seconds as they wanted before they made a single decision.

We ran two versions of the untimed control treatments. In the "last choice" treatment, after subjects made a choice they had to click a decision button to advance to the next screen for the choice to be implemented

[10] For example, if subjects' timed questions were dictator games, then their untimed questions were prisoner's dilemmas.

(the decision button is labeled ">>" in Figure A1). In particular, they could click either of the two choice buttons (i.e., "Transfer $1" and "Do not transfer $1") as often as they wished, but only their last choice was implemented as their answer to the question. In this "last choice" control treatment, the time of choice is recorded as the last time at which the subject clicked one of the two choice buttons — "Transfer $1" or "Do not transfer $1" — before clicking the decision button to implement their choice.

While having the option to click multiple choice buttons resembles the timed treatment, it could be that subjects still thought about their answer between the time they last clicked one of the two choice buttons and the time at which they clicked the decision button to implement their choice. We therefore ran a second version of the untimed control treatment that, while depriving subjects of the ability to click multiple buttons, measures precisely how long a subject takes to submit a final answer. In the "single choice" control treatment, subjects faced the same screen as in Figure A1 but without the decision button. Subjects could take as much time as they wanted to make a choice, but as soon as a subject clicked on either the "Transfer $1" or "Do not transfer $1" button, that choice was implemented as their answer to the question. The time of the choice for the "single choice" control treatment was simply the time at which the subject clicked one of the two choice buttons.

We ran a final control treatment to investigate the extent to which subjects have difficulty in processing information about the exchange rate X, which we introduce here and discuss in detail in Section VI. In the "accounts" treatment, subjects make the same choices about whether to transfer $1 for $X as in dictator games, but they also receive the $X generated as a result of the transfer. That is, we eliminate the other subject and thus eliminate generosity as a motive for making the transfer. In particular, subjects are told that: they have two accounts, they receive the money in both accounts, and transferring $1 from one account gives $X to the other account. A subject who wants to maximize their payoffs, just like a subject who wants to maximize the sum of payoffs in the dictator game, should transfer $1 whenever the exchange rate X is 2 or higher and should not transfer $1 when the exchange rate X is 0.5 or 0. To ensure that we can compare choices and how long subjects took to make them, the interface of the accounts treatment mirrors that of the dictator game as much as possible (see Figure A2 in the Appendix).[11]

In all treatments, subjects were paid based on their choices for one randomly selected question.[12] We describe the subject pool in Section IV.

[11] Subjects who answered the 10 "account" questions then answered 10 dictator games or the prisoner's dilemmas in the "single choice" control treatment.

[12] The instructions for all treatments are available in Appendix B. After being asked the dictator game and prisoner's dilemma questions for this study, most subjects also answered a timed "sanity check" question that asked them

## III. THEORY

In this section, we discuss the hypotheses for behavior that motivate our experimental design. We indicate how we test between competing hypotheses and discuss the related literature by highlighting how previous results speak to these hypotheses.

***Hypothesis I: Stable preferences and choices***. This hypothesis posits that optimal choices of subjects do not change over time. Much of the previous work that claims to support dual-system models uses either correlational evidence (e.g. comparing fast to slow choices) — so cannot directly rule out hypothesis I — or attempts to experimentally manipulate the cognitive process making a decision (e.g., by varying time to a decision) — leading to selection problems that have met with harsh criticism.

The literature that compares choices of fast and slow subjects typically finds that selfish individuals are slower in making choices.[13] However, for such findings to be evidence of a dual-system model, or to rule out hypothesis I, one must assume that subjects are similar in their thought processes, but some happen to answer questions fast (and hence make intuitive choices) while others answer slowly (and hence make deliberate choices). Three criticisms challenge this central assumption and suggest other reasons why response time might correlate with choices, even among individuals with stable preferences. The first criticism is the most direct, namely that differences in reaction time may be due to selection rather than treatment. For example, Rubinstein (2016) argues that people who make fast choices are different from those who make slow choices. The second criticism posits that, rather than being intuitive, choices that are fast are less responsive to parameters and more "reasonless".[14] Recalde, Riedl and Vesterlund (2014) show that by changing the parameters of the game to make reasonless choices more or less generous, fast choices by subjects can be made to be either more or less generous (see also Rubinstein 2007, 2013). The third criticism is that single-system choice models that argue that reaction time is a function of the "difficulty" of a decision (such as evidence accumulation or drift diffusion models) also lead to aggregate

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whether they wanted to earn -$1, $0, or $1 for the question. Of the 466 subjects asked this question, 464 (99.6%) answered $1 as their last recorded choice (the other 2 selected $0 as their last recorded choice), suggesting that subjects understood how the timed questions worked. In addition, after making all choices for this study, some subjects were asked additional, unrelated timed and untimed questions to pilot questions for other studies.

[13] See Rubinstein (2007) on the ultimatum game; Rand, Greene and Nowak (2012), Lotito, Migheli and Ortona (2013), and Nielsen, Tyran and Wengström (2014) on public good games; and Cappelen et al. (2016) on dictator games. However, not all findings follow this pattern. Piovesan and Wengström (2009) find that selfish choices in dictator games are faster and Lohse, Goeschl and Diederich (2016) find that those who decide to keep money rather than contribute to climate change mitigation efforts decide faster.

[14] Rubinstein (2007) classifies an action as "reasonless" if it is likely to be the outcome of a random process with little or no reasoning about the decision problem.

correlations between decision speeds and choices (for more detail see Section VII).[15] All three criticisms directly attack the presumption that choices of fast subjects differing from choices of slow subjects is evidence that individuals have two systems that make predictably different choices. To summarize, correlational evidence cannot rule out hypothesis I.[16]

The second leading method to investigate dual-system models is to experimentally manipulate the cognitive process and assess the impact on choices. The most common manipulation is time pressure, in which subjects are asked to make choices either very quickly or to not make a choice before a specified amount of time has elapsed. For example, in Rand, Greene and Nowak (2012) subjects in a four-player public good game were randomly asked to record a choice in the first 10 seconds, or after 10 seconds had passed. While subjects under time pressure contribute more to the public good than those under time delay, only half of the subjects in the time pressure condition comply (compared to about 80% in the time delay condition). This failure to comply has sparked a controversy (see Tinghög et al., 2013). A Registered Replication Report (Bouwmeester et al., 2017) of Rand, Greene and Nowak (2012) confirms that selection is an important driver for the result that choices under time pressure differ from choices under time delay.[17] Other manipulations of the cognitive process include cognitive load, ego-depletion, and asking subjects to use an intuitive or deliberate decision process. Each of these approaches has met with their own criticisms.[18]

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[15] These models predict that less conflicted individuals, that is, individuals who have a larger difference in utility between the two available options, make faster choices. Hence, when giving is very efficient, generous subjects will be less conflicted than selfish subjects, and hence a heterogeneous pool of subjects with stable preferences will lead to fast choices being more generous than slow choices. The opposite will be the case when giving is less efficient and hence generous subjects are more conflicted than selfish ones. Krajbich et al. (2015) provide evidence that dependent on the efficiency of giving in public good games, fast choices are sometimes more generous than slow choices (efficient giving) and sometimes less generous (inefficient giving). For a theoretical model of such an optimal sequential sampling problem, see Fudenberg, Strack and Strzalecki (2015). Evans, Dillon and Rand (2015) also argue that decision conflict drives reaction times. See also Hutcherson et al. (2015).

[16] While the criticisms argue that the evidence comparing fast to slow subjects is consistent with hypothesis I, it of course does not prove it. For example, while there may be heterogeneity across subjects, or while drift diffusion models may guide the speed of decisions, it could still be that when a specific person keeps deliberating about a decision problem, his later choices predictably differ from his early ones. Indeed, we will show evidence that decisions change over time within an individual.

[17] Specifically, the replication report involved 3596 participants from 21 laboratories. Across this data, 92.5% of subjects complied in the time delay treatment but only 34.1% complied in the time pressure treatment. When non-compliant subjects are included in the data, there is no effect of time pressure on contribution — if anything, those under time pressure were 0.37 percentage points less generous. See also Rand's comment on the Registered Replication Report, Rand et al. (2014), and Rand (2016) on meta-analyses on experimentally promoting intuitive choices or deliberate choices.

[18] In cognitive load studies, subjects engage in an easy or difficult cognitive task while participating in a game. In ego-depletion studies the idea is the same, only that instead of performing the cognitive task while making choices, subjects do them before making choices. However, recent work has suggested that ego-depletion may rather reduce subjects' motivations to use resources to make choices (Inzlicht and Schmeichel, 2012) and may perhaps not be a

Our experiment is designed to directly test whether the same individual changes her choice over time, avoiding the existing criticisms in the literature and ruling out hypothesis I directly. In particular, we compare first and last choices of subjects to identify whether choices change over time within an individual. Before we can assert that preferences are changing, however, we have to rule out two alternative explanations for why choices may change over time in our experiment (hypotheses II and III).

***Hypothesis II: Design-driven artificial manipulation of first choices.*** One concern with our design is that it incentivizes subjects to make fast first choices, perhaps so fast that first choices are reasonless. In that case, even subjects with fixed preferences may have to correct their initial, reasonless choices with choices based on their preferences. If in our paradigm subjects make first choices that are too fast for them to process the exchange rate information, then changes in choices may be these corrections rather than changes in preferences.

We assess hypothesis II in two ways. First, we test whether the timed design results in subjects making unusually fast choices. Specifically, we compare the speed of choices in the two "untimed" control treatments (where questions are asked in the standard way) to the speed of first choices in our "timed" treatments. Second, we check whether the results we find are robust to: (i) changing recorded first choices that appear reasonless to more "thoughtful" first choices, for example treating second choices as first choices if first choices were changed quickly[19] and (ii) only analyzing subjects whose first choices appear to systematically depend on the parameters of the game.[20]

However, even if first choices in our paradigm are not unusually fast or reasonless, a change in choices does not necessarily imply that a fast-choice system has inherently different preferences than a slow-choice system. Specifically, it could be that a subject has fixed underlying preferences that do not change, but an early choice may be a less-perfect implementation of those preferences than a later choice for reasons outlined in hypothesis III.

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robust phenomenon (Hagger et al., 2016). Likewise, Kessler and Meier (2014) cast doubt on the robustness of cognitive load manipulations.

[19] For example, imagine a first choice is changed almost immediately (e.g., a second choice is recorded less than 2 seconds after the initial choice is recorded). We might argue that the true first choice is actually the second choice, since the first choice was almost immediately corrected and, hence, presumably a mistake. We then perform our analysis treating the second choice as the first choice.

[20] For example we look only at subjects whose first choices are monotone in the exchange rate X (i.e., if they transfer the $1 in their first choice at an exchange rate X, they transfer the $1 in their first choice for any exchange rate Y>X). Being monotone is not trivial as subjects see the 10 exchange rates in random order.

***Hypothesis III: Processing exchange rate information takes time***. Subjects may change their behavior in our experiment because it takes time to process the parameter of the game (i.e., the exchange rate). If this is the case, subjects' first choices may be different from their last choices because their first choices reflect computational mistakes and additional time allows subjects to better compute outcomes.

We assess hypothesis III by using the accounts treatment to evaluate a subject's ability to process exchange rate information. If subjects' choices change in the main treatment due to difficulties in processing exchange rates, then we should see similar behavior in the accounts treatment. However, if changes in choices follow a different pattern in the main treatment than in the accounts treatment, then changes in choice in the main treatment cannot be solely attributed to difficulties in processing exchange rate information.

Once we rule out hypotheses I, II and III and determine that preferences indeed change over time, we aim to distinguish between three hypotheses for how and why preferences change.

***Hypothesis IV: Uniform changes in pro-social behavior or inequity aversion over time.*** The dual-system model posits that there are two systems (or selves) where one is fast and intuitive and the other is slow and deliberate. The main hypothesis of the recent literature suggests that the fast, intuitive system is more pro-social than the slow, deliberate system. A recent explanation is the social heuristics hypothesis (Rand et al., 2014; see Bear and Rand, 2016, for a more formal approach), which argues that fast, intuitive responses are shaped by past experience and prescribe behavior that is typically advantageous. Since everyday social interactions are likely to be repeated interactions (where cooperation may be more advantageous than selfishness), first intuitions are likely to be cooperative. In contrast, deliberation allows decisions to adjust to specific social situations and can override the intuitive response.[21] There are other reasons why the more an individual thinks about a decision that involves another person the more (or less) the individual may value the contribution made to the other person. This could be because altruism (i.e., the weight a subject places on the utility of another person, see Becker, 1974) changes over time. It could also be that the warm glow a subject receives from giving to the other person (see Andreoni, 1989, 1990) changes over time.[22]

[21] Similarly, in environments with important future consequences, deliberation can lead to the recognition that cooperation is important. Consequently, in strategic situations, deliberate choices may be more cooperative than intuitive choices.

[22] For a recent debate on what fraction of giving might be attributable to altruism or warm glow motives see Ottoni-Wilhelm, Vesterlund and Xie (2014).

In our design, being generous by transferring $1 is associated with eliminating inequity between the payoffs (for certain in dictator games and potentially in prisoner's dilemmas). Therefore, in our experiment, a result that individuals' generosity consistently changes in one direction over time is also consistent with changes in inequity aversion over time (see Fehr and Schmidt, 1999 and Bolton and Ockenfels, 2000 on inequity aversion; see Cooper and Kagel, 2016, for a recent survey).

***Hypothesis V: Changes in beliefs or weight on reciprocity.*** In prisoner's dilemmas, subjects may care about reciprocity (Rabin, 1993) and changes in choices over time could be due to changes over time in the weight a subject places on reciprocity or changes over time in a subject's beliefs about the action of the other subject.

Since most of the previous literature has only studied games where several subjects make choices, like prisoner's dilemmas or public good games, it has not been able to assess hypothesis V compared to hypothesis IV (or VI, which we describe below).[23,24] To evaluate hypothesis V, we compare prisoner's dilemmas to the corresponding dictator games with the same exchange rate. Subject's options are similar in the two settings — in both cases, transferring $1 generates $X for the other subject. But only the prisoner's dilemmas involve beliefs about the other subjects' behavior, since only in those questions does the other subject have the option to take an action that impacts payoffs. If behavior changes in a similar way in both types of games, this suggests that hypothesis V alone cannot fully explain the data.

Instead of beliefs or concerns about others' behavior changing over time, it could be that what changes over time is the relative weight subjects put on their own payoff relative to that of the other subjects.

***Hypothesis VI: Changes in concerns for social efficiency over time.*** This hypothesis posits that subjects' concern for social efficiency changes over time (see, e.g., Charness and Rabin, 2002, on how subjects respond to social efficiency in static decisions). This would allow changes in generosity over time to depend on the exchange rate X. For example, subjects could show more concern for social efficiency over time.

[23] Note that most of the previous literature also has to contend with the fact that the actions other players choose may depend on how much time they take to make a decision. We avoid this issue in our design, since we fix the action of the other player to be the action taken at second 15 or 45, randomized at the subject level. Consequently, while making decisions over the course of the minute, our subjects do not need to worry (in terms of monetary consequences) about whether others are changing their behavior over time.

[24] The exceptions are a small set of papers on dictator games that have found fast dictators to be less selfish (Cappelen et al., 2016) or more selfish (Piovesan and Wengstrom, 2009; Lohse, Goeschl and Diederich, 2016). There are also two papers on responder behavior in ultimatum games, where those accepting offers are either faster than those rejecting offers (Fischbacher, Hertwig and Bruhin, 2013) or equally fast (Rubinstein, 2007).

Since a large fraction of previous work on changes in generosity over time focused only on one (or a very small set) of exchange rates, previous work has not been able to evaluate whether choices change over time in this more nuanced way.[25]

## IV. RESULTS

Of the 734 subjects in our experiment, 639 participated in the main timed treatment and the "last choice" untimed treatment and 95 subjects played in the "accounts" treatment followed by the "single choice" untimed treatment. Of the 734 subjects, 367 subjects were University of Pennsylvania students who participated in the Wharton Behavioral Lab (WBL) and 367 subjects participated on Amazon's Mechanical Turk (MTurk) platform.[26]

In this paper, we restrict analysis to the 553 out of 639 subjects in the main treatment and 94 out of 95 subjects in the control treatments who satisfy two conditions. First, subjects must have recorded at least one answer for each of the 20 questions they faced. This criterion eliminates subjects who got distracted or who switched out of the web browser in the middle of the study and let a question go by without recording an answer. Based on this criterion, we exclude 12 subjects from the WBL and 60 subjects from MTurk. Second, subjects must make fewer than 40 choices (i.e., switch fewer than 40 times) in each of the timed questions they face. This cutoff arises because the maximum number of choices that the experimental software could be guaranteed to record for any given question was 40. Based on this criterion, we exclude 12 subjects from the WBL and 3 from MTurk. Consequently, our main analysis focuses on 647 subjects (343 from WBL and 304 from MTurk). In what follows, we mostly combine the data from these two subject pools. While there are some differences in the baseline level of generosity between MTurk and WBL subjects, we show in Appendix Table A1 that across the two subject pools subjects are otherwise quite similar with regard to how fast they answer, how often they change their choices, and how their choices change over time.

Of the subjects we analyze, 229 play timed dictator games followed by timed prisoner's dilemmas, 225 play timed prisoner's dilemmas followed by timed dictator games, 40 play timed dictator games followed by "last choice" prisoner's dilemmas, 59 play timed prisoner's dilemmas followed by "last choice" dictator games, 48 play "accounts" games followed by "single choice" prisoner's dilemmas, and 46 play

[25] Consequently, previous papers on dual-system models may have found that subjects become less generous over time due to a focus on relatively low exchange rates. For a notable exception, see Krajbich et al. (2015).

[26] Subjects who participated in the WBL earned a $10 show-up fee in addition to any earnings from choices in our experiment. (Some WBL subjects also completed other, unrelated studies as part of their hour in the laboratory; however, our study was always played first in a session.) Subjects from MTurk received a show-up fee of $1 in addition to any earnings from choices in our experiment.

"accounts" games followed by "single choice" dictator games. Only subjects from MTurk answered the untimed questions in either the "last choice" or "single choice" designs, and so when drawing comparisons to untimed behavior we pay special attention to MTurk subjects playing in their second set of 10 questions.

This section proceeds as follows. We first show summary statistics about first choices and the timing of choices, which rules out hypothesis II (in Section V on robustness we provide additional evidence against hypothesis II). We then analyze whether and how subjects change their choices over time.

**IV.1. First Choices**

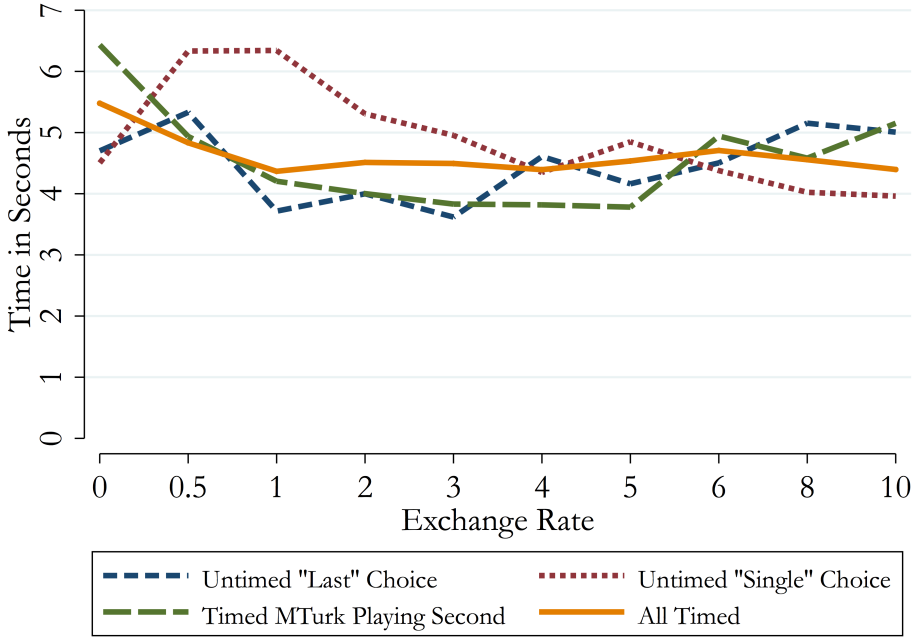
Before analyzing changes in choices, we provide evidence that first choices in the timed treatment are not made faster than normal and, as such, are unlikely to be more reasonless than when choices are made without time pressure. This is likely driven by the very simple nature of the two games and the simple choice between either transferring $1 or not.

In contrast to subjects in the timed treatments, subjects in untimed treatments do not face an incentive to answer quickly, and they can take as long as they want to make a first choice, which is also their final choice. Because only MTurk subjects answered untimed questions, and because they always answered them after answering 10 timed questions, our main comparison considers only MTurk subjects who have already answered 10 timed questions.[27] While we focus on this subset of the data, results are nearly identical when we use all timed subjects.[28] Figure 2 shows that the time of choices is basically identical whether we consider first (and hence final) choices in games in untimed treatments or first choices in the same games in the timed treatment. Figure A3 in the appendix confirms these results using medians instead of means. Figure A4 in the appendix shows that the timing of first choices is not only the same on average, but also in the CDFs, collapsed across exchange rates.[29] This suggests that first choices in our timed games likely reflect intuitive choices, at least as much as choices in the untimed treatment do.

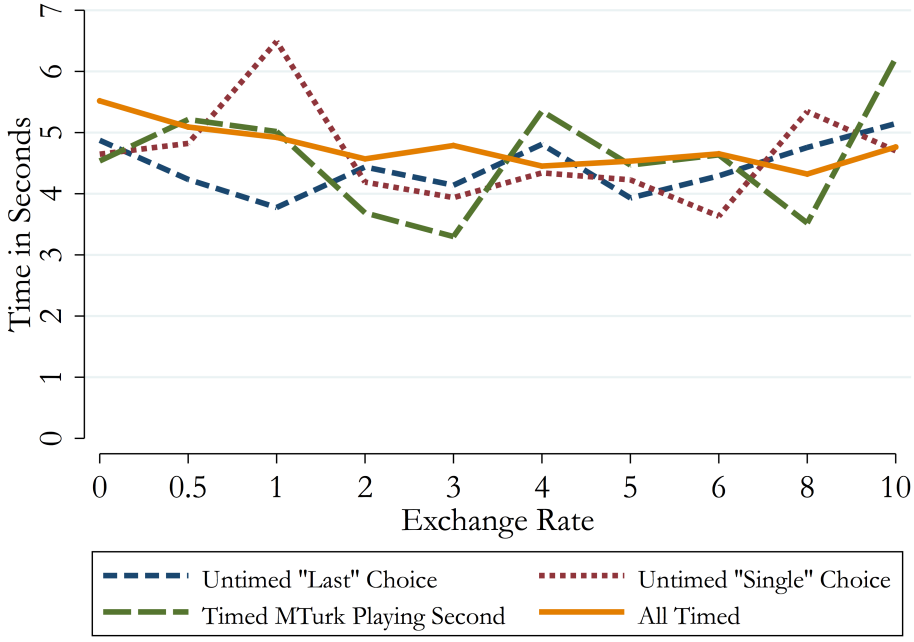
[27] One might argue that having subjects play 10 timed questions, in which there is an incentive to answer quickly, may "train" subjects to answer quickly in response to the untimed questions. However, those timed questions similarly "train" subjects to sit with each question for a minute and think about it. Whether this speeds up or slows down response time to the untimed questions — if either — is clearly ambiguous.

[28] Appendix Table A2 shows that the speed of first choices is no different between MTurk subjects answering their second set of timed questions and the speed of the other timed subjects.

[29] As one might expect, and as is shown in Appendix Figure A5, the speed of first choices gets faster as subjects have more experience playing timed games. Because we randomized the order in which exchange rates are shown to subjects at the individual level, we can average across all games without this affecting the speed of any specific exchange rate.




**Panel A:** Speed of First Choices in Dictator Games




**Panel B:** Speed of First Choices in Prisoner's Dilemmas

**Figure 2:** Average speed of choices in the untimed control treatments compared to the speed of first choices in the timed versions.

*Notes*: Since all untimed responses are of MTurk subjects answering their second set of 10 questions, we separately show the speed of first choices in the timed versions of MTurk subjects answering their second set of 10 questions.

Note that while the speed of untimed choices and first timed choices is the same in our experiment — which is convenient to confirm that first choices are not especially reasonless in out timed treatment — we do not expect this to hold in general; for example, it may be unlikely to hold in more complex decision environments.

We provide two more pieces of evidence that first choices in timed treatments are not particularly reasonless. First, we show that first choices are quite responsive to the exchange rate. Figure 3 shows for each exchange rate the percentage of first choices that are to transfer the $1 in timed dictator games and timed prisoner's dilemmas. This percentage, which we label as the "Percent Being Generous" (with the recognition that this terminology may not be exactly correct when the exchange rate is 0), rises from 15% to over 60% as the exchange rate increases from 0 to 10.

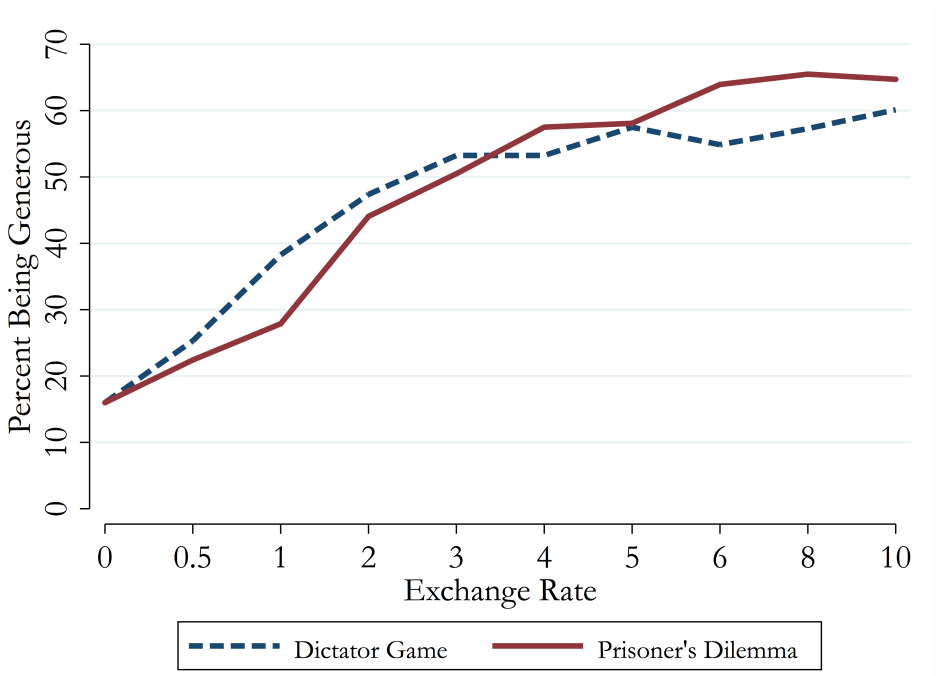



**Figure 3:** Average transfer rates (i.e., generosity) in percent for all 10 exchange rates for 494 subjects who answered the timed DG questions and 513 subjects who answered the timed PD questions.

Second, we assess whether first choices in timed treatments are similar to single (and hence final) choices in untimed treatments. For dictator games, if choices in both treatments are equally non-reasonless, we would expect them to be very similar given that they take the same amount of time to make. For prisoner's dilemmas, the choices may be different, since beliefs about the other player's choice may

differ[30] but we can still test whether choices are equally responsive to the exchange rate. As shown in Appendix Table A3, we find that in dictator games, first choices are virtually identical in the timed or untimed treatments. The table further shows that while subjects are more generous in the timed prisoner's dilemmas, the change in generosity as a function of the exchange rate is very similar.[31]

**IV.2. Do subjects change their choices?**

To assess how generosity changes over time, we rely on individuals whose choices change at least once over the minute during which they face a question. Of the 494 subjects who play the 10 timed dictator games, 339 subjects (68.6%) change their choice to at least one question. Similarly, out of the 513 subjects who play the 10 timed prisoner's dilemmas, 330 subjects (64.3%) change their choice to at least one question. Table 2 counts the number of questions (out of each set of 10) in which a subject changes her choice at least once. The table shows that in both the dictator games and prisoner's dilemmas approximately a third of subjects never change their answers, another third of subjects change the answers to either 1 or 2 questions, and the final third change their answers to 3 or more questions out of 10.[32]

**Table 2:** Percent of subjects changing their answer for any given number of questions

| | Number of questions (out of 10) in which a subject changes choices at least once | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Dictator Game | 31.4% | 26.5% | 13.2% | 9.1% | 5.7% | 3.0% | 3.8% | 2.8% | 2.8% | 0.8% | 0.8% |
| Prisoner's Dilemma | 35.7% | 27.3% | 14.0% | 8.1% | 4.3% | 3.4% | 2.8% | 3.2% | 0.8% | 1.8% | 1.0% |

The percent of subjects who change their choice is relatively consistent across exchange rates and across games. Between 16% and 23% of subjects change their choice in each dictator game (between 19% and 23% if we exclude exchange rates of 0 and 0.5). Between 15% and 20% of subjects change their choice in each prisoner's dilemma (between 18% and 20% if we exclude exchange rates of 0 and 0.5). Among changes that occur, the modal number of changes is 1 (which is also the median in all but 3 questions). Relatedly, in all questions, the majority of subjects change their choice an odd number of times (i.e., their

[30] This is because in the timed version of the game, a subject plays against the decision another subject made at second 15 (or 45) while in the untimed version of the game, subjects play against whatever choice the other subject made in the same untimed setting.

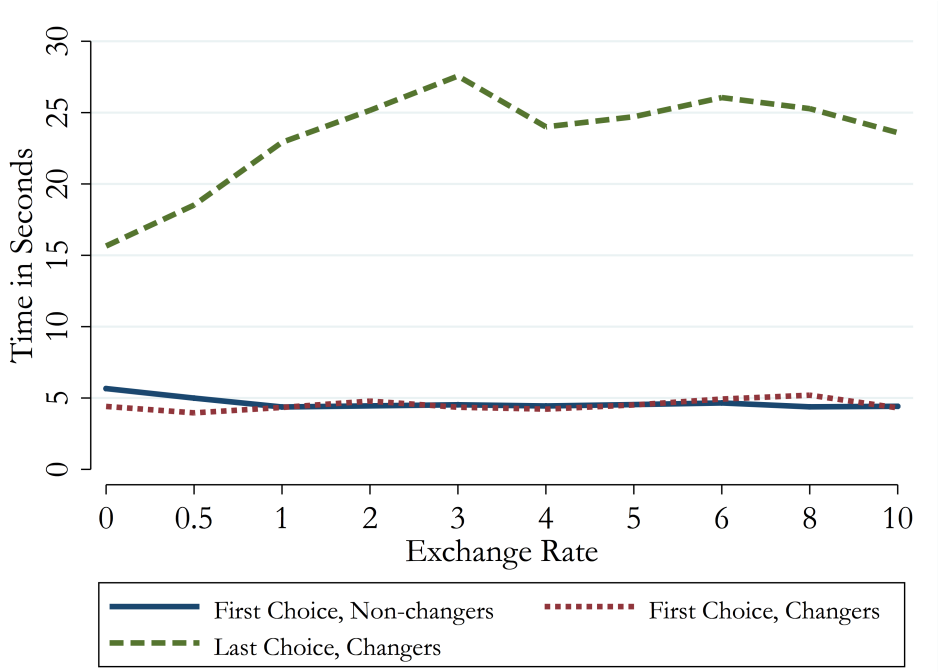
[31] Since untimed questions are always answered by MTurk subjects after 10 previously timed questions, for choices in timed games in the previous analysis we restrict attention to MTurk subjects who play the timed questions after having answered 10 timed questions (of the other game type).

[32] See Appendix Table A4, which shows Table 2 broken down by the first 5 questions and the last 5 questions of each set of 10. We also investigate the timing of changes and do not see excessive changes at second 15 or 45 in the prisoner's dilemmas.

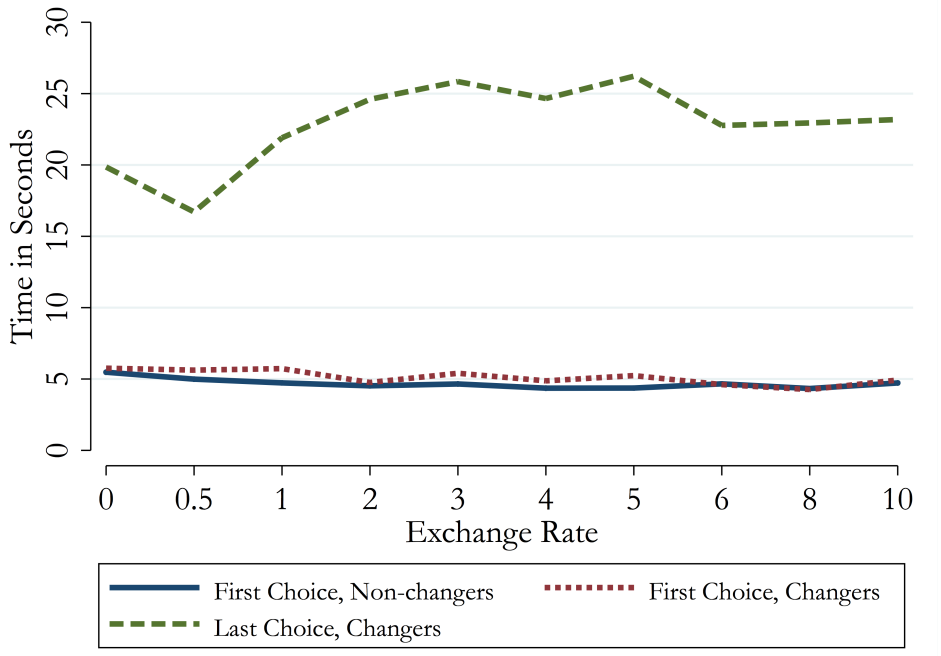
final choice is different from their first choice). See Appendix Figure A6 for histograms of the number of times subjects change their choice within a question.

One way to interpret our data is that subjects' choices are mostly stable over the course of the minute. Indeed, for any given exchange rate in the dictator games or the prisoner's dilemmas, most subjects become neither more generous nor more selfish over time. In the next subsection, we ask whether the subjects who do change their choices change in predictable ways.

Above, we showed that the average time of first choices in the timed games is the same as the time of first (and final) choices in the untimed games. However, the data we use to identify how generosity changes over time necessarily come from subjects whose choices change over the course of 60 seconds. Consequently, we want to ensure that the first choices of those subjects who change their choices are not made unduly fast, which might suggest they represent reasonless choices. Furthermore, we want to show that, conditional on a choice being changed, last choices are made with more deliberation and hence are not (for example) quick corrections of first choices. In Figure 4, we plot for each game type, and each exchange rate, the time to first choice of subjects who change their answers and of those who do not. We find that the time of first choice is comparable in both groups, suggesting that the speed of first choices of subjects who subsequently change their mind are also not unduly fast. In Figure 4, we also plot for each game, and each exchange rate, the time of last choices of subjects who change their choice. The average time of last choice is about 25 seconds, which is 20 seconds later than the average time of first choice, suggesting that when individuals change their mind, their last choice reflects substantially more deliberation than their first choice.




**Panel A:** Speed of First and Last Choices in Dictator Games




**Panel B:** Speed of First and Last Choices in Prisoner's Dilemmas

**Figure 4:** Average time of first and last choices for subjects who change their choice in the timed version of the game at each exchange rate; average time of first choices for those who do not change their choices in the timed version of the game at each exchange rate.

**IV.3. Generosity over time**

We now turn to our main analysis to address how later, deliberate choices are different from earlier, intuitive choices. Our main result can be seen in Figure 5, which shows the "Change in Percent Being Generous". This is the percentage of subjects being generous (i.e., transferring $1 to give $X to the other subject) in their last choice minus the percentage of subjects being generous in their first choice. For both sets of games — the dictator games (Panel A) and the prisoner's dilemmas (Panel B) — subjects' change in generosity between first and last choice is a function of the exchange rate. In dictator games, for low exchange rates, where giving is inefficient (0 and 0.5), subjects become less generous over time. On the other hand, when giving is quite efficient, for exchange rates of 3 or more, subjects become significantly more generous over time. In the prisoner's dilemmas, subjects become less generous not only when giving is not efficient (0 and 0.5), but also when it is efficient but still expensive (exchange rates of 1 and 2). At relatively high exchange rates (5 and 10), subjects become significantly more generous over time. For these results, we treat each question separately, and use a binomial probability test to assess whether changes are more likely to become generous than to become selfish.[33]

Clearly, in contrast to hypothesis IV and claims of the previous literature, subjects do not become uniformly more or less generous over time. Instead, deliberate choices respond more to the underlying exchange rate than intuitive choices. Note that the parameterization that has been most popular in the literature is the prisoner's dilemma with an exchange rate of 2 (see, e.g., Rand, Greene and Nowak, 2012), for which we find a significant decrease in generosity over time.[34] Consequently, our paradigm (which in contrast to the previous literature is able to refute stability of choices over time) is consistent with previous findings, but is able to demonstrate that the broad conclusions that individuals become systematically more selfish over time may be an artifact of the chosen parameters rather than a general finding.

[33] More precisely, we estimate whether the number of subjects going from selfish to generous divided by the total number of subjects whose first and last choice differ is equal to 50%.

[34] Similarly, the dictator game with an exchange rate of 1 — the parameterization used in Cappelen et al. (2014) — generates directionally less generosity over time, which is consistent with the findings in that paper.

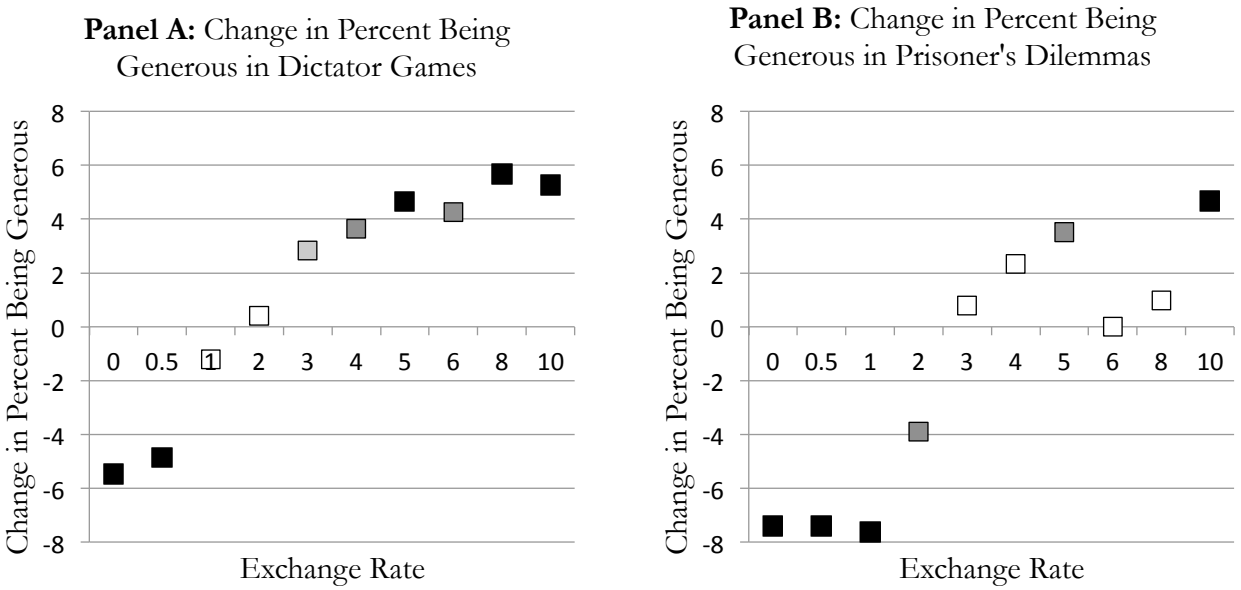



**Figure 5:** Percentage Change in Subjects Being Generous Between First and Last Choices

*Notes*: Tests of significance are binomial probability tests with the null that changes between first and last choices are equally like in both directions; black squares indicate significant at 1%, dark gray squares at 5%, the light gray square (DG 3) at 10%.

The results in Figure 5 show that subjects' last choices are more responsive to the exchange rate than their first choices are and that subjects become less generous for low exchange rates and more generous for high exchange rates. Table 3 confirms these results using a linear probability model (OLS). Specifically, we regress generosity on the exchange rate (*Rate*), a last choice dummy (*Last Choice*), and an interaction (*Rate x Last Choice*). The regression results allow us to estimate, in our linear specification, whether subjects become less generous for the lowest exchange rate (*Last Choice*) and more generous for the highest exchange rate (*Last Choice at Rate = 10)*. Table 3 shows the results combining all data in columns (1) and (2) as well as separately for just dictator games, columns (3) and (4), and prisoner's dilemmas, columns (5) and (6).

**Table 3:** Changes in Generosity with Respect to the Exchange Rate

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | | | |
|---|---|---|---|---|---|---|
| | Combined | | Dictator Games | | Prisoner's Dilemmas | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Rate x* | 0.011 | 0.011 | 0.011 | 0.011 | 0.012 | 0.012 |
| *Last Choice* | (0.0014)*** | (0.0014)*** | (0.0020)*** | (0.0020)*** | (0.0017)*** | (0.0017)*** |
| *Last Choice* | -0.045 | -0.045 | -0.027 | -0.027 | -0.062 | -0.062 |
| | (0.0062)*** | (0.0062)*** | (0.0085)*** | (0.0085)*** | (0.0079)*** | (0.0079)*** |
| *Rate* | 0.043 | 0.044 | 0.037 | 0.037 | 0.050 | 0.050 |
| | (0.0021)*** | (0.0021)*** | (0.0026)*** | (0.0026)*** | (0.0025)*** | (0.0024)*** |
| *MTurk* | | 0.059 | | 0.037 | | 0.079 |
| | | (0.026)** | | (0.031) | | (0.029)*** |
| *Left* | | 0.023 | | 0.010 | | 0.033 |
| | | (0.019) | | (0.027) | | (0.026) |
| *First10* | | -0.012 | | -0.092 | | 0.068 |
| | | (0.013) | | (0.027)*** | | (0.027)** |
| *PDFirst* | | 0.083 | | | | |
| | | (0.023)*** | | | | |
| *Dictator* | 0.0072 | 0.016 | | | | |
| | (0.013) | (0.013) | | | | |
| *Constant* | 0.29 | | 0.32 | | 0.27 | |
| | (0.014)*** | | (0.014)*** | | (0.014)*** | |
| Controls | No | Yes | No | Yes | No | Yes |
| Observations | 20,140 | 20,140 | 9,880 | 9,880 | 10,260 | 10,260 |
| Clusters (Subjects) | 553 | 553 | 494 | 494 | 513 | 513 |
| R-Squared | 0.098 | 0.109 | 0.072 | 0.083 | 0.127 | 0.142 |
| *Last Choice at* | 0.070 | 0.070 | 0.080 | 0.080 | 0.059 | 0.059 |
| *Rate = 10* | p<0.001 | p<0.001 | p<0.001 | p<0.001 | p<0.001 | p<0.001 |

*Notes:* Table 3 shows linear probability model estimates of how generosity responds to the exchange rate and changes over time. *Rate* shows the slope with respect to the first choice. *Rate x Last Choice* shows how the slope changes when comparing last choices to first choices. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice. *Last Choice at Rate = 10* reports *Last Choice + 10(Rate x Last Choice)*, the estimated change in generosity for the exchange rate of 10 when going from first to last choice, and the p-value that it is equal to 0 from a post-estimation test. Regressions (2), (4) and (6) additionally control for whether the button to be generous was on the *Left,* for whether the game was played in the first set of 10 questions (*First10*), and whether the subject came from *MTurk*. Controls include a dummy for the number of questions of the same game the subject had already answered, a dummy for the exchange rate they faced in the previous round, and a dummy for the second of the other player that was used in the prisoner's dilemma game. For the combined data, we also report whether the game was a *Dictator* game and, in the more controlled regression, whether the prisoner's dilemma was played first, *PDFirst.* Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

That *Rate* is positive and significant for both games demonstrates that the upward sloping lines in Figure 3 reflect statistically significant increases in generosity with respect to the exchange rate for first choices. *Last Choice* is negative and significant for both types of games, demonstrating that the regressions also estimate — like the non-parametric tests reported in Figure 5 — that subjects become less generous over time for the exchange rate of 0. The fact that *Rate x Last Choice* is positive and significant for both types of games demonstrates that the slope of generosity with respect to exchange rate indeed becomes larger in magnitude (i.e., steeper) when looking at subjects' last choices, reinforcing Figure 5. The slopes are estimated to be around 25% larger for the last choice than for the first choice for both the dictator games (0.11/0.37 = 30%) and the prisoner's dilemmas (0.12/0.50 = 24%). Finally, the last row reports the p-value of the test that subjects become more generous over time for the exchange rate of 10. These p-values are $p<0.001$, reinforcing the non-parametric tests showing increases in generosity for high exchange rates.

In Table 3, columns (2), (4), and (6) have additional controls for the subject pool (i.e., MTurk vs. Wharton), whether the transfer button was on the left for the subject, which set of 10 questions the subject was playing, whether the dictator games or prisoner's dilemmas were played first, as well as dummies for the number of questions of the question type the subject had previously answered and dummies for the exchange rate they faced in the previous round. While there are some level effects (e.g., MTurk subjects are more generous overall), the key coefficients of interest: *Rate*, *Last Choice*, *Rate x Last*, and *Last Choice at Rate = 10* and their standard errors are essentially identical to the corresponding uncontrolled regression. We do not include these controls for the remainder of the results, though adding them never qualitatively changes the results.

An advantage of the parametric approach in Table 3 is that it provides a framework for analyzing whether subjects become more responsive to the exchange rate over time. In particular, we can perform robustness tests by changing specifications and then reporting whether the coefficient *Rate x Last Choice* remains positive and significant.[35] Appendix Table A5 shows a number of robustness tests. The first robustness test shows that *Rate x Last Choice* remains positive and significant (at $p<0.05$) when we only use data from the very first question that subjects answer in the experiment. While subjects become significantly less generous at the lowest exchange rate (*Last Choice* is negative and significant) they only become directionally more generous for the highest exchange rate (*Last* Choice *at Rate = 10* is positive, but not significantly so). The second robustness test shows that the results are virtually identical when we restrict

[35] A benefit of this approach is that it allows us to report robustness tests without recreating Figure 5 (and running the 20 non-parametric tests) for each new specification.

attention to either the first five or the last five questions of each game type. The third robustness test shows that our effect is not driven by exchange rates 0 and 0.5 — the effect persists when we only focus attention on exchange rates of 1 and higher. For all three of these robustness tests we confirm that subjects become less generous for the lowest exchange rate and more generous for the highest exchange rate. In Appendix Table A6, we show that our results are indeed driven by subjects becoming less generous in dictator games with X=0 and X=½ and in prisoner's dilemmas with X=0, X=½, X=1, and X=2 as well as becoming more generous in dictator games with X=3 and higher and in prisoner's dilemmas with X=4 and higher. These results highlight that our effects are not dependent on the linear specification we use in Table 3 and in the robustness tests.[36]

In the next section, we provide additional robustness tests where we alter first choices to be more conservative, and thus more in line with later choices, and show that results persist there as well.

## V. ROBUSTNESS

The results in the previous section suggest that subjects do not become uniformly more or less generous over time. Rather, over time, subjects respond more to the underlying parameters of the decision problem. Specifically, subjects become more generous when giving to the other subject is relatively efficient and less generous when giving is relatively expensive.

We interpret our results as reflecting changes in behavior from intuitive to deliberate choices. This interpretation rests on the assumption that first choices are intuitive (i.e., based on subjects having read the parameter and developed a first intuition about it) rather than reasonless. That is, we rely on having convincingly refuted hypothesis II, which states that first choices in our timed treatments may be made too fast for subjects to process the exchange rate information. In Section IV.1 we provided three pieces of evidence refuting hypothesis II and showing that our subjects do not seem to make reasonless first choices. First, the time of first choices in the timed questions is basically identical to the time of first (and final) choices in the untimed treatments, where subjects only make a single choice (see Figure 2). Second, first choices respond to the exchange rate (see Figure 3). Third, subjects who subsequently change their answer do not report faster first choices than subjects who do not change their answer (see Figure 4).

[36] That we find somewhat different patterns for exchange rates 1 and 2 between the dictator games and prisoner's dilemmas suggests that, consistent with hypothesis V, subjects may indeed care about reciprocity differently over time or beliefs about the choices of the other subject change over time (Cooper and Kagel, 2016, shows that it is notoriously difficult to disentangle various motivations).

In this section, we provide additional evidence that the change in decisions over time reflects a difference between intuitive and deliberate choices (and not between reasonless decisions and later corrections). We have two types of robustness tests. The first type of robustness tests consists of identifying first choices that one might worry could be reasonless and replacing those first choices with choices made later, which are more likely to be intuitive (or deliberate, if our robustness test is too conservative). We then compare these new "first" choices to last choices to address whether (further) deliberation yields different choices. The second type of robustness tests consist of restricting attention to a subset of subjects who are less likely to have made reasonless first choices.

The results of these robustness tests are reported in Table 4. Each column in the table shows the result of a separate test. These tests are conservative in nature (we often alter first choices so that they are the same as last choices or drop subjects entirely, leaving us with significantly less data to perform our analyses). Consequently, results reported in Table 4 combine data from dictator games and prisoner's dilemmas to recreate the specification (1) from Table 3 for each robustness test. For completeness, the results are broken down by game type in the Appendix (Table A7 and Table A8, respectively).[37]

We present two pairs of the first type of robustness test, which involves altering first choices. The first pair consists of identifying first choices that may have been made in error and hence may constitute mistakes rather than intuitive choices. Specifically, consider a subject whose second choice follows their first choice very quickly. This suggests the first choice may have been a mistake (e.g., a subject meant to click the transfer button, accidentally clicked the other one, and quickly corrected it). In such a case, the subject's second choice (the quick correction of the first choice) may be the "true" intuitive choice. We rerun our main analysis by replacing first choices with second choices when a second choice comes quickly after the first choice — within 2 seconds in column (1) or within 5 seconds in column (2). Note that the median speed of first choices ranges from 2.94 and 3.85 seconds in dictator games and 2.76 and 4.05 seconds in prisoner's dilemmas, so allowing for corrections within 2 or 5 seconds both generate conservative tests.

By relabeling second choices as first choices when they come within 2 seconds of each other we adjust first choices for 17% of the dictator games and 26% of the prisoner's dilemmas in which a subject changes choices; for 5 seconds we adjust first choices for 42% (DG) and 48% (PD) of the questions in

[37] When we analyze the two types of questions separately, we always find that *Rate x Last Choice* is at least directionally positive for the dictator game and the prisoner's dilemma separately, and always statistically significant for at least one.

which a subject changes choices, respectively. Notice that by expanding the length of time from 2 to 5 seconds we become more likely to adjust choices of subjects whose changes in behavior are actually changes from intuitive to deliberate choices, so the 5-second specification is more conservative than the 2-second specification. Columns (1) and (2) of Table 4 show that the pattern of behavior described earlier is robust in both specifications: *Rate x Last Choice* remains positive and significant and the increased responsiveness to the exchange rate is associated with subjects becoming less generous for the lowest exchange rate (*Last Choice* is negative and significant) and more generous for the highest exchange rate (*Last Choice at Rate = 10* is positive and significant).

The second pair of robustness tests also identifies first choices that one might worry are reasonless and changes those choices to later choices. Specifically, we generate a subject-specific "reading speed" variable that is our best guess of the longest number of seconds it takes a subject to read a question and click their preferred answer. We then replace a subject's first choice with whatever choice the subject had recorded at their subject-specific reading speed. We construct the reading speed variable in two ways, both of which rely on the intuition that the choices that are easiest in our experiment are the decisions with very low exchanges rates of 0 and 0.5. In fact, these games have fewer changes in choices and subjects reach their final answers more quickly than for other exchange rates.

Our first reading speed variable is constructed within each game type (DG and PD) by looking at subjects who change their choice in the exchange rate 0 question for that game type. We treat as their reading speed the time at which they make their *last* choice for the exchange rate 0 question. Subjects who do not change their choice in the exchange rate 0 question are assigned the median of reading speeds of those who do change their choice (10.49 seconds for DG and 13.85 seconds for PD). Our second reading speed variable is constructed as the maximum time of *last* choice of subjects who change their choice in either of the dictator games or prisoner's dilemmas with exchange rates of 0 and 0.5. Again, subjects who do not change their choice in any of those four questions are assigned the median of this reading speed variable of those who do change in at least one question (14.05 seconds). Results of the robustness tests of both reading speed measures are reported in columns (3) and (4) of Table 4. Using both measures we find that the robustness tests are consistent with the main results, *Rate x Last Choice* remains positive and significant, and subjects become less generous for the lowest exchange rate and more generous for the highest exchange rate.

**Table 4:** Changes in Generosity with Respect to the Exchange Rate — Robustness Tests

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | | | |
|---|---|---|---|---|---|---|
| | Altering First Choices | | | | Dropping Data | |
| | First choice replaced with second choice: | | First choice replaced with choice at reading speed: | | Data dropped unless: | |
| | Within 2 seconds | Within 5 seconds | Rate 0 of game | Max rate 0 & 0.5 of both | Positive slope | Monotone first choices |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Rate x Last Choice* | 0.0085 | 0.0045 | 0.0035 | 0.0024 | 0.0051 | 0.0044 |
| | (0.0012)*** | (0.00098)*** | (0.00087)*** | (0.00081)*** | (0.0014)*** | (0.0013)*** |
| *Last Choice* | -0.031 | -0.015 | -0.015 | -0.011 | -0.030 | -0.018 |
| | (0.0053)*** | (0.0047)*** | (0.0045)*** | (0.0038)*** | (0.0063)*** | (0.0067)*** |
| *Rate* | 0.046 | 0.050 | 0.051 | 0.052 | 0.076 | 0.056 |
| | (0.0021)*** | (0.0021)*** | (0.0022)*** | (0.0021)*** | (0.0015)*** | (0.0026)*** |
| *Dictator* | 0.0036 | 0.0077 | 0.012 | 0.012 | 0.015 | 0.014 |
| | (0.013) | (0.013) | (0.013) | (0.013) | (0.015) | (0.023) |
| *Constant* | 0.28 | 0.26 | 0.26 | 0.26 | 0.26 | 0.24 |
| | (0.014)*** | (0.014)*** | (0.013)*** | (0.013)*** | (0.014)*** | (0.020)*** |
| Observations | 20,140 | 20,140 | 20,140 | 20,140 | 13,160 | 10,240 |
| Clusters (Subjects) | 553 | 553 | 553 | 553 | 426 | 372 |
| R-Squared | 0.100 | 0.104 | 0.113 | 0.115 | 0.253 | 0.135 |
| % of questions we adjust changer's first choice | 17% of Dictator; 26% of PD | 42% of Dictator; 48% of PD | 43% of Dictator; 46% of PD | 52% of Dictator; 50% of PD | | |
| % of data dropped | | | | | 38% of Dictator; 31% of PD | 50% of Dictator; 48% of PD |
| *Last Choice at Rate = 10* | 0.054 | 0.030 | 0.020 | 0.013 | 0.021 | 0.026 |
| | p<0.001 | p<0.001 | p=0.002 | p=0.030 | p=0.051 | p=0.01 |

*Notes:* Table 4 shows linear probability model estimates of how generosity in choices responds to the exchange rate. *Rate* shows the slope with respect to the first choice. *Rate x Last Choice* shows how the slope changes when comparing the last choices to the first choice. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice. *Last Choice at Rate = 10* reports *Last Choice + 10(Rate x Last Choice)*, the estimated change in generosity for the exchange rate of 10 when going from first to last choice, and the p-value that it is equal to 0 from a post-estimation test. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

"Rate 0 of game" reading speed is defined as time to last choice if the subject changed answers in the exchange rate 0 of the question type or, if the subject did not change, then the median speed to last choice of the subjects who did change (10.49 seconds for dictator game, 13.85 seconds for prisoner's dilemma).

"Max rate 0 & 0.5 of both" reading speed is defined as the maximum time to last choice if the subject changed answers in at least one of the exchange rate 0 or 0.5 questions in either question type, if the subject did not change answers to any of those four questions, the median reading speed of those who did (14.05 seconds).

Our second type of robustness test does not involve altering first choices. Instead, we drop data from subjects whose first choices fail to satisfy certain criteria. First, for each subject and each game type we

regress first choices on the exchange rate and exclude any subject who does not have a directionally positive slope of generosity with respect to the exchange rate.[38] This drops 38% of our dictator game subjects and 31% of our prisoner's dilemma subjects. Column (5) of Table 4 shows that this robustness test is consistent with the main results, and *Rate x Last Choice* remains positive and significant and subjects become less generous for the lowest exchange rate and more generous for the highest exchange rate. Second, for each subject and each game type, we ask whether subjects are "monotone" in their first choices. To be monotone in their first choices, a subject who is generous in their first choice for an exchange rate X must be generous in their first choice for any exchange rate larger than X (and similarly if they are selfish in their first choice for any exchange rate X they must be selfish in their first choice for any exchange rate smaller than X). This drops roughly half of our subjects from each game type. Column (6) of Table 4 shows that this robustness test is also consistent with the main results, *Rate x Last Choice* remains positive and significant, and subjects become less generous for the lowest exchange rate and more generous for the highest exchange rate.

## VI. Computational Complexity or Preferences for Efficiency

Above, we showed that the change in generosity over time depends on the exchange rate. Subjects become less generous for low exchange rates and more generous for high exchange rates. In this section, we present a final robustness test to confirm that subjects change their choices over time because their preferences change, rather than because they correct initial mistakes for static preferences. Specifically, while we have argued that choices change from intuitive first choices to deliberate last choices, it is still possible, as suggested by hypothesis III, that the intuitive choices of subjects are only an imperfect implementation of fixed preferences and deliberate choices are just more accurate implementations of those fixed preferences. In other words, even when first choices are not reasonless, subjects may need time to correctly compute the choice that best reflects their static preferences. It is worth noting that if hypothesis III explains our data, then subjects in our untimed treatments likely fail to implement their true preferences as well. Because, as shown in Section IV, the time of first choices in the timed treatments is virtually identical to the time of choice in untimed treatments.

In this section, we explore the role of computational complexities on changes in generosity in the context of the dictator game so that concerns about the behavior of the other subject play no role. In this setting, the specific concern of hypothesis III is that subjects who want to transfer at high exchange rates in the dictator game might initially choose not to transfer — and take a while to change their mind — because it takes them time to realize that the exchange rate is indeed high. To directly test this hypothesis, we ran

[38] Note that this excludes subjects who always give or never give in their first choice within a game type.

the "accounts" treatment, which mirrors the dictator games with one crucial difference — we eliminate the other subject. Instead of deciding whether to transfer $1 from herself to another subject who receives $X, a subject in the accounts treatment decides whether to transfer $1 from one account she owns to another account she also owns (where the $1 transferred still turns into $X). In all other respects, the accounts treatment is as close as possible to the dictator game and the 60-second decision screens are virtually identical (compare Appendix Figure A2 and Figure 1).

We perform two tests where we compare data from the accounts treatment to data from the dictator games in the main treatment. First, we investigate how long it takes subjects to arrive at a final answer in the event that they change their answer. Second, we investigate the patterns of changed answers.

Table 5 reports on the relative speed of choices in the accounts and dictator game data. The first set of three columns compares the accounts treatment, which was always played first, with all dictator games that were played first. Since only MTurk subjects played the accounts treatment, the second set of three columns compares the accounts treatment to all dictator games played first by MTurk subjects. Columns (1) and (4) compare the average speed of first choices. Columns (2) and (5), compare the average speed of last choices. Columns (3) and (6) compare the average speed of last choices of those who changed choices such that the first and last choices are different. The data shows that while subjects' first choices are roughly made at the same time, the subjects who change their minds — who drive the main results in Sections IV and V — take much longer to make their final choices in the dictator game than in the accounts treatment.[39] This pattern runs counter to hypothesis III. If subjects in dictator games change their choices solely because it took them time to process the exchange rate, then the speed of last choices among subjects who change their choice should be similar between the dictator game and the accounts treatment. The fact that subjects who change their choices in dictator games take much longer to reach a final choice than subjects in the accounts treatment confirms that subjects in dictator games are doing more than just recognizing that the exchange rate is high or low.

[39] These results are robust to using the log of the number of seconds rather than the number of seconds (see Appendix Table A9).

**Table 5:** Speed of Choices in Dictator Games and the Accounts Treatment

| | Dependent Variable: *Seconds* | | | | | |
|---|---|---|---|---|---|---|
| | All Played First | | | MTurk Played First | | |
| | First Choice | Last Choice | Last Choice if Changed | First Choice | Last Choice | Last Choice if Changed |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Dictator* | 0.27 | 1.16 | 7.92 | 0.36 | 0.22 | 5.28 |
| | (0.39) | (1.00) | (2.06)*** | (0.47) | (1.14) | (2.61)** |
| *Constant* | 4.57 | 8.24 | 13.0 | 4.57 | 8.24 | 13.0 |
| | (0.34)*** | (0.88)*** | (1.67)*** | (0.34)*** | (0.88)*** | (1.68)*** |
| Observations | 3,630 | 3,630 | 596 | 1,940 | 1,940 | 321 |
| Clusters (Subjects) | 363 | 363 | 233 | 194 | 194 | 123 |
| R-squared | 0.001 | 0.002 | 0.048 | 0.001 | 0.000 | 0.029 |

*Notes*: Table 5 compares the speed of choices in the accounts treatment to timed dictator games played first either including all subjects in Columns (1) to (3) or including MTurk subjects playing first in Columns (4) to (6). *Dictator* indicates it was the dictator game rather than data from the accounts treatment. Last Choice if Changed looks at speed of last choices conditional on the subject changing their choice such that their first and last choices are different. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The second test we perform is to compare patterns of changed answers between dictator games and the accounts treatment. For this exercise, we focus on exchange rates of 2 and above where the choice in the accounts treatment that maximizes a subject's earnings is to transfer the \$1.[40] For these exchange rates, subjects in the dictator game become more generous over time. If these changes in choices in dictator games arise largely due to changing preferences with regard to another subject (e.g., changing concerns for social efficiency over time, as suggested in hypothesis VI and our reigning theory), then the pattern of choices in the accounts treatment should be different from that in the dictator games. If, however, changes in choices in dictator games are due only to subjects' failure to process the level of efficiency of the exchange rate, then the behavior in the accounts treatment should mirror the behavior in dictator games.

Table 6 compares the changes in the decision to transfer \$1 between the dictator games and accounts questions for exchange rates $X \geq 2$. "Generosity" is in quotes since transferring in the accounts treatment is not being generous, it is turning \$1 into \$X for the subject's other account. Column (1) shows that in the accounts treatment there is no significant difference in generosity between later and earlier choices. Column (2) shows data from all subjects who played dictator games first. It finds that for these exchange rates ($X \geq 2$), last choices are on average 5 percentage points more generous than first choices. Column (3) compares Columns (1) and (2) and shows that the difference in changes in generosity is significant.

[40] As is common in the literature of other-regarding preferences, we ignore other-regarding preferences that concern the experimenter.

Columns (4) and (5) repeat this exercise restricting the analysis to MTurk subjects who played dictator games first.

One potential worry is that because the initial proportion of transferring a $1 in the accounts treatment is higher — the constant is 0.84 in the accounts treatment in Column (1) but only 0.47 in the dictator games in Column (2) — there are simply fewer subjects for whom the last choice is different from the first choice in the accounts treatment compared to the dictator games. This could be why we find a significant difference in the change in generosity in these two treatments. However, when we check the proportion of subjects with different first and last choices in the accounts treatment (13.7%), we find that the proportion is nearly identical to the dictator game data whether including all subjects who play the dictator game first (16.3%) or MTurk subjects who play the dictator games first (14.6%). This means that there are just as many subjects changing choices such that first choice is different from last choice, but subjects in the dictator games are becoming more generous whereas the changes in the accounts treatment do not seem systematic.

**Table 6:** Changes in **"**Generosity" Comparing Dictator Games to the Accounts Treatment

| | Dependent Variable: "*Generosity*" (i.e., Transferring $1) | | | | |
|---|---|---|---|---|---|
| | | All Played First | | MTurk Played First | |
| | Accounts | Timed DG | Combined | Timed DG | Combined |
| | (1) | (2) | (3) | (4) | (5) |
| *Last* | -0.0091 | 0.050 | -0.0091 | 0.060 | -0.0091 |
| | (0.019) | (0.014)*** | (0.019) | (0.023)** | (0.019) |
| *Dictator* | | | -0.37 | | -0.35 |
| | | | (0.031)*** | | (0.045)*** |
| *Dictator x Last* | | | 0.060 | | 0.069 |
| | | | (0.024)** | | (0.030)** |
| *Constant* | 0.84 | 0.47 | 0.84 | 0.49 | 0.84 |
| | (0.020)*** | (0.023)*** | (0.020)*** | (0.040)*** | (0.020)*** |
| Observations | 1,316 | 3,766 | 5,082 | 1,400 | 2,716 |
| Clusters (Subjects) | 94 | 269 | 363 | 100 | 194 |
| R-squared | 0.000 | 0.003 | 0.093 | 0.004 | 0.116 |

*Notes*: Table 6 compares choices in the accounts treatment in Column (1) to choices in the timed dictator game played first either including all subjects in Columns (2) and (3) or including MTurk subjects playing first in Columns (4) and (5), always for questions with an exchange rate $X \geq 2$. *Last* indicates it was the last choice subjects made in the minute. *Dictator* indicates it was the dictator game rather than data from the accounts treatment. *Dictator x Last* is the interaction of these two variables. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Furthermore, the result that when $X \geq 2$ subjects in the dictator game are significantly more likely to transfer $1 in last choices than first choices and that this change is significantly different from the change

in the accounts treatment is robust. In particular, we show results are the same when we re-run regression (3) from Table 6 after making the same adjustments we made to first choices in Section V (e.g., adjusting the first choice with the second choice if the second choice is made within 2 seconds of the first choice). These results appear in Appendix Table A10.

## VII. Timing of Choices and The Drift Diffusion Model

One motivation for our design was to produce a direct test of dual-system models that is immune to the critique of the predominant approach of testing these models, which is to compare the choices of fast and slow subjects. Nevertheless, it is in principle possible that fast first choices differ systematically from slow first choices. Two such correlations are possible. First, it could be that the correlation previously claimed as evidence of dual-system models (i.e., fast choices being more generous than slower choices), might be present in our rich dataset. Second, it could be that which choice is fast depends on the exchange rate. If generous choices are systematically faster than selfish choices at exchange rates for which subjects become less generous over time and the opposite holds for exchange rates at which subjects become more generous over time, then the speed of first choices may indeed be predictive of the difference in choices between an intuitive and deliberate system.[41] In Section VII.1, below, we correlate the speed of untimed choices and timed first choices with whether the subjects make a generous choice, testing these two hypotheses.

In addition, however, there is a model that explicitly predicts which choices should be fast and which should be slow. This is the drift diffusion model, which argues that choices should be faster when the utility difference between the options is large. In Section VII.2, we show that we have substantial support for a key comparative static prediction of the drift diffusion model.

### VII.1. Fast versus Slow Choices

We replicate the analysis of Rand, Greene and Nowak (2012) in comparing the generosity of fast versus slow subjects. We first report on untimed subjects, as this treatment is closer to the standard implementation used by Rand, Greene and Nowak (2012), and combine data from our two untimed treatments. For each game type (DG and PD), we compute the median speed to answer a question for each exchange rate. We classify an answer as slow if it takes longer than the median speed for a particular exchange rate of a particular game type and classify it as fast otherwise.

[41] In a recent paper, however, Krajbich et al. (2015) predict just the opposite correlation, namely that fast choices are more generous for high exchange rates.

Table 7 tests the first correlation, asking whether slower choices are more selfish across all of our exchange rates. Columns (1) and (3) show that, if anything, slow choices are *more generous* than fast choices. This difference is directional for both game types and significant for the prisoner's dilemmas. Columns (2) and (4) show that slow first choices (defined similarly) in the timed games are also more generous than fast first choices.

**Table 7:** Generosity Comparing Fast to Slow Choices

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | Dictator Games | | Prisoner's Dilemmas | |
| | Untimed Choice | First Timed Choice | Untimed Choice | First Timed Choice |
| | (1) | (2) | (3) | (4) |
| *Slow Choice* | 0.051 | 0.12 | 0.086 | 0.057 |
| | (0.046) | (0.020)*** | (0.043)** | (0.020)*** |
| Rate Dummies | Yes | Yes | Yes | Yes |
| Observations | 1,050 | 4,940 | 880 | 5,130 |
| Clusters (Subjects) | 105 | 494 | 88 | 513 |
| R-squared | 0.156 | 0.096 | 0.131 | 0.129 |

*Notes*: Table 7 compares the generosity of choices as a function of the speed of choices in the untimed games (1) and (3) and the first choice in the timed games (2) and (4). *Slow Choice* is defined as whether the speed was longer than the median time for that exchange rate in that treatment. Rate Dummies include dummies for each exchange rate, which we allow to be different for the two different untimed treatments. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Tables 8 and 9 test the second correlation, asking whether the speed of choices predicts the direction of changes in behavior. In particular, Table 8 investigates whether slower choices are more selfish among exchange rates where we find subjects become more selfish over time ($X \leq 0.5$ for dictator games and $X \leq 2$ for prisoner's dilemmas). While none of the differences are statistically significant, in the untimed treatments we find conflicting results between the dictator games and prisoner's dilemmas. In the timed treatments, effects are much smaller than when we examine all exchange rates in Table 7, though the effects are generally in the same direction, indicating that slow choices are somewhat more generous. Table 9 investigates whether slower choices are more generous among exchange rates where we find subjects become more generous over time ($X \geq 3$ for dictator games and $X \geq 4$ for prisoner's dilemmas). Indeed, in the timed games, slow subjects are significantly more generous than fast subjects, a pattern that is directional, but not significant, in the untimed data. To summarize, if anything, we find that slow choices are more generous, a correlation that is particularly strong for exchange rates in which later, deliberate choices are more generous than early, intuitive choices. Consequently, there may be some hope

that response time could be predictive of changes in behavior associated with a dual-system model, although the evidence is far from conclusive.

**Table 8:** Generosity Comparing Fast to Slow Choices for Low Exchange Rates

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | Dictator Games (X = 0,0.5) | | Prisoner's Dilemmas (X = 0,0.5,1,2) | |
| | Untimed Choice | First Timed Choice | Untimed Choice | First Timed Choice |
| | (1) | (2) | (3) | (4) |
| *Slow Choice* | -0.082 | 0.020 | 0.062 | 0.0051 |
| | (0.056) | (0.026) | (0.041) | (0.023) |
| Rate Dummies | Yes | Yes | Yes | Yes |
| Observations | 210 | 988 | 352 | 2,052 |
| Clusters (Subjects) | 105 | 494 | 88 | 513 |
| R-squared | 0.058 | 0.014 | 0.047 | 0.054 |

*Notes*: Table 8 compares the generosity of choices as a function of the speed of choices in the untimed games (1) and (3) and the first choice in the timed games (2) and (4) for exchange rates where subjects become less generous over time. *Slow Choice* is defined as whether the speed was longer than the median time for that exchange rate in that treatment. Rate Dummies include dummies for each exchange rate, which we allow to be different for the two different untimed treatments. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table 9:** Generosity Comparing Fast to Slow Choices for High Exchange Rates

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | Dictator Games (X = 3,…,10) | | Prisoner's Dilemmas (X = 4,…,10) | |
| | Untimed Choice | First Timed Choice | Untimed Choice | First Timed Choice |
| | (1) | (2) | (3) | (4) |
| *Slow Choice* | 0.086 | 0.14 | 0.091 | 0.088 |
| | (0.058) | (0.026)*** | (0.063) | (0.026)*** |
| Rate Dummies | Yes | Yes | Yes | Yes |
| Observations | 630 | 2,964 | 440 | 2,565 |
| Clusters (Subjects) | 105 | 494 | 88 | 513 |
| R-squared | 0.032 | 0.023 | 0.027 | 0.013 |

*Notes*: Table 9 compares the generosity of choices as a function of the speed of choices in the untimed games (1) and (3) and the first choice in the timed games (2) and (4) for exchange rates where subjects become more generous over time. *Slow Choice* is defined as whether the speed was longer than the median time for that exchange rate in that treatment. Rate Dummies include dummies for each exchange rate, which we allow to be different for the two different untimed treatments. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

### VII.2. Drift Diffusion Model

In a basic version of the drift diffusion model, an individual receives signals about the utility associated with each of the option she considers. These signals are modeled with a drift diffusion process. The individual reaches a decision as soon as she is sufficiently certain which option yields a higher utility. In a recent theoretical analysis where subjects incur costs from gathering information, Fudenberg, Strack and Strzalecki (2015) shows that when the utilities of two options are closer, subjects are more likely to receive conflicting — and less strong — signals of the relative utility, making it harder for the drift diffusion process to pass a (moving) threshold at which the subject is ready to make a decision.[42]

This turns out to be a key comparative static prediction of the drift diffusion model, which distinguishes it from different models of costly information acquisition. Hébert and Woodford (2017) generalize a rational inattention model (Sims, 2010). In the sequential information sampling problem, the information sampled at each stage can be chosen very flexibly given an information cost function. As in Fudenberg, Strack and Strzalecki (2015), the decisions of when to stop sampling and what choice to make are optimized given the entire history of information sampled up to that point. While the resulting model of Hébert and Woodford (2017) shares many features with the drift diffusion model, it does not predict that subjects should take longer to make a choice when questions are hard (in the sense that utilities between the options are close).

While our design is not perfectly suited to address the drift diffusion model or the rational inattention model with sequential information sampling, we have several features conducive for a test of the key comparative static prediction that distinguishes these two models. We have subjects make binary choices where the utility of the two options changes with the exchange rate X and we have explicit costs of delaying choice. To test the comparative static that relies on a measure of the utility difference between options, we restrict attention to the subset of subjects for whom we can reasonably identify the decision problems for which the utility between options is closer. Specifically, we start by considering subjects whose first choices are monotone in the exchange rate X. There are three types of subjects whose first choices are monotone: subjects who always transfer, subjects who never transfer, and subjects who transfer as soon as the exchange rate reaches some "crossover exchange rate" but not for lower exchange rates. We call this last group of subjects "Elastic". For our evaluation of the drift diffusion model, we focus on Elastic subjects. For these subjects, we can reasonably argue that the utilities of the two choices

[42] For early introductions of the drift diffusion model in economics, see Fehr and Rangel (2011) and Krajbich, Oud and Fehr (2014).

— transfer or not transfer — are closer when the exchange rate is closer to their crossover exchange rate than when it is farther from it.

A test in the spirit of the drift diffusion model is to assess whether the time of first choices of Elastic subjects is later when the exchange rate is close to, rather than far from, their crossover exchange rate. In our design, the cost of delaying a choice is to increase the risk of not getting any payment. So, if a subject knew the utilities of the two options were basically identical, she would optimally make a decision immediately instead of gathering costly evidence on which is the slightly better option. While there has been some previous evidence that "hard" choices (i.e., choices where the utilities of the options are closer) take longer than "easy" choices, most of this evidence does not have subjects incurring direct costs of delaying decisions.

We have 141 subjects who are classified as Elastic in the dictator games and 166 in the prisoner's dilemmas. For each Elastic subject, we identify the lowest exchange rate for which the subject chose to transfer and the highest for which the subject decided not to transfer, and we label the question at these two exchange rates as "hard" while questions at other exchange rates are labeled "easy". Column (1) of Table 10 shows that the time of first choice is almost a second longer (i.e., over 20% longer) when the decision is made for a hard rather than an easy question. This result holds when we look at the first five rounds in Column (2) and the last five rounds in Column (3). A second prediction of the drift diffusion model (Fudenberg, Strack and Strzalecki, 2015) is that when utilities are similar, individuals do not just take longer to make a choice but they are also more likely to make a wrong choice. One interpretation of this prediction in our experiment would be that subjects are more likely to change their choices for hard questions than for easy questions. Indeed, Column (4) shows that subjects are 12 percentage points more likely to change their choice when the decision is classified as hard then when it is classified as easy (in which case less than 6 percent of subjects change their choices, an increase of over 200%). These results are true both for the first five rounds, as in Column (5), and the last five rounds, as in Column (6).[43]

These results are robust to a variety of alternative specifications, such as classifying two additional decisions as hard (i.e., calling hard the exchange rates neighboring the decisions previously labeled as hard, so subjects have 4 hard and 6 easy questions for the 10 exchange rates), as in Appendix Table A11.

[43] These results are in line with Konovalov and Krajbich (2017). That paper finds that slow choices — a potential indication of hard choices — are more likely to be associated with a preference reversal when subjects are asked to make the same choice for a second time.

We can also re-do the analysis when we classify subjects as Elastic and questions as hard and easy based on the last choice (i.e., rather than the first choice) that subjects made, as in Appendix Table A12.

**Table 10:** Hard vs. Easy Questions

| | Speed of first choice (seconds) | | | Change Choice | | |
|---|---|---|---|---|---|---|
| | All 10 Rounds | First 5 Rounds | Last 5 Rounds | All 10 Rounds | First 5 Rounds | Last 5 Rounds |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Hard Question* | 0.96 | 1.03 | 0.79 | 0.12 | 0.13 | 0.11 |
| | (0.21)*** | (0.28)*** | (0.30)*** | (0.015)*** | (0.025)*** | (0.022)*** |
| *Dictator* | -0.080 | -0.37 | 0.20 | -0.033 | -0.029 | -0.036 |
| | (0.19) | (0.30) | (0.28) | (0.015)** | (0.022) | (0.016)** |
| Mean for Easy | 4.67 | 5.46 | 3.88 | 0.059 | 0.077 | 0.041 |
| Observations | 3,070 | 1,535 | 1,535 | 3,070 | 1,535 | 1,535 |
| Subjects (Clusters) | 237 | 237 | 237 | 237 | 237 | 237 |
| R-Squared | 0.359 | 0.459 | 0.393 | 0.273 | 0.322 | 0.367 |

*Notes*: Table 10 reports how speed of first choice and probability of changing a choice correlates with whether the question is hard or easy. *Hard Question* is a dummy for whether the question is classified as hard or easy for a subject. *Dictator* is a dummy indicating the game type. All regressions include subject fixed effects, controls for the order in which the questions were answered in the set of 10, and the exchange rate. Standard errors are clustered on the subject level and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

While our design is not directly geared towards testing the drift diffusion model, we provide direct evidence that, even when there are explicit costs of making slow choices, subject answers are slower for hard questions (i.e., questions where the utilities of the two options are closer than they are for other questions). We therefore confirm a key comparative static prediction that distinguishes the drift diffusion model from a rational inattention model with sequential information sampling.

## VIII. CONCLUSION

We use a direct test that incentivizes choices over time to address whether individuals change their choice when they deliberate on a generous act. We use simple dictator games and prisoner's dilemmas. We find that deliberate last choices are more responsive to the parameters of the game than intuitive first choices. Specifically, individuals become systematically less generous for low exchange rates and more generous for high exchange rates. Control treatments and robustness tests reveal that this pattern is not an artifact of our experimental design, nor does it arise due to reasonless first choices. The fact that the pattern holds for both dictator games and prisoner's dilemmas suggests that changes in choices are not solely due to changes in beliefs or changes in the interpretation or considerations about the choice of the other subject. A final robustness test shows that the change in choices cannot be attributed to a subject having difficulty

in computing outcomes. Rather, as individuals deliberate longer, their choices change in a way that is largely consistent with placing more weight on social efficiency.

Our experiments thus refute two hypothesis of the existing literature. First, we can reject that choices and preferences are stable over time, a possibility that had been left open by critiques of the previous approaches to testing dual-system models (e.g., Recalde, Riedl and Vesterlund, 2014). Second, we can reject that individuals become uniformly less (or more) generous over time, refuting the hypothesis by Rand, Greene and Nowak (2012). Rather, our results are best described by a dual-system (or dual-self) model where, in contrast to the fast and intuitive system, the slow and deliberate system puts more weight on social efficiency. As such, our results lend support to the second, slower process being more calculating (see, e.g., Loewenstein and Small, 2007).[44]

While our experimental design aimed to determine whether and how choices change over the course of a minute, we have a rich dataset on how long it takes individuals to make a choice in an environment where there are explicit costs of delay. We can therefore test a comparative static prediction of drift diffusion models.[45] Consistent with the drift diffusion model, subjects in our experiment take longer to make a choice in hard questions where they are likely to be close to indifferent.

Our results highlight two potential complications of using revealed preference for welfare analysis in the context of generous behavior. First, as noted above, our results are consistent with a dual-system model in which one system places more weight on social efficiency. It is now open for debate which preference we should honor for welfare calculation. Second, we find that choices subjects make in untimed games (when they have as much time as they want to make decisions) are as fast as the first choices in timed games, in which subjects can subsequently change their choice. Since most questions answered in the world are answered in the untimed way, this suggests that choices observed in practice might be intuitive choices that do not reflect deliberate preferences and thus might be different if individuals took more time to deliberate. Consequently, without the ability to observe choices change over time, we do not know whether we are observing an intuitive or deliberate choice, which makes it hard to use revealed preference for welfare analysis, even if we decided which set of preferences we wanted to honor.

[44] In a similar spirit, Imas, Kuhn and Mironova (2016) show that more deliberation leads to less present bias.
[45] In addition, the comparative static allows us to distinguish a drift diffusion model from a model of rational inattention with sequential information sampling.

Policy makers who want to encourage private provision of public goods and charity fundraisers can also learn from our results. In particular, our results suggest that less-efficient charities might have more success raising funds if they ask donors for funds in settings under time pressure (e.g., as individuals are walking by on the street or on a screen at check-out of a supermarket). In contrast, more-efficient charities might do better by giving potential donors the opportunity to reflect on the opportunity to donate, so that a more deliberate system or self that cares more about social efficiency can recognize the value of this giving opportunity.[46] Whether such patterns arise empirically is a topic for future work.

[46] Of course, changes in attitudes toward generosity may not be the only thing that changes over time. Previous work has shown that in some settings individuals may use extra time to look for an "excuse" not to give (Exley and Petrie, 2016).

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## Appendix (For Online Publication)

### Appendix A: Figures and Tables

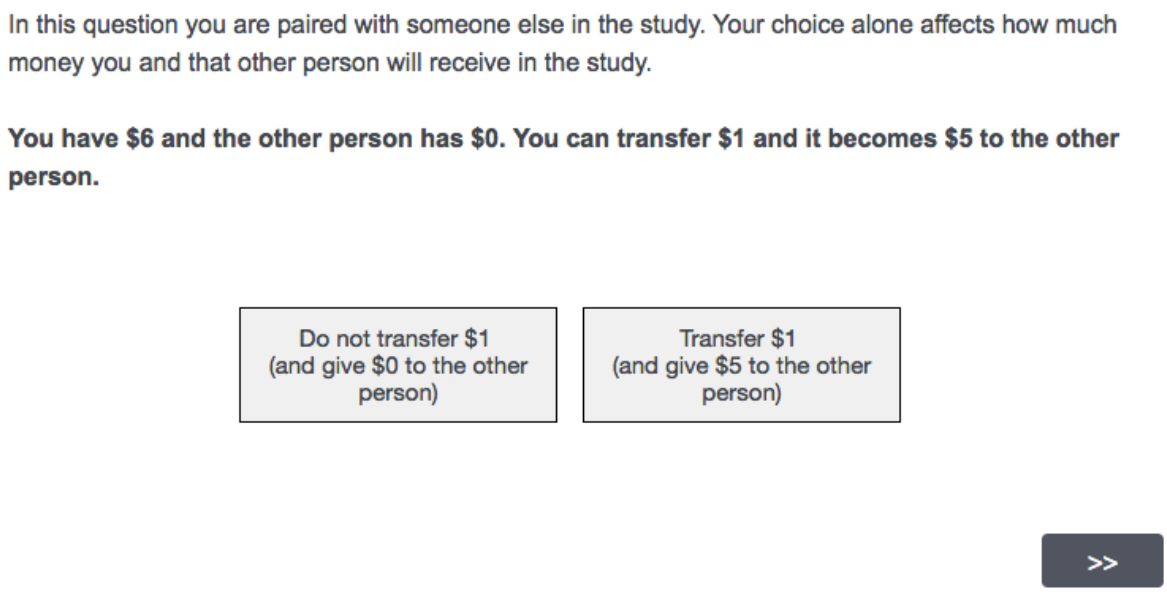



**Figure A1**: The Decision Screen for "Last Choice" Untimed Questions

Note: The decision screen for the "single choice" untimed questions looked identical except that the decision button ">>" was removed.

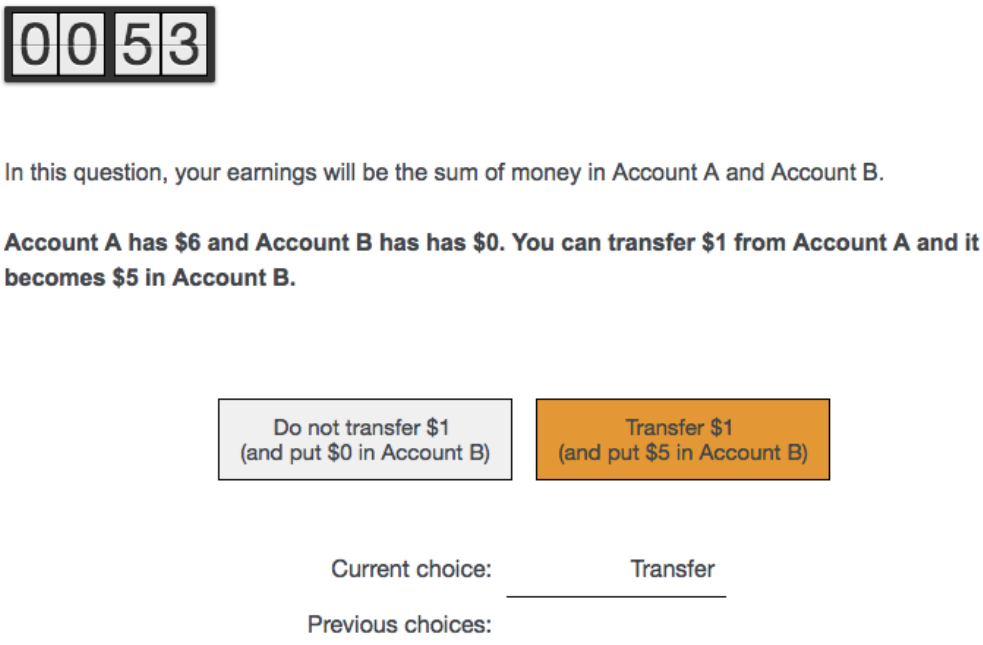
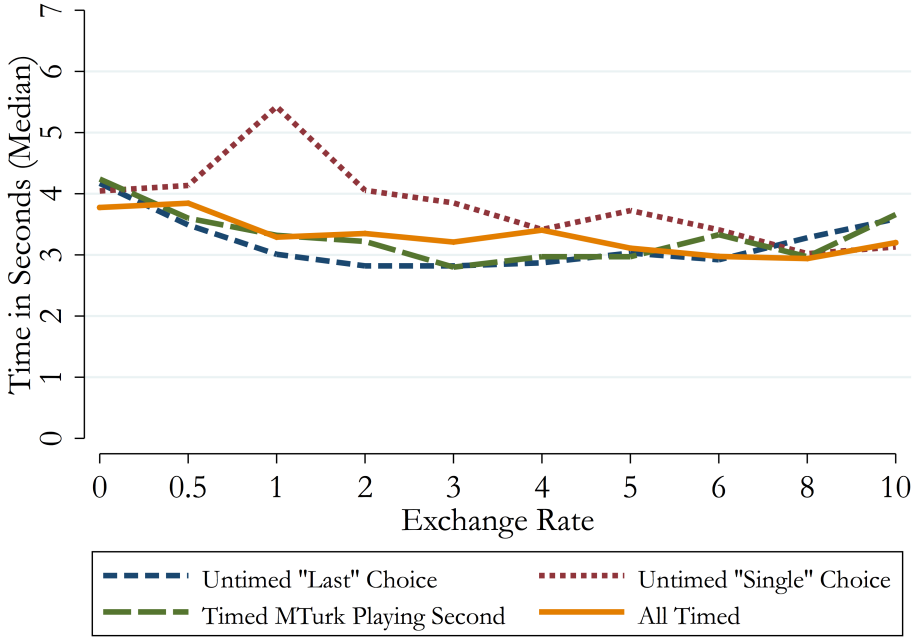
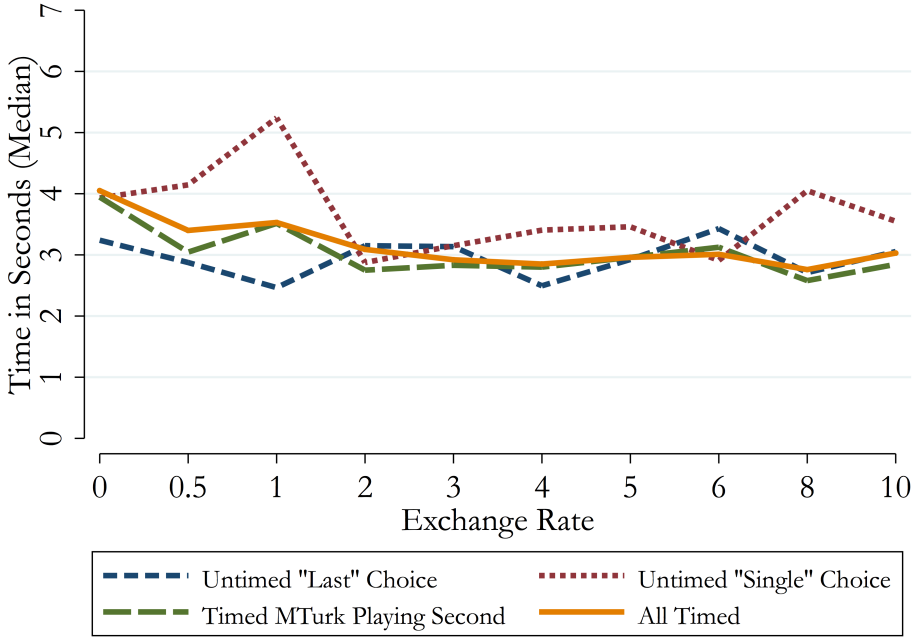



**Figure A2**: The Decision Screen for the "Accounts" Questions

Note: This is how the accounts question with exchange rate of 5 would look if a subject had clicked to transfer within the first 7 seconds of the minute. (A typo in the survey code inserted an extra "has" between "Account B" and "$0" in the first bold sentence. This typo was only caught after all data had been collected.)

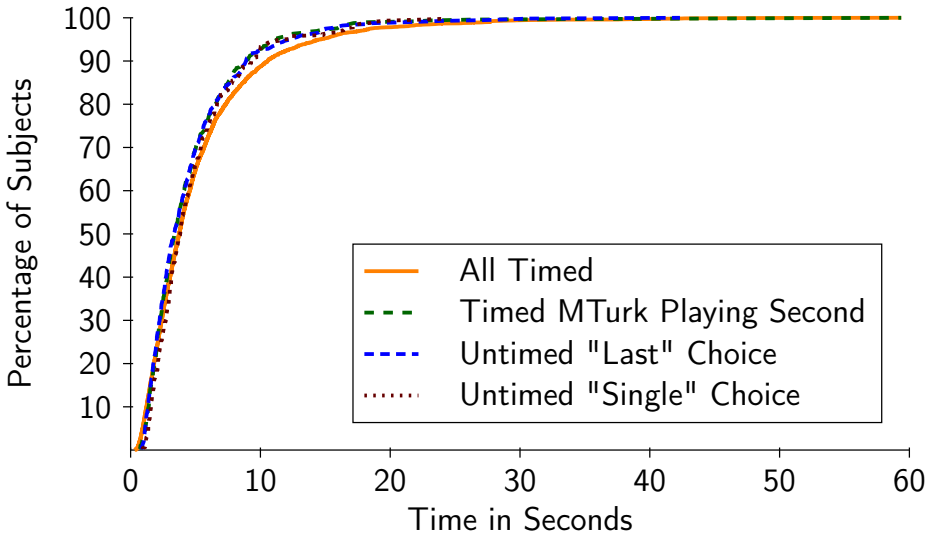



**Panel A:** Median speed of First Choices in Dictator Games

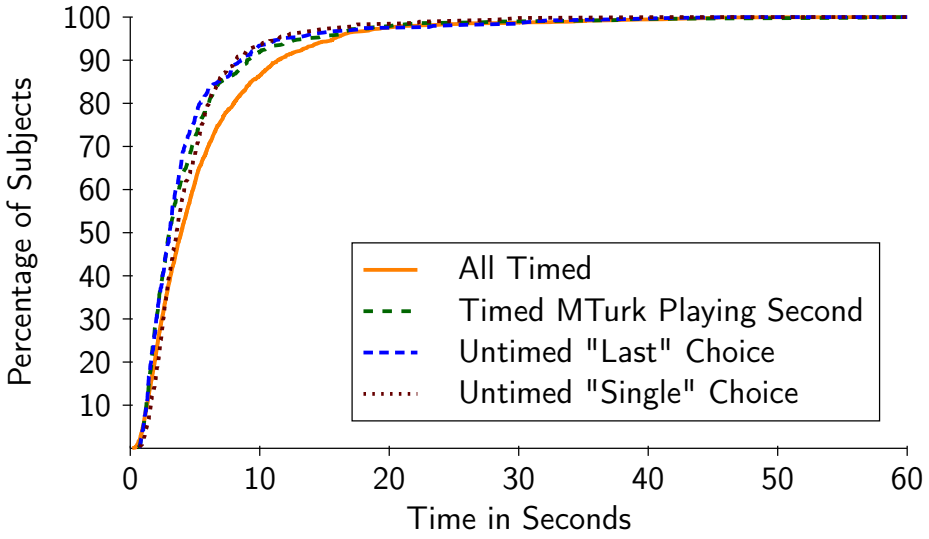



**Panel B:** Median speed of First Choices in Prisoner's Dilemmas

**Figure A3:** Median speed of choices in the untimed control treatments compared to the median speed of first choices in the timed versions.

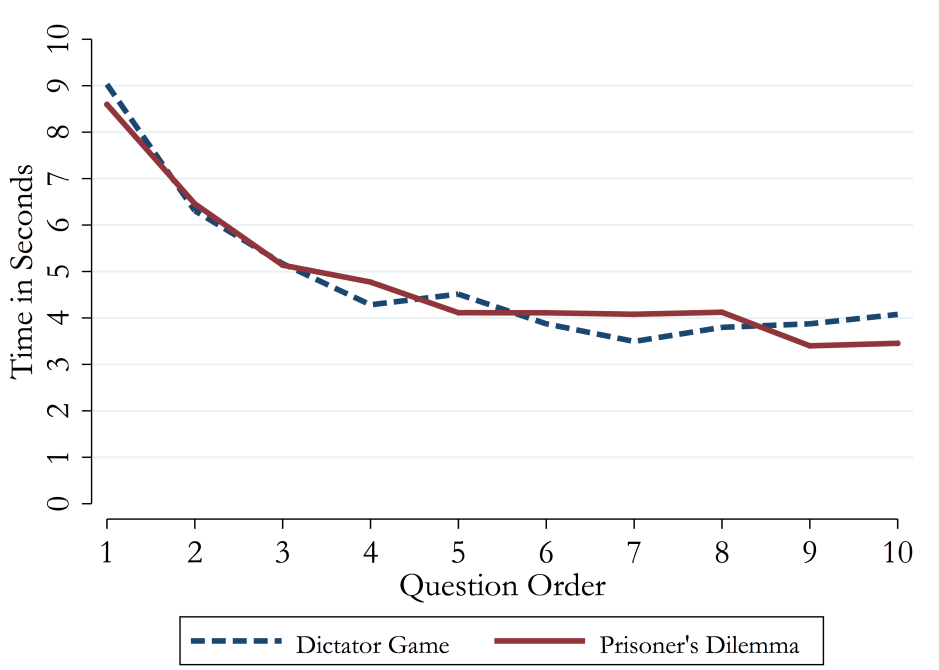



**Panel A:** Dictator Game

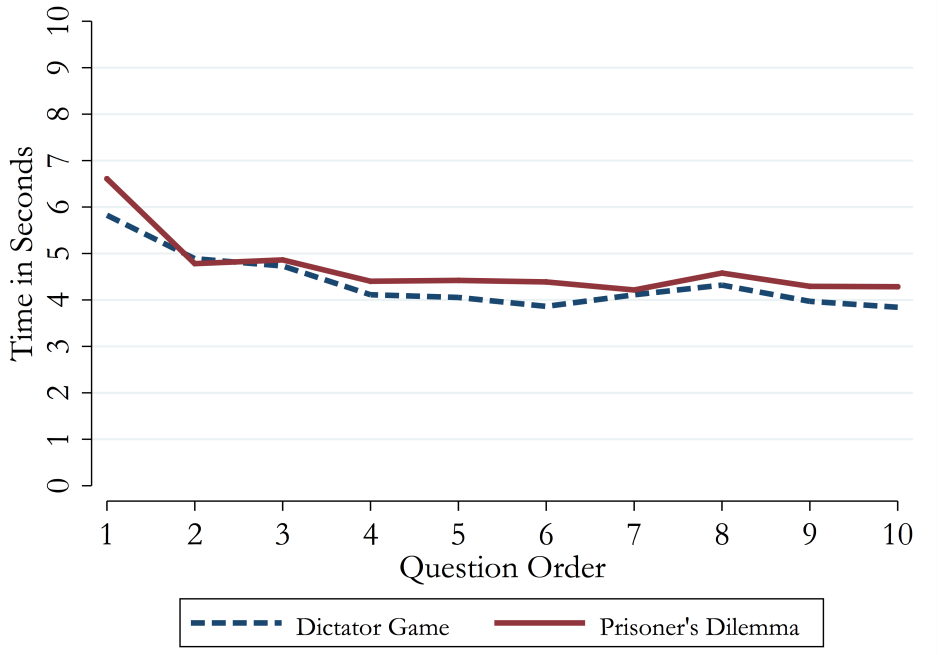



**Panel B:** Prisoner's Dilemma

**Figure A4:** CDFs of decision times of first choices, averaged across all exchange rates for the dictator games (Panel A) and the prisoner's dilemmas (Panel B).




**Panel A:** Speed of First Choices for First Set of 10 Questions




**Panel B:** Speed of First Choices for Second Set of 10 Questions

**Figure A5:** Average speed of first choices in the timed questions by the order in which the subject saw the question, averaging over exchange rates.

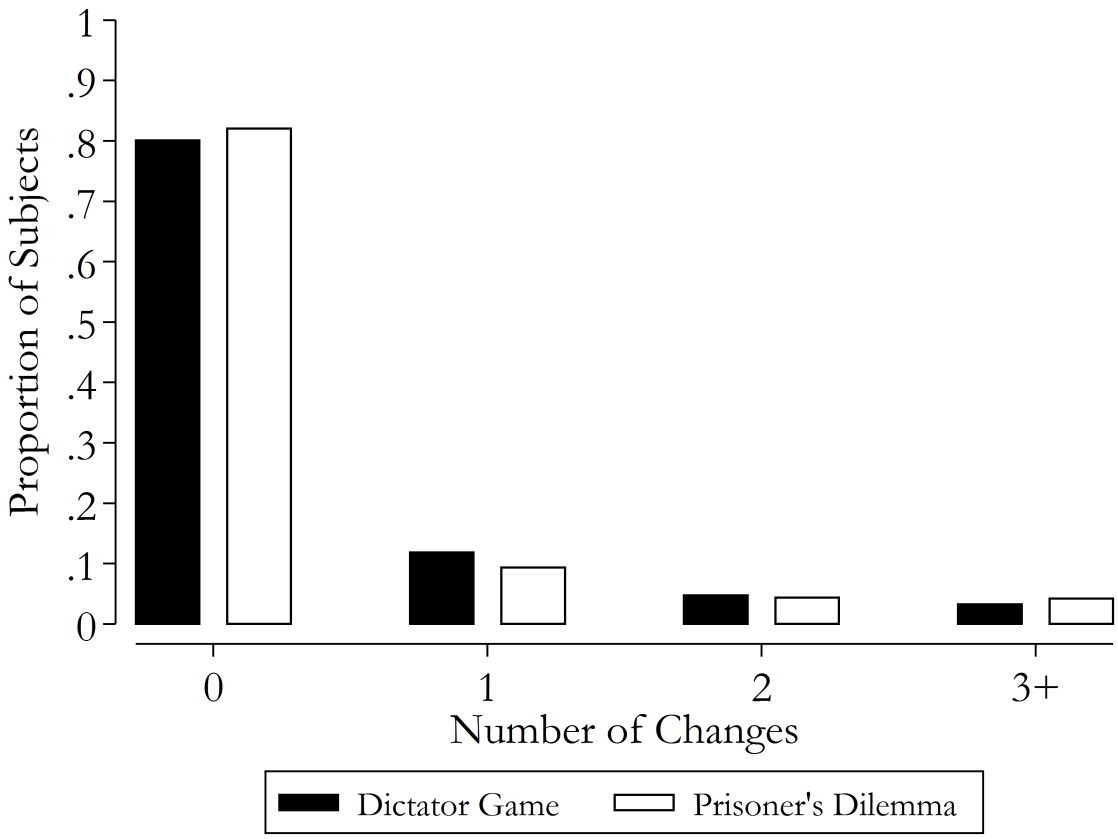



**Figure A6**: Overall Number of Times Subjects Change Choices Within a Question

**Table A1:** Comparing Wharton and MTurk Subjects

| | Speed of first choice (seconds) | Generosity Dictator Games | Generosity Prisoner's Dilemmas | Change Choice |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *MTurk* | 0.19 | 0.021 | 0.096 | -0.055 |
| | (0.25) | (0.033) | (0.030)*** | (0.016)*** |
| *Dictator* | -0.13 | | | 0.0031 |
| | (0.12) | | | (0.0099) |
| *Constant* | 5.50 | 0.15 | 0.13 | 0.15 |
| | (0.23)*** | (0.018)*** | (0.018)*** | (0.014)*** |
| *Rate Dummies* | Yes | Yes | Yes | Yes |
| Observations | 10,070 | 4,940 | 5,130 | 11,060 |
| Clusters (Subjects) | 553 | 494 | 523 | 553 |
| R-squared | 0.004 | 0.082 | 0.134 | 0.007 |

*Notes*: Table A1 compares subjects playing on Amazon's Mechanical Turk to those subjects playing in the Wharton Behavioral Lab. Regressions include dummies for exchange rate. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A2:** Comparing Speed of MTurk Subjects Playing Second to All Timed Subjects

| | Speed of first choice (seconds) | | |
|---|---|---|---|
| | All | Dictator Game | Prisoner's Dilemma |
| | (1) | (2) | (3) |
| *MTurk Played Second* | -0.13 | -0.066 | -0.19 |
| | (0.26) | (0.40) | (0.39) |
| *Dictator* | -0.14 | | |
| | (0.12) | | |
| *Constant* | 5.58 | 5.49 | 5.54 |
| | (0.22)*** | (0.28)*** | (0.26)*** |
| *Rate Dummies* | Yes | Yes | Yes |
| Observations | 10,070 | 4,940 | 5,130 |
| Clusters (Subjects) | 553 | 494 | 523 |
| R-squared | 0.004 | 0.005 | 0.004 |

*Notes*: Table A2 compares speed of first choices MTurk subjects playing in their second set of 10 questions to all other timed subjects. Regressions include dummies for exchange rate. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A3:** Generosity in First (Only) Choices of MTurk Subjects Playing Second: Timed vs. Untimed

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | Dictator Games | | Prisoner's Dilemmas | |
| | (1) | (2) | (3) | (4) |
| *Timed Games* | 0.012 | 0.0074 | 0.13 | 0.17 |
| | (0.057) | (0.054) | (0.057)** | (0.054)*** |
| *Rate* | | 0.042 | | 0.048 |
| | | (0.0048)*** | | (0.0061)*** |
| *Timed Games x Rate* | 0.15 | 0.0011 | 0.074 | -0.012 |
| | (0.043)*** | (0.0080) | (0.049) | (0.0089) |
| *Constant* | 0.11 | 0.37 | 0.10 | 0.16 |
| | (0.030)*** | (0.031)*** | (0.034)*** | (0.028)*** |
| Rate Dummies | Yes | No | Yes | No |
| Observations | 1,560 | 1,560 | 1,480 | 1,480 |
| Clusters (Subjects) | 156 | 156 | 148 | 148 |
| R-squared | 0.134 | 0.073 | 0.110 | 0.096 |

*Notes*: Table A3 compares generosity of subjects playing in their second set of 10 questions to all subjects playing the untimed versions of the game. Regressions include dummies for exchange rate or estimate it linearly. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A4:** Percent of subjects changing their choice for any given number of games

| | Number of questions (out of *first 5*) in which a subject changes choices at least once | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 |
| Dictator Game | 44.7% | 28.1% | 12.4% | 6.3% | 4.9% | 3.6% |
| Prisoner's Dilemma | 44.6% | 26.9% | 13.3% | 7.4% | 4.5% | 3.3% |

| | Number of questions (out of *last 5*) in which a subject changes choices at least once | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 |
| Dictator Game | 57.3% | 22.7% | 9.5% | 4.7% | 4.5% | 1.4% |
| Prisoner's Dilemma | 64.1% | 18.7% | 7.8% | 4.1% | 3.5% | 1.8% |

**Table A5:** Changes in Generosity with Respect to the Exchange Rate (Robustness)

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | First Round | First 5 Rounds | Last 5 Rounds | Dropping X=0, X=0.5 |
| | (1) | (2) | (3) | (4) |
| *Rate x Last Choice* | 0.013 | 0.012 | 0.011 | 0.0085 |
| | (0.0066)** | (0.0019)*** | (0.0016)*** | (0.0015)*** |
| *Last Choice* | -0.12 | -0.058 | -0.032 | -0.025 |
| | (0.032)*** | (0.0084)*** | (0.0079)*** | (0.0081)*** |
| *Rate* | 0.039 | 0.041 | 0.046 | 0.028 |
| | (0.0062)*** | (0.0025)*** | (0.0027)*** | (0.0020)*** |
| *Dictator* | -0.11 | 0.015 | -0.0012 | 0.0026 |
| | (0.035)*** | (0.015) | (0.015) | (0.015) |
| *Constant* | 0.41 | 0.30 | 0.28 | 0.40 |
| | (0.037)*** | (0.016)*** | (0.016)*** | (0.018)*** |
| Observations | 1,106 | 10,070 | 10,070 | 16,112 |
| Clusters (Subjects) | 553 | 553 | 553 | 553 |
| R-Squared | 0.104 | 0.090 | 0.106 | 0.035 |
| *Last Choice at Rate = 10* | 0.010 | 0.062 | 0.078 | 0.060 |
| | p=0.82 | p<0.001 | p<0.001 | p<0.001 |

*Notes:* Table A5 shows linear probability model estimates of how generosity in the games responds to exchange rate. *Rate* shows the slope with respect to the first choice. *Rate x Last Choice* shows how the slope changes when comparing the last choices to the first choice. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice. *Last Choice at Rate = 10* reports *Last Choice + 10(Rate x Last Choice)*, the estimated change in generosity for the exchange rate of 10 when going from first to last choice, and the p-value that it is equal to 0 from a post-estimation test. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A6:** Change in Generosity with Respect to the Exchange Rate (Robustness)

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | |
|---|---|---|---|---|
| | Dictator Game | | Prisoner's Dilemma | |
| | Low Rate (X=0,0.5) | High Rate (X=3,…,10) | Low Rate (X=0,0.5,1,2) | High Rate (X=4,…,10) |
| | (1) | (2) | (3) | (4) |
| *Last Choice* | -0.052 | 0.044 | -0.066 | 0.023 |
| | (0.011)*** | (0.010)*** | (0.0080)*** | (0.0081)*** |
| *Constant* | 0.21 | 0.56 | 0.28 | 0.62 |
| | (0.015)*** | (0.018)*** | (0.013)*** | (0.018)*** |
| Observations | 1,976 | 5,928 | 4,104 | 5,130 |
| Clusters (Subjects) | 494 | 494 | 513 | 513 |
| R-Squared | 0.005 | 0.002 | 0.006 | 0.001 |

*Notes:* Table A6 shows linear probability model estimates of how generosity in first choices and last choices differ as a function of game and whether the exchange rate is "low" or "high". We define low or high for game type based on the direction of the changes in Figure 5 (based on whether the graph demonstrates a decrease or increase from first to last choice) in order to show that we get significance even without the linear specification used elsewhere in the paper. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A7:** Robustness Tests (Dictator Games Only)

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | | | |
|---|---|---|---|---|---|---|
| | Altering First Choices | | | | Dropping Data | |
| | First choice replaced with second choice: | | First choice replaced with choice at reading speed: | | Data dropped unless: | |
| | Within 2 seconds | Within 5 seconds | Rate 0 of game | Max rate 0 & 0.5 of both | Positive slope | Monotone first choices |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Rate x Last Choice* | 0.0078 | 0.0038 | 0.0044 | 0.0029 | 0.0026 | 0.0054 |
| | (0.0017)*** | (0.0014)*** | (0.0014)*** | (0.0012)** | (0.0019) | (0.0019)*** |
| *Last Choice* | -0.0096 | 0.0024 | -0.0088 | -0.0034 | -0.0078 | -0.013 |
| | (0.0076) | (0.0066) | (0.0069) | (0.0061) | (0.0086) | (0.0096) |
| *Rate* | 0.040 | 0.044 | 0.043 | 0.045 | 0.073 | 0.050 |
| | (0.0026)*** | (0.0027)*** | (0.0027)*** | (0.0027)*** | (0.0020)*** | (0.0032)*** |
| *Constant* | 0.30 | 0.29 | 0.30 | 0.29 | 0.29 | 0.27 |
| | (0.014)*** | (0.014)*** | (0.014)*** | (0.014)*** | (0.015)*** | (0.022)*** |
| Observations | 9,880 | 9,880 | 9,880 | 9,880 | 6,100 | 4,900 |
| Clusters (Subjects) | 494 | 494 | 494 | 494 | 305 | 245 |
| R-Squared | 0.077 | 0.084 | 0.082 | 0.085 | 0.223 | 0.112 |
| % of questions we adjust changer's first choice | 17% | 42% | 43% | 52% | | |
| % of data dropped | | | | | 38% | 50% |
| *Last Choice at Rate = 10* | 0.068 | 0.040 | 0.035 | 0.026 | 0.018 | 0.041 |
| | p<0.001 | p<0.001 | p<0.001 | p<0.01 | p=0.24 | p=0.011 |

*Notes:* Table A7 shows linear probability model estimates of how generosity in the games responds to exchange rate. *Rate* shows the slope with respect to the first choice. *Rate x Last Choice* shows how the slope changes when comparing the last choices to the first choice. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice *Last Choice at Rate = 10* reports *Last Choice + 10(Rate x Last Choice)*, the estimated change in generosity for the exchange rate of 10 when going from first to last choice, and the p-value that it is equal to 0 from a post-estimation test. Standard errors are clustered by subject and significance is denoted as *** p < 0.01, ** p < 0.05, * p < 0.1.

"Rate 0 of game" reading speed is defined as time to last choice if the subject changed choices in the exchange rate 0 of the dictator game or, if the subject did not change, then the median speed to last choice of the subjects who did change (10.49 seconds).

"Max rate 0 & 0.5 of both" reading speed is defined as the maximum time to last choice if the subject changed choices in at least one of the exchange rate 0 or 0.5 questions in either question type, if the subject did not change choices to any of those four questions, the median reading speed of those who did (14.05 seconds).

**Table A8:** Robustness Tests (Prisoner's Dilemmas Only)

| | Dependent Variable: *Generosity* (i.e., Transferring $1) | | | | | |
|---|---|---|---|---|---|---|
| | Altering First Choices | | | | Dropping Data | |
| | First choice replaced with second choice: | | First choice replaced with choice at reading speed: | | Data dropped unless: | |
| | Within 2 seconds | Within 5 seconds | Rate 0 of game | Max rate 0 & 0.5 of both | Positive slope | Monotone first choices |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Rate x Last Choice* | 0.0092 | 0.0051 | 0.0027 | 0.0020 | 0.0074 | 0.0034 |
| | (0.0014)*** | (0.0013)*** | (0.0011)** | (0.0011)* | (0.0018)*** | (0.0016)** |
| *Last Choice* | -0.051 | -0.031 | -0.021 | -0.018 | -0.050 | -0.023 |
| | (0.0071)*** | (0.0061)*** | (0.0055)*** | (0.0048)*** | (0.0089)*** | (0.0088)*** |
| *Rate* | 0.053 | 0.057 | 0.059 | 0.060 | 0.080 | 0.061 |
| | (0.0025)*** | (0.0024)*** | (0.0024)*** | (0.0024)*** | (0.0019)*** | (0.0032)*** |
| *Constant* | 0.26 | 0.24 | 0.23 | 0.23 | 0.26 | 0.23 |
| | (0.013)*** | (0.013)*** | (0.013)*** | (0.013)*** | (0.014)*** | (0.020)*** |
| Observations | 10,260 | 10,260 | 10,260 | 10,260 | 7,060 | 5,340 |
| Clusters (Subjects) | 513 | 513 | 513 | 513 | 353 | 267 |
| R-Squared | 0.133 | 0.141 | 0.147 | 0.149 | 0.280 | 0.158 |
| % of questions we adjust changer's first choice | 26% | 48% | 46% | 50% | | |
| % of data dropped | | | | | 31% | 48% |
| *Last Choice at Rate = 10* | 0.041 | 0.020 | 0.006 | 0.002 | 0.024 | 0.011 |
| | p<0.001 | p=0.036 | p=0.48 | p=0.85 | p=0.085 | p=0.26 |

*Notes:* Table A8 shows linear probability model estimates of how generosity in the games responds to exchange rate. *Rate* shows the slope with respect to the first choice. *Rate x Last Choice* shows how the slope changes when comparing the last choices to the first choice. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice. *Last Choice* shows the estimated change in generosity for the exchange rate of 0 when going from first to last choice *Last Choice at Rate = 10* reports *Last Choice + 10(Rate x Last Choice)*, the estimated change in generosity for the exchange rate of 10 when going from first to last choice, and the p-value that it is equal to 0 from a post-estimation test. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

"Rate 0 of game" reading speed is defined as time to last choice if the subject changed choices in the exchange rate 0 of the prisoner's dilemma or, if the subject did not change, then the median speed to last choice of the subjects who did change (13.85 seconds).

"Max rate 0 & 0.5 of both" reading speed is defined as the maximum time to last choice if the subject changed choices in at least one of the exchange rate 0 or 0.5 questions in either question type, if the subject did not change choices to any of those four questions, the median reading speed of those who did (14.05 seconds).

**Table A9:** Speed of Choices in Dictator Games and the Accounts Treatment (Robustness, Logs)

| | Dependent Variable: *log(Seconds+1)* | | | | | |
|---|---|---|---|---|---|---|
| | All Played First | | | MTurk Played First | | |
| | First Choice | Last Choice | Last Choice if Changed | First Choice | Last Choice | Last Choice if Changed |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Dictator* | 0.0083 | 0.050 | 0.47 | 0.018 | -0.0055 | 0.33 |
| | (0.052) | (0.069) | (0.12)*** | (0.062) | (0.080) | (0.15)** |
| *Constant* | 1.52 | 1.82 | 2.28 | 1.52 | 1.82 | 2.28 |
| | (0.044)*** | (0.060)*** | (0.097)*** | (0.044)*** | (0.060)*** | (0.097)*** |
| Observations | 3,630 | 3,630 | 596 | 1,940 | 1,940 | 321 |
| Clusters (Subjects) | 363 | 363 | 233 | 194 | 194 | 123 |
| R-squared | 0.000 | 0.001 | 0.061 | 0.000 | 0.000 | 0.039 |

*Notes*: Table A9 compares the log speed of choices in the accounts treatment to timed dictator games played first either including all subjects in Columns (1) to (3) or including MTurk subjects playing first in Columns (4) to (6). *Dictator* indicates it was the dictator game rather than data from the accounts treatment. Last Choice if Changed looks at speed of last choices conditional on the subject changing their choice such that their first and last choices are different. The dependent variable is log(Seconds+1). Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A10: "**Generosity" Comparing Dictator Game to Accounts Data (Robustness Tests)

| | Dependent Variable: "*Generosity*" (i.e., Transferring $1) for X ≥ 2 | | | | | |
|---|---|---|---|---|---|---|
| | Altering First Choices | | | | Dropping Data | |
| | First choice replaced with second choice: | | First choice replaced with choice at reading speed: | | Data dropped unless: | |
| | Within 2 seconds | Within 5 seconds | Rate 0 of game | Max rate 0 & 0.5 of both | Positive slope | Monotone first choices |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Last* | -0.0015 | 0.0015 | -0.026 | -0.017 | -0.021 | -0.069 |
| | (0.017) | (0.015) | (0.0094)*** | (0.0088)* | (0.016) | (0.030)** |
| *Dictator* | -0.36 | -0.34 | -0.36 | -0.35 | -0.18 | -0.50 |
| | (0.030)*** | (0.029)*** | (0.027)*** | (0.027)*** | (0.031)*** | (0.051)*** |
| *Dictator x Last* | 0.049 | 0.029 | 0.053 | 0.044 | 0.035 | 0.11 |
| | (0.021)** | (0.018) | (0.013)*** | (0.012)*** | (0.023) | (0.035)*** |
| *Constant* | 0.83 | 0.83 | 0.85 | 0.84 | 0.85 | 0.97 |
| | (0.019)*** | (0.018)*** | (0.014)*** | (0.015)*** | (0.018)*** | (0.027)*** |
| Observations | 5,082 | 5,082 | 5,082 | 5,082 | 2,912 | 2,156 |
| Clusters (Subjects) | 363 | 363 | 363 | 363 | 208 | 154 |
| R-squared | 0.090 | 0.084 | 0.091 | 0.088 | 0.029 | 0.156 |

*Notes:* Table A10 shows linear probability model estimates of how "generosity" in the games responds to exchange rate replicating column (3) from Table 6 in the main text. *Last* indicates it was the last choice subjects made in the minute. *Dictator* indicates it was the dictator game rather than data from the accounts treatment. *Dictator x Last* is the interaction of these two variables. *Dictator x Last* is positive and significant in most of the specifications, suggesting a different pattern of changes in generosity in the dictator game and accounts treatment. Standard errors are clustered by subject and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

"Rate 0 of game" reading speed is defined as time to last choice if the subject changed choices in the exchange rate 0 of the dictator game or accounts game or, if the subject did not change, then the median speed to last choice of the subjects who did change (10.49 for dictator games, 8.30 for accounts).

"Max rate 0 & 0.5 of both" reading speed is defined as the maximum time to last choice if the subject changed choices in at least one of the exchange rate 0 or 0.5 questions in either dictator game or prisoner's dilemma, if the subject did not change choices to any of those four questions, the median reading speed of those who did (14.05 seconds). We defined a similar measure for the accounts data looking at whether a subject changed at exchange rate 0 or 0.5 (median time was 8.35).

**Table A11:** Time to First Choice Fast to Slow Choices (Robustness, Four Hard Questions)

| | Speed of first choice (seconds) | | | Change Choice | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All 10 Rounds | First 5 Rounds | Last 5 Rounds | All 10 Rounds | First 5 Rounds | Last 5 Rounds |
| *Hard Question* | 0.88 | 0.88 | 0.75 | 0.11 | 0.11 | 0.10 |
| | (0.20)*** | (0.29)*** | (0.21)*** | (0.013)*** | (0.023)*** | (0.017)*** |
| *Dictator* | -0.072 | -0.36 | 0.21 | -0.032 | -0.027 | -0.035 |
| | (0.19) | (0.31) | (0.28) | (0.015)** | (0.022) | (0.016)** |
| Mean for Easy | 4.52 | 5.32 | 3.72 | 0.046 | 0.066 | 0.026 |
| Observations | 3,070 | 1,535 | 1,535 | 3,070 | 1,535 | 1,535 |
| Subjects (Clusters) | 237 | 237 | 237 | 237 | 237 | 237 |
| R-Squared | 0.359 | 0.458 | 0.394 | 0.274 | 0.321 | 0.372 |

*Notes*: Table A11 reports how speed of first choice and probability of changing a choice correlates with whether the question is hard or easy where *Hard Question* is defined as 2 exchange rates above and 2 exchange rates below a subject's crossover point. All regressions include subject fixed effects, controls for the order in which the questions were answered in the set of 10, and the exchange rate. Standard errors are clustered on the subject level and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Table A12:** Time to First Choice Fast to Slow Choices (Robustness, Elastic Based on Last Choice)

| | Speed of first choice (seconds) | | | Change Choice | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All 10 Rounds | First 5 Rounds | Last 5 Rounds | All 10 Rounds | First 5 Rounds | Last 5 Rounds |
| *Hard Question* | 0.59 | 0.48 | 0.58 | 0.11 | 0.12 | 0.10 |
| | (0.21)*** | (0.28)* | (0.36) | (0.022)*** | (0.033)*** | (0.028)*** |
| *Dictator* | -0.096 | -0.50 | 0.30 | 0.00072 | -0.013 | 0.014 |
| | (0.15) | (0.25)** | (0.20) | (0.015) | (0.022) | (0.018) |
| Mean for Easy | 4.40 | 5.17 | 3.62 | 0.132 | 0.156 | 0.107 |
| Observations | 4,460 | 2,230 | 2,230 | 4,460 | 2,230 | 2,230 |
| Subjects (Clusters) | 308 | 308 | 308 | 308 | 308 | 308 |
| R-Squared | 0.373 | 0.449 | 0.385 | 0.278 | 0.326 | 0.347 |

*Notes*: Table A12 reports how speed of first choice and probability of changing a choice correlates with whether the question is hard or easy based on the crossover point for subjects who are elastic in last choices. All regressions include subject fixed effects, controls for the order in which the questions were answered in the set of 10, and the exchange rate. Standard errors are clustered on the subject level and significance is denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

**Appendix B: Experimental Instructions**

*The following screens show the Instructions that were common to all versions of the experiment. Notes about the instructions appear in blue italics.*

---

*Consent Form:*

**Title of the Research Study: Decision Making Study**

**Protocol Number**: 821552

**Principal Investigators**: Professor Judd Kessler (juddk@wharton.upenn.edu)

You are being asked to take part in a research study. This is not a form of treatment or therapy. It is not supposed to detect a disease or find something wrong. Your participation is voluntary which means you can choose whether or not to participate. If you decide to participate or not to participate there will be no loss of benefits to which you are otherwise entitled. Before you make a decision you will need to know the purpose of the study, the possible risks and benefits of being in the study and what you will have to do if decide to participate. The researcher is available by email to talk with you about the study and give you this consent document to read.

If you do not understand what you are reading, do not sign it. Please ask the researcher to explain anything you do not understand, including any language contained in this form. If you decide to participate, you will be asked to continue with the study after reading this form and your continuation will indicate your consent.

**What is the purpose of this research?**

The purpose of the study is to better understand how people make decisions.

**How long will I take part in this research?**

Your participation will take approximately 30 minutes.

**What can I expect if I take part in this research?**

As a participant, you will be asked to answer a series of questions. Additional information will be provided to you during your study participation.

**What are the risks and possible discomforts?**

There are no anticipated risks associated with the study.

**Will I be compensated for participating in this research?**

In addition to your show-up fee, you may earn additional money from participating in the study.

**If I take part in this research, how will my privacy be protected? What happens to the information you collect?**

The data we collect will not include any personal or sensitive information. In addition, it will not be identified with your name, but only with a participant number. The data will eventually be used for publication in research journals and presentations at scientific conference. At such time, the data will be presented in aggregate, and individual participants will never be discussed.

**Who can I call with questions, complaints or if I'm concerned about my rights as a research subject?**

If you have questions, concerns or complaints regarding your participation in this research study or if you have any questions about your rights as a research subject, you should speak with the Principal Investigator listed at the top of this form. If a member of the research team cannot be reached or you want to talk to someone other than those working on the study, you may contact the Office of Regulatory Affairs with any question, concerns or complaints at the University of Pennsylvania by calling (215) 898-2614.

By continuing with this study, you are consenting to participate.

---

Thank you for participating in this study.

In this study you can earn money and you can affect the earnings of other people who participate in this study. Anything you earn in the study will be paid to you as a bonus payment on top of your show-up fee.

**Please read the rules of the study carefully** so you understand how the study works.

---

**What are the rules of the study?**

On each screen in this study, you will face a decision question that may affect your earnings and may affect the earnings of others in the study.

There are two types of questions. Some are in the standard format, where your answer is only recorded when you press submit. Other questions you will see for a fixed amount

of time. For these timed questions, the answer you record at each second has the potential to affect your earnings and the earnings of others in the study.

You will be shown each timed question for 60 seconds. In addition to having an initial answer to the question, you may decide you want to change your answer one or more times during the 60 seconds.

Your earnings and the earnings of the other people in the study depend on what your answer is at each moment during the 60 seconds. In particular, for each question we will determine your *official answer* to that question by randomly picking one second out of the 60 seconds. Whatever your answer was during that second of the 60 seconds will be your *official answer* for the question, and this *official answer* will determine your payment.

**This means that at each moment during the 60 seconds, you should report whatever is your best answer to the question at that moment in time.**

If you had not yet provided an answer at the second that we randomly pick, no additional earnings will be awarded for you or anyone else in the study for that question.

**This means that you should record your initial answer as soon as you have one.**

---

**How do I answer the question at each moment in time?**

For each question, you will report your answer by pressing one of a number of buttons on the screen. Each button has one potential answer to the question.

To select your initial answer, click one of the buttons. To change your answer at any moment in time, click a new button.

Every time you click a button, we will display your choice in a table below the buttons. We will report your most recent choice in the top row of the table.

A timer will appear above the question to let you know how many seconds remain for the question.

---

**What are the types of questions I will answer?**

The timed questions you will answer in the study take a variety of forms. On each screen you will see a description of the question for 10 seconds before the buttons appear and the 60 seconds to answer the question begin. A 10-second timer will count down the number of seconds before the buttons appear.

We will show you a sample question on the following screen so you can see how the interface looks and how the boxes and table work.

---

**Sample question**

This question does not affect your or anyone's earnings. Please click on the buttons to see how they work.

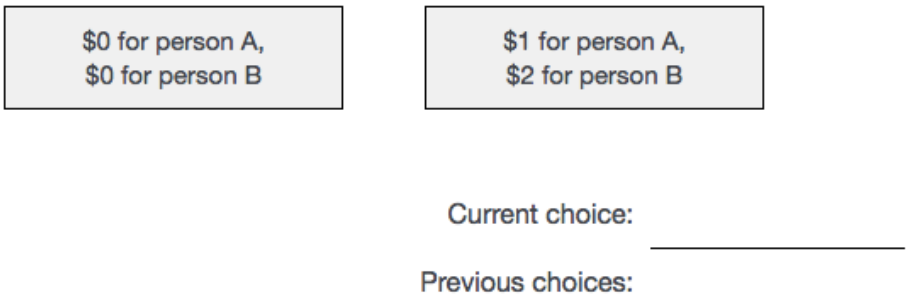
---

*20-second screen (timer appeared):*

**Sample question**

This question does not affect your or anyone's earnings. Please click on the buttons to see how they work.

Choose which outcome you want for person A and person B.




---

We will now show you some examples so you can see how your official answer is determined by your choices. To explain this more clearly we label the buttons #1 and #2.

---


Example 1:

Suppose you chose the button #2 immediately and left it there for the entire 60 seconds. Then for any second we randomly selected your official answer would be "$1 for person A, $2 for person B" since that was your choice at every second.

Example 2:

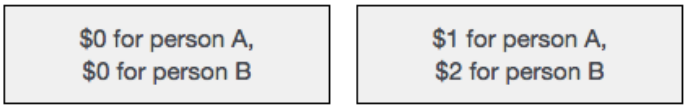
Suppose that you selected nothing for 10 seconds and then selected button #2. Suppose then that at second 15 you switched to button #1. Suppose that then at second 22 you switched to button #2 and left it there for the rest of the time.

In this case your official answer would be:

• If we randomly select a second between 1 and 9 seconds: No answer recorded.
• If we randomly select a second between 10 and 14 seconds: $1.00 for person A, $2.00 for person B.
• If we randomly select a second between 15 and 21 seconds: $0.00 for person A, $0.00 for person B.
• If we randomly select a second between 22 and 60 seconds: $1.00 for person A, $2.00 for person B.

Reminder: if you have no answer recorded at the randomly selected second, then neither you nor anyone else in the study can earn any money from that question.

---



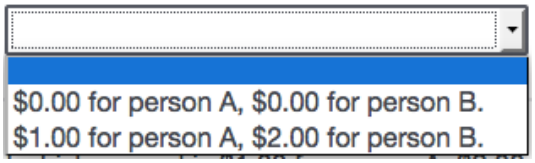

#1 #2

To make sure you understand how choices map into an official answer, please read the example below and answer the two accompanying questions. You will not be able to advance with the study until you answer both questions correctly.

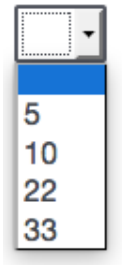
Survey Question 1:

Suppose that you selected nothing for 13 seconds and then selected button #2. Suppose that then at second 20 you switched to button #1. Suppose that then at second 32 you switched to button #2 and left it there for the rest of the time.

Imagine second 25 was randomly chosen to be the one that count. What would be your official answer?




At which second is $1.00 for person A, $2.00 for person B your official answer?



---

**How do you determine my extra earnings?**

There are 21 questions in this study.

We will randomly pick 1 question to be paid, and pay you (and possibly others in the study) based on your choices.

Note that for the question that gets picked, your official answer will determine your earnings (and possibly the earnings of others in the study).

---

*The following screens show the Instructions in the Timed Dictator Games*

---

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Your choice alone will affect how much money you and that person receive in the study.

You have the opportunity to transfer money to them but they do not have an opportunity to transfer to you.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

---

*1-minute screen (timer appeared), example question:*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

**You have $3 and the other person has $0. You can transfer $1 and it becomes $2 to the other person**

---

*The following screens show the Instructions in the Timed Prisoner's Dilemmas*

---

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Both your choice and that person's choice will affect how much money you and that person earn in the study.

You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

Your earnings will depend on what they choose at second 15.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you. Your earnings will depend on what they choose at second 15.

---

*1-minute screen (timer appeared), example question:*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you. Your earnings will depend on what they choose at second 15.

**You have $1 and the other person has $1. You can transfer $1 and it becomes $2 to the other person.**

---

*The following screens show the Instructions in the Accounts Treatment*

---

For each of the next 10 questions, you will have two accounts. The accounts will be called Account A and Account B. Your earnings from each question will be the sum of the money in the two accounts. For example, if you have $4 in Account A and $3 in Account B, you will earn $4 + $3 = $7 dollars for the question.

---

In each of the next 10 questions, you can choose whether or not transfer money from Account A to Account B. The amount of money from Account A may change when it is put into Account B.

For example, suppose Account A has $5 and Account B has $0. Suppose you can transfer $2 from Account A and it becomes $6 in Account B.

Please answer the comprehension questions about the example above. You must answer all of them correctly to proceed with the study.

If you do not transfer $2 from Account A: How much money do you have in Account A and in Account B?

- ○ $5 in Account A and $0 in Account B
- ○ $3 in Account A and $6 in Account B
- ○ $0 in Account A and $5 in Account B

If you do not transfer $2 from Account A: How much money do you earn for this question?

- ○ $5
- ○ $6
- ○ $2

If you transfer $2 from Account A: How much money do you have in Account A and in Account B?

- ○ $5 in Account A and $0 in Account B
- ○ $3 in Account A and $6 in Account B
- ○ $0 in Account A and $5 in Account B

If you transfer $2 from Account A: How much money do you earn for this question?

○ $0
○ $9
○ $2

---

For another example, suppose account A has $8 and Account B has $0. Suppose you can transfer $1 from Account A and it becomes $7 in Account B.

How much money do you make in this question if you transfer the $1?

How much money do you make if you do not transfer?

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question, your earnings will be the sum of money in Account A and Account B.

---

*1-minute screen (timer appeared), example question:*

In this question, your earnings will be the sum of money in Account A and Account B.

**Account A has $3 and Account B has has $0. You can transfer $1 from Account A and it becomes $2 in Account B.**

---

*The following screens show the Common Instructions in the "Single Choice" Treatments*

---

The next 10 questions have the single-choice format, where your answer is recorded when you make a choice. After you press a button, your choice will be recorded and you will automatically advance to the next page.

We will show you a sample question on the following screen so you can see how the interface looks and how you are automatically advanced to the next page when you make a choice.

---

*10-second screen (timer appeared):*

This is an example question that doesn't affect anyone's payoffs. After you press a button, your choice is recorded and you will automatically advance to the next page.

---

This is an example question that doesn't affect anyone's payoffs. After you press a button, your choice is recorded and you will automatically advance to the next page.

Choose which outcome you want for person A and person B:

| | |
|---|---|
| $0 for person A,<br>$0 for person B | $1 for person A,<br>$2 for person B |

---

*The following screens show the Dictator Game Instructions for the "Single Choice" Treatments*

---

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Your choice alone will affect how much money you and that person receive in the study.

You have the opportunity to transfer money to them but they do not have an opportunity to transfer to you.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

---

*Example question:*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

**You have $3 and the other person has $0. You can transfer $1 and it becomes $2 to the other person.**

---

*The following screens show the Prisoner's Dilemma Instructions for the "Single Choice" Treatments*

---

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Both your choice and that person's choice will affect how much money you and that person earn in the study.

You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

---

*Example question:*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

**You have $1 and the other person has $1. You can transfer $1 and it becomes $2 to the other person.**

---

*The following screens show the Dictator Game Instructions for the "Last Choice" Treatments*

---

The next 10 questions have the standard format where your answer is only recorded when you press submit.

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Your choice alone will affect how much money you and that person receive in the study. You have the opportunity to transfer money to them but they do not have an opportunity to transfer to you.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

---

*Example question:*

In this question you are paired with someone else in the study. Your choice alone affects how much money you and that other person will receive in the study.

**You have $3 and the other person has $0. You can transfer $1 and it becomes $2 to the other person.**

---

*The following screens show the Prisoner's Dilemma Game Instructions for the "Last Choice" Treatments*

---

The next 10 questions have the standard format where your answer is only recorded when you press submit.

For each of the next 10 questions, you will randomly be paired with another person in the study. You will be paired with a different person for each question.

Both your choice and that person's choice will affect how much money you and that

person earn in the study.

You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

---

On the next page, you will see one of the questions. Only click to proceed to the next screen when you are ready.

---

*10-second screen (timer appeared):*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

---

*Example question:*

In this question you are paired with someone else in the study. Your choice and their choice both affect how much money you and that other person will receive in the study. You have the opportunity to transfer money to them and they have the exact same opportunity to transfer to you.

**You have $1 and the other person has $1. You can transfer $1 and it becomes $2 to the other person.**