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Error-prone inference from response time: The case of intuitive generosity in public-good games☆

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ABSTRACT

Previous research on public-good games revealed greater contributions by fast decision-makers than by slow decision-makers. Interpreting greater contributions as generosity, this has been seen as evidence of generosity being intuitive. We caution that fast decisions are more prone to error, and that mistakes, rather than preferences, may drive the observed comparative static. Varying the location of the equilibrium in public-good games with a unique dominant strategy, we show that the location of the equilibrium determines whether contributions are larger for fast decision-makers than for slow decision-makers. Replicating previous results, we find that fast decision-makers give more than slow decision-makers when the equilibrium is below the mid-point of the strategy set, but that this result is reversed when the equilibrium is above the mid-point. Consistent with fast decisions being more prone to error, we find that individuals who make (or have to make) fast decisions are insensitive to incentives, more often make mistakes, and are less likely to make equilibrium contributions. These findings make clear that we must control for the rate of errors if we are to draw inference on preferences from response time.

1. Introduction

To better understand the choices people make, researchers have begun to investigate the decision process that leads to choices. Brain imaging, eye tracking, and measures of heart rate and skin conductance have all been used to understand this process.[1] While these physiological measures require special equipment, response time, which is the time it takes individuals to make decisions, is easily acquired and is increasingly used to examine decision-making.[2] For example, response time has been used to predict choices between products, to predict indifference points, to more broadly draw inference on preferences, and to understand strategic thinking and behavior (see Spiliopoulos and Ortmann, 2017 for a review).[3]

Our ability to directly infer preferences from response time, however, hinges on the assumption that observed decisions reflect the underlying preferences, and that the reflection is independent of the time it takes individuals to make a decision. Questioning the validity of this assumption, we find that fast decisions are more prone to error. This holds when response time is endogenously chosen by the decision-maker, and when it is exogenously imposed by the experimenter through time pressure or time delay. Thus, inference on preferences from response time requires that we account for the rate of mistakes.

To demonstrate the potential for false inference from response time we examine the literature on whether individuals are tempted to be generous or to be selfish. This literature extends models on dual selves and dual-processes reasoning to voluntary giving and asks: Is giving

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[1] See e.g., Crawford (2008), Rustichini (2008), Smith and Dickhaut (2005), Caplin and Schotter (2008), Camerer et al. (2005).

[2] The software used in the experimental laboratory automatically records the time it takes for participants to make decisions, thus making it straightforward for scholars to examine how response times correlate with individual choice.

[3] See also Rubinstein (2007, 2013, 2016), Chabris et al. (2009), Milosavljevic et al. (2010), Schotter and Trevino (2012), Agranov et al. (2015), Arad and Rubinstein (2012), and Caplin and Martin (2013).

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impulsive and intuitive or, is it a deliberate and calculated choice?[4] Arguing that intuitive decisions can be inferred from fast decisions and that calculated decisions can be inferred from decisions that are made more slowly, this literature explores how contributions to a public good vary with response time. Lending support to generosity being intuitive, these studies demonstrate in constant-return public-good games (aka voluntary contribution mechanism, VCM) that fast decisions involve greater contributions. This comparative static holds both when response time is endogenously chosen by participants and when it is exogenously imposed by the experimenter through time pressure or time delay.[5]

The concern in using response time to draw inference on preferences is that fast decisions may be more prone to error.[6] This concern is particularly relevant in the VCM, where mistakes cannot be distinguished from generosity (Andreoni, 1995; Houser and Kurzban, 2002), and where fast mistakes can be misinterpreted as fast generosity. In the classic VCM n individuals form a group and each allocates an endowment between a private and a public good. A unit allocation to the private good generates a private payoff of 1, while a unit contribution to the public good secures a payoff of r to each group member, where $1/n < r < 1$. To maximize own material payoffs, it is a dominant strategy to allocate the endowment to the private good, whereas maximization of the group's aggregate material payoff requires that the endowment is allocated to the public good.[7] With the dominant strategy equilibrium of zero contribution to the public good, all equilibrium deviations benefit others and are consistent with generosity. Consequently, quick erroneous deviations from equilibrium will attribute to contributions being greater for fast decision-makers.

To explore the potential role of mistakes, we modify the VCM to a public-good game where mistakes can be identified. We design a game with an interior equilibrium where some deviations from equilibrium decrease both the earnings of the individual and the earnings of other group members.[8] As neither a selfish nor a generous person should be selecting such contributions, we classify them as mistakes and examine whether the rate of mistakes varies with response time. To demonstrate the effect mistakes may have on inference from response time, we look at the effect of varying the location of the equilibrium. The equilibrium in one set of treatments lies below the midpoint of the strategy set (as in the VCM) and in another lies above the midpoint. This variation allows us to explore if the finding that fast decision-makers contribute more than slow decision-makers is robust to changing the location of the equilibrium, and thereby assess whether mistakes may have contributed to the earlier finding.

Our main study uses a 2×3 between-subject design. We examine two different locations of the equilibrium, and three different time treatments. In one of the time treatments, decision-makers freely choose their response time. Time is instead exogenously manipulated in the two other time treatments by imposing a time delay or a time limit.

The two different locations of the equilibrium allow us to assess the relative generosity of fast versus slow decisions, and the role of mistakes when drawing inference from response time. We refer to the treatment with the equilibrium below the midpoint of the strategy set as the “Low” treatment, and to the treatment with the equilibrium above the midpoint of the strategy set as the “High” treatment. If response time solely reflects preferences, then we should find the same generosity ordering of fast and slow decision-makers in the Low and High treatments. In particular, if fast decisions are more generous, then fast decision-makers should make larger contributions in both the Low and the High treatments. In varying the location of the equilibrium we can also assess the responsiveness to incentives and whether it varies with response time.

Our three time treatments help us assess differences in behavior by fast and slow decision-makers. We examine the effect of response time when decision-makers are free to choose how long they take to decide and when they are forced to make a fast or slow decision. In the endogenous-time treatments we classify fast decision-makers as those who use less than the median time to decide. In two exogenous-time treatments we impose either time pressure or time delay. Decisions in time-pressure treatments must be made before the time limit expires and decisions in time-delay treatments cannot be made until after a time limit has passed. In line with the endogenous-time treatments, we refer to participants in the time-pressure treatment as fast decision-makers and to those in the time-delay treatment as slow decision-makers.

Our results from the Low endogenous-time treatment replicate existing research on intuitive generosity, showing that fast decision-makers contribute more than slow decision-makers. However, this relationship is reversed in the High endogenous-time treatment, where fast decision-makers contribute less than slow decision-makers. We find in both the Low and High endogenous-time treatments that fast decision-makers are more likely to make mistakes. That is, they choose contributions that simultaneously decrease earnings to themselves and to other group members. By contrast, slow decision-makers are more likely to contribute the equilibrium amount, and when they deviate from the dominant strategy they are more likely to make welfare-improving contributions. Comparing the Low and High treatments we find significant differences in the contributions made by slow decision-makers, while those made by fast decision-makers are not distinguishable by treatment. These results are replicated in the treatments with exogenous time-pressure and time-delay. Thus, fast decision-makers appear insensitive to incentives and are more prone to error, irrespective of whether they voluntarily make fast decisions or are forced to do so.

All these findings are from one-shot interactions. We also have data from repeated interactions, which shows that contributions quickly converge toward the interior equilibrium. Convergence of average contributions occurs from above in the Low treatments and from below in the High treatments. These opposing directions of convergence are consistent with overcontribution in the Low treatment and the undercontribution in the High treatment being due to mistakes.

As noted above, our main study examines contributions in a public-good game with an interior equilibrium. Specifically, we rely on piecewise linear payoff functions that allow us to identify mistakes. The resulting payoff structure is less transparent than that of the classic VCM games, and this complexity may increase the rate of mistakes

[4] Central to models of dual selves is that decisions are influenced by an intuitive system which is responsible for automated, rule-based choices, and by a deliberative system, through which calculated reflective decisions are made (see e.g., Evans, 2008; Kahneman, 2003, 2011; Shefrin and Thaler, 1988; Loewenstein and O'Donoghue, 2004; Benhabib and Bisin, 2005; Bernheim and Rangel, 2004; Fudenberg and Levine, 2006, 2012). Examples of studies asking whether generosity is intuitive or calculated are Martinsson, Myrseth, and Wollbrant (2012), Kocher et al. (2017), Kinnunen and Windmann (2013), Kessler and Meier (2014), Achtziger et al. (2015), Yamagishi et al. (2017). Dreber et al. (2016) extends the dual-self model to account for intuitive generosity. While it is important to understand whether generosity is intuitive, it is less clear how one is to examine it. For example, Vesterlund (2016) argues that a temptation to give generates the same comparative statics as those attributed to “avoiding the ask” in DellaVigna et al. (2012). Some studies suggest that generosity is intuitive while others find evidence in favor of a deliberate generosity hypothesis. For example, Ruff et al. (2013), and Kinnunen and Windmann (2013) show evidence consistent with other-regarding behavior being intuitive, while Achtziger et al. (2015, 2016), Knoch et al. (2006), Kocher et al. (2017), Fiedler et al. (2013) and Strang et al. (2014) show evidence consistent with other-regarding behavior being a deliberative choice.

[5] See Rand et al. (2012), Lotito et al. (2013) and Nielsen et al. (2014) for studies examining the correlation between contributions and response times. Tinghög et al. (2013), Rand et al. (2014), and Bouwmeester et al. (2017) examine the response to time pressure.

[6] Studies examining the correlation between response times and choices in beauty contest games show that lower frequencies of dominated choices are associated with larger response times (e.g., Kocher and Sutter, 2006; Rubinstein, 2007; and Agranov et al., 2015).

[7] Throughout the paper we use the term ‘dominant strategy’ to refer to selfish material payoff-maximizing choices, and Nash equilibrium refers to the Nash equilibrium under narrow material selfishness.

[8] We maintain an equilibrium in dominant strategies and place both the equilibrium and the group-payoff-maximizing outcomes away from the boundaries and the midpoint of the strategy set. These non-linear public-good games allow us to identify mistakes and to better capture the incentives associated with voluntary contributions to public goods. Examining voluntary contributions to public goods, be it in theoretical or empirical work, researchers assume that there exists an interior equilibrium where individuals have a private incentive to secure the good (street lighting, clean air, etc.) and where the marginal return from such goods are decreasing (e.g., Bergstrom et al., 1986).