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Beliefs and truth-telling: A laboratory experiment☆

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ABSTRACT

We conduct a laboratory experiment with a constant-sum sender–receiver game and a sequential game of matching pennies with the same payoff structure to investigate the impact of individuals' first- and second-order beliefs on truth-telling. While first-movers in matching pennies choose an action at random, senders in the sender–receiver game tell the truth more often than they lie. Since second-order beliefs are uncorrelated with actions in both games, excessive truth-telling is unlikely to be driven by guilt aversion or preferences for truth-telling that are based on second-order beliefs; preferences for truth-telling *per-se*, on the other hand, cannot be rejected.

1. Introduction

A robust finding in experimental studies on strategic information transmission is that individuals reveal more private information than predicted by (sequential) equilibrium (e.g., Blume et al., 2001; Cai and Wang, 2006). As argued by Gneezy (2005), an individual's willingness to misreport private information thereby seems to be a matter of weighing costs and benefits: The higher the possible gains from deception and the lower the associated losses for those being deceived, the more keen individuals are to deceive. Many contributions emphasize that the costs and benefits of deception are not entirely captured by the corresponding monetary consequences (e.g., Gneezy, 2005; Sánchez-Pagés and Vorsatz, 2007; Kartik, 2009). In fact, it has been shown recently that some individuals prefer Pareto-inferior allocations (in monetary terms) if a

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Pareto-improvement would involve deception (Erat and Gneezy, 2011) or refuse to lie at a cost for themselves even if there is no other player involved or the other player's payoff is unaffected (Gibson et al., 2013; López-Pérez and Spiegelman, 2013).

The literature offers various explanations for excessive truth-telling (i.e. truth-telling beyond (sequential) equilibrium predictions). These explanations differ with respect to how individuals react to their beliefs regarding the behavior and the beliefs of other players. Following Crawford (2003), Kawagoe and Takizawa (2009) and Wang et al. (2010) explain their experimental findings in sender-receiver games with a model that assumes individuals to maximize payoffs given their beliefs but to differ in their depth of reasoning when forming these beliefs. In contrast, Kartik (2009) remains in the sequential rationality paradigm and enriches the original analysis with payoff-maximizing agents (see Crawford and Sobel, 1982) with the introduction of exogenous lying costs for senders. This approach has been useful for an interpretation of the experimental findings in Sánchez-Pagés and Vorsatz (2009), Gibson et al. (2013), López-Pérez and Spiegelman (2013), and Gneezy et al. (2013).

Lying costs as in Kartik (2009) are purely action-based (i.e. the individual suffers from uttering a lie) and an analysis of the sender's trade-off between costs of lying and gains from truth-telling therefore only requires a consideration of the sender's action and her (first-order) beliefs over the receiver's action. Other contributions, however, suggest an impact of the sender's second-order beliefs (i.e. whether the sender thinks that the receiver expects her to lie or to tell the truth). Using the framework of psychological games (Geanakoplos et al., 1989; Battigalli and Dufwenberg, 2007, 2009), Charness and Dufwenberg (2011) and Battigalli et al. (2013) propose guilt aversion as a motivation for truth-telling. Battigalli et al. (2013) demonstrate that the data in Gneezy (2005)'s experiment can be explained by senders who feel guilty if they let down the receiver relative to his payoff expectations. In this case, the sender's lying costs are increasing in the probability that she assigns to the receiver expecting the truth (i.e. the sender's second-order belief).

To investigate the actual role of beliefs for strategic information transmission (and to compare it with the different theoretical explanations), we conduct a laboratory experiment with a constant-sum sender–receiver game where we elicit first- and second-order beliefs and compare actions and beliefs in the sender-receiver game with the corresponding actions and beliefs in a game of matching pennies that exhibits the same payoff structure. In the sender–receiver game, the sender is privately informed which of the two possible tables (*X* or *Y*) represents the payoff consequences and sends a message (*X* or *Y*) to the receiver with which she (not necessarily truthfully) reports the actual state to him. The receiver, who only knows the two possible payoff tables and that each is chosen with equal probability, receives the sender's message and chooses between two options (*X* or *Y*). If the receiver's choice matches the actual payoff table (i.e. option X if the table is *X* or option *Y* if the table is *Y*), he receives 3 and the sender receives 1. If his choice does not match the table (i.e. option X if the table is *Y* or option *Y* if the table is *X*), payoffs are reversed. In what follows we will refer to indicating the true table in the message as *telling the truth* and to choosing the action that matches the sender's message as *trust*.[1] We elicit the sender's and receiver's actions *and* the sender's first- and second-order belief as well as the receiver's first-order belief; i.e., we ask how likely a sender considers the receiver to trust, how likely a receiver considers the sender to tell the truth, and what the sender thinks the receiver expects. For the elicitation of the first-order beliefs we incentivize subjects by means of the quadratic scoring rule and for the second-order belief we use the interval scoring rule.

In a second treatment, we implement the same design, including belief elicitation, for a sequential game of matching pennies. Both players choose actions and the first player (the sender in the other treatment) receives 1 whereas the second player (the receiver in the other treatment), who does not observe the first player's choice, receives 3 if both choose the same action, and vice versa if choices do not match. Game-theoretically this treatment is equivalent to the sender–receiver game in the reduced form as it is implemented in our design. The two treatments only differ in context: in the sender–receiver game there is a clear social norm (i.e. one should not lie), while (also due to the constant-sum payoff structure) there is no underlying social norm in the matching pennies game. This second treatment allows us to investigate whether motives to deviate from profit-maximizing behavior are triggered by the presence of the social norm of truth-telling. In particular, we can analyze the extent to which possible motives for truth-telling such as guilt are already induced by payoff expectations (by looking at the matching pennies game alone) and isolate the effect of the communication structure (by looking at the difference between the two treatments).

In line with the literature, we find that senders tell the truth in significantly more than 50% of the cases (i.e. more often than predicted by sequential equilibrium with standard preferences) – and actually also more often than according to a payoff maximizing best response to the senders' own (first-order) beliefs, whereas first-movers in the matching pennies game randomize in accordance with the Nash equilibrium prediction. A probit maximum likelihood regression of the probability to tell the truth as a sender (or to choose option X as a first-mover in the matching pennies game) reveals that first-order beliefs of the sender have an impact as described by simple egoistic payoff maximization or the first part in the trade-off discussed by Gneezy (2005): the higher the first-order belief (i.e. the higher the expected costs of truth-telling for the sender), the less likely is the sender to tell the truth. No such effect is found for the first-mover in the matching pennies game. Finally, in none of the games there is a significant impact of second-order beliefs on actions by senders or first-movers. We can conclude from these findings that the asymmetry between the choice to tell the truth and to lie is not driven by the payoff distribution or the formation of beliefs but by the fact that a message is sent from the sender to the receiver.

[1] We use the label *truth-telling* to refer to the act of sending a truthful message; of course, someone sending the truthful message may have deceptive motives in spirit of Sutter (2009) but since we also know individual beliefs, it is possible to identify this kind of "sophisticated deception".