Statistical Evaluation of Intention in Group Decision-making Dialogue

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Abstract

We explore the dialogue implications of a strategic voting game with a communication component and the resulting dialogue from laboratory experiments. The data reveals the role of communication in group decision making with uncertainty and personal biases. The experiment creates a conflict in human players between selfish, biased behavior and beneficial social outcomes. Unstructured chats showcase this conflict as well as issues of trust, deception, and desire to form agreement.

1 Introduction

Communication has a long history within game theory. From the earliest examples of signaling games (Lewis, 1969) to their most recent acceptance as an essential component of interacting computer agents (Shoham and Leyton-Brown, 2009), the exchange of information alters both strategies and incentives. Natural dialogue shows a human response to problem-solving situations.

Previous work has investigated information sharing among networks of individuals with partial information (Choi et al., 2005) or a personal bias towards sending misinformation (Wang et al., 2009). These experiments use the given task to explore how actors reason about the game.

In this work we discuss a task for a group to make a simple binary decision with both of these forces at work. Given noisy private signals about a risky policy, players must decide whether to take the risky route. Players may be biased toward one outcome and while most share their private data, they are not forced to report accurately. Before the vote, there is an opportunity to chat with others using natural language. The data provides insight into the various mechanisms of persuasion and trust people bring to such games. Our insights into subjects' information and decision making offer a complementary perspective to previous studies of collaborative dialogue (DiEugenio et al., 2000).

2 Experiment: Voting Game with Chats

In two series of behavioral economics experiments, five players were told to decide between two collective actions with different payouts.

- Game 1: One Risky Policy, Vote Yes or No. Policy succeeds with probability p. If a group votes yes, it gets average score p. If a majority votes no all get 0.5.
- Game 2: Two Opposing Policies: A or B. If a group votes A, it gets average score p and otherwise $1 - p$.

All players receive a noisy signal s that nobody else sees, drawn from a distribution centered on p. They converse with other players through anonymous chat boxes, and then must vote on the policy. In addition to s, players are given a bias, a personal payoff adjustment ppa that shifts the amount a player receives in the event the policy is passed.

3 Decision Factors

There are several key decisions to be made over the course of a single round. First, each participant has the option to share their private signal. As a result of social pressure, a number is reported almost every time. Since a player controls only this piece of information, there is an opportunity to falsify what they say to push the group's decision towards an outcome that is personally beneficial or beneficial to the score of a subgroup.

The other major decision is the vote. Before the actual vote, typically there is discussion about the merits of each choice, and some agreement may be reached. Two competing factors that affect this decision are reliance on one's known personal signal and the available public knowledge.

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Table 1: Percentage of voter type in experiments

Type of voter	A/B	Y/N
Self-interest vote (s + ppa)	0.12	0.11
Vote based on group interest	0.14	0.19
Both factors align with vote	0.54	0.60
Neither factor aligns with vote	0.20	0.10

By isolating the information ultimately available to each player we identify the goal of most players (see Table 1). In most cases, the interests of the individual and that of the group, measured by the average signal, line up with the chosen option. When indicators conflict, players will choose one condition over the other. For the purpose of modeling communicative strategy, it is useful to know how the voting decision is aligned with the phrases used to propose courses of action.

We have identified five major phrase types that are used when someone would like to indicate voting preference, which are *Declarative*, *Suggestive*, *Question*, *Imperative*, and *Everyone says*. Different forms can have very different connotations even with the same root words. The relative frequency of such phrases answers questions about how people negotiate based on the expected outcomes. The types of utterances do indicate how strong the evidence is, and in turn how committed people are to the vote expressed in the message. In addition, we have found that people use different negotiation tactics based on their interests, such as personal versus group. The poster presents results in detail.

4 Experimental Results

We have posed a number of questions given the corpus attached to this experiment.

- How are conversations organized?

Typically, there are three phases to each conversation. Players first exchange signals, then they discuss the merits of each choice. The reasons discussed include the average signal, biases, and riskiness. Finally they announce decisions by either coming to an agreement or not. Mostly these tasks take much less time than is available and so players also conduct side talk.

- Who lies and how much does it pay off?

We have found that liars do take advantage of gullible partners occasionally. Somewhere between 10% and 20% of the signals passed to others are adjusted in some way. There is also some evidence that too much exaggeration can backfire on the liar as well as the group.

- What phrases do people use to push for one result over another, and how do they affect votes and scores?

Selfish voters and group interest voters differ somewhat in their choice of words used to indicate votes. For instance, when expressing a vote for the public good, players tend to use the words "we" and "everyone" more often.

5 Conclusion

In keeping with previous negotiation models (DiEugenio et al., 2000) we can see our dialogues as playing out of a formal process involving a set of moves and arguments. Our data opens up the possibility to characterize how the specific moves that people choose reflect their interests and expectations about reaching agreement, as well as their interests and strategies for success in the underlying domain task.

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