Bayesian Persuasion: Evidence from the Laboratory

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Introduction

"All that moves without violence is, then, persuasion."

Introduction

Kamenica and Gentzkow (2011): In environments where information is symmetric, persuasion can be achieved, theoretically, by a sender's ability to manipulate the environment through which a receiver gets her information.

- Sender: information designer.
- Selecting a signal: choosing receiver's information environment.

Introduction

Testing the theory using empirical data is a formidable task:

- Cannot observe how much private information agents have.
- Cannot observe the signals (evidence, persuasion tactics) available to the persuader.
- Agents preferences unobservable and difficult to elicit.

Introduction

This paper uses data from a controlled laboratory experiment to directly test Kamenica and Gentzkow (2011). The design can be adapted to test other theories in the information design literature.

The Model:

- The state of the world can be either R or B. Sender and Receiver share a prior belief about the state of the world.
- Receiver makes a guess about the state of the world: "guess R"or "guess B".
- Receiver gets utility 1 from a correct guess, utility 0 from an incorrect guess.
- Sender gets utility 1 only if receiver guesses R.

The Model:

- Prior to making her guess Receiver sees a signal realization which informs her about the state of the world.
- The signal can have realization r or b.
- Sender chooses how informative the signal realization will be. That is, Sender chooses (x, y) where $x = Pr(r|R)$ and $y = Pr(b|B)$.
- Receiver observes the signal (x, y) chosen by the sender.

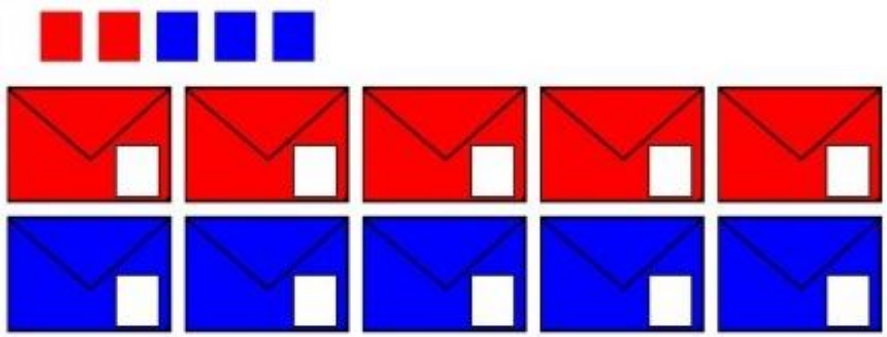
The Model:

Given a prior distribution, the theory pins down the optimal signal for the Sender.

Central Question of this Paper

Do laboratory subjects implement the optimal strategy as predicted by theory?

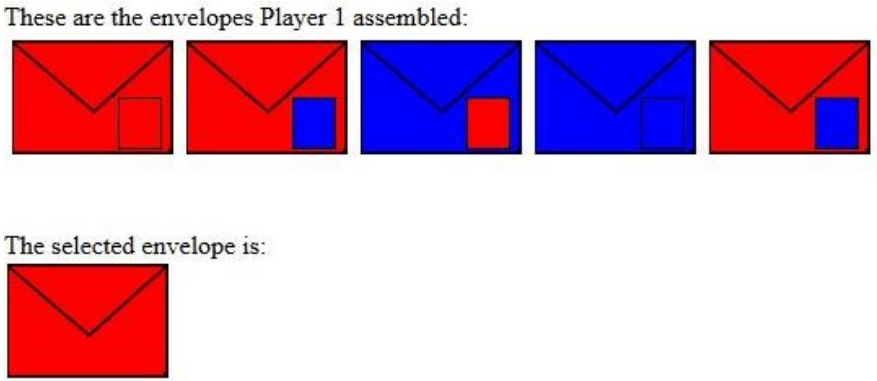
Experimental Design



Subjects play either as Sender or Receiver.

- Senders are given 2 red cards and 3 blue cards.
- Senders are asked to place each card into either a blue or a red envelope.
- One of the five filled envelopes is selected randomly by the computer.

Experimental Design



- Receiver sees how Sender assembles the envelopes and the color of the selected envelope.
- Receiver is asked to guess the color of the card inside the selected envelope.
- Receiver gets 1 ECU for guessing correctly. Sender gets 1 ECU if Receiver guesses **RED.**

Experimental Design:

- The color of the cards correspond to the states of the world.
- The color of the envelopes correspond to the signal realizations.
- By assembling cards into envelopes, the Sender is selecting a signal.
- When an envelope is randomly selected, the state of the world is drawn.

Experimental Design: Optimal Strategy

In the experimental design

- The sender can choose from a set of signals such that $x \in \{0, 1/2, 1\}$ and $y \in \{0, 1/3, 2/3, 1\}$
- Assuming the receiver chooses to guess red with probability $p < 0.75$ when indifferent, the optimal signal for the sender is either $(1, 2/3)$ or $(0, 1/3)$
- The sender can put all red cards and a blue card into a red envelopes, and put the remaining blue cards into blue envelopes. Or equivalently, put all reds and a blue into blue envelopes, and put the remaining two blues in red envelopes.

Experimental Implementation:

- The experiment was conducted at the Economic Science Laboratory at the University of Arizona.
- 144 subjects were recruited from the undergraduate subject pool.
- Subjects had no prior experience with persuasion games.
- Subjects played either as sender or receiver and were randomly matched after each round.

Experimental Implementation: Pilot Sessions

- 9 sessions with 6-8 subjects per session.
- 20 rounds : 4 practice rounds, 16 paid rounds.
- 1 ECU = 80 cents
- Sessions lasted 60 minutes on average.

Experimental Implementation: Pilot Sessions

6 strategies:

- 1. No information $(0, 1)$ $(1, 0)$
- 2. Full information $(1, 1)$ $(0, 0)$
- 3. Optimal $(1, 2/3)$ $(0, 1/3)$
- 4. Mixed 1 $(1/2, 1/3)$ $(1/2, 2/3)$
- 5. Theory optimal $(1, 1/3)$ $(0, 2/3)$
- 6. Mixed 2 $(1/2, 0)$ $(1/2, 1)$

Experimental Implementation: Pilot Sessions

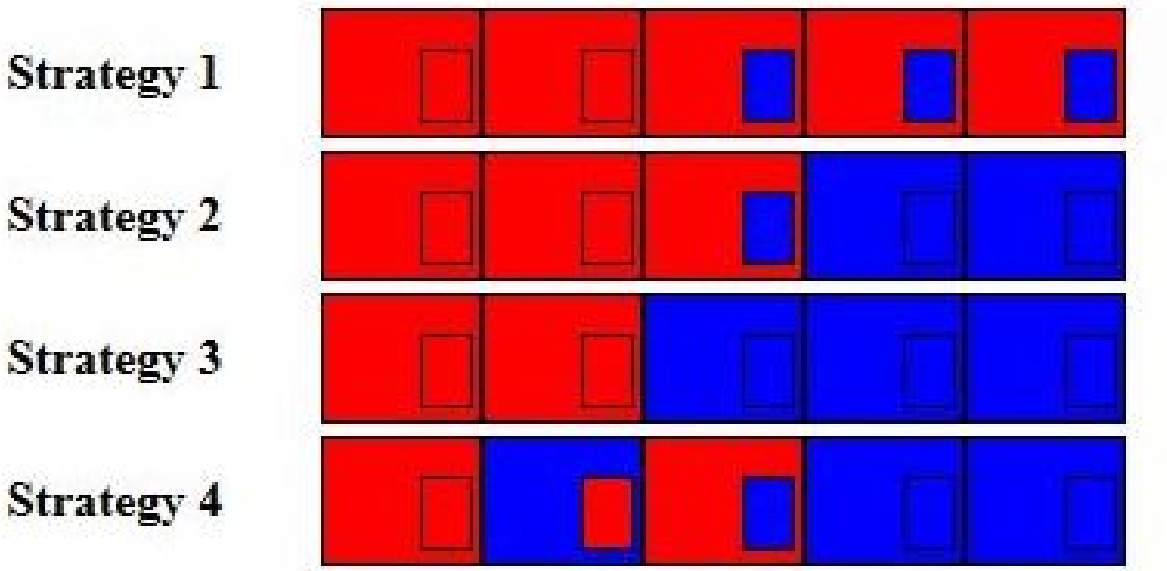
- Receiver behavior was consistent with theoretical predictions.
- Senders did not converge to choosing the signal that gives them the highest expected payoff given receiver behavior.

Experimental Implementation: Pilot Sessions

- There was a deliberate attempt to influence the receivers beliefs.
- Sender behavior was consistent with random selection of strategies.

Experimental Implementation: Simplification

To further simplify the design I restrict the Senders choice to 4 strategies:



Experimental Implementation: Simplification

- 7 sessions 84 subjects
- 4 practice 80 paid rounds
- 1 ECU $=$ 25 cents
- Feedback about past performance: average payoff for each strategy

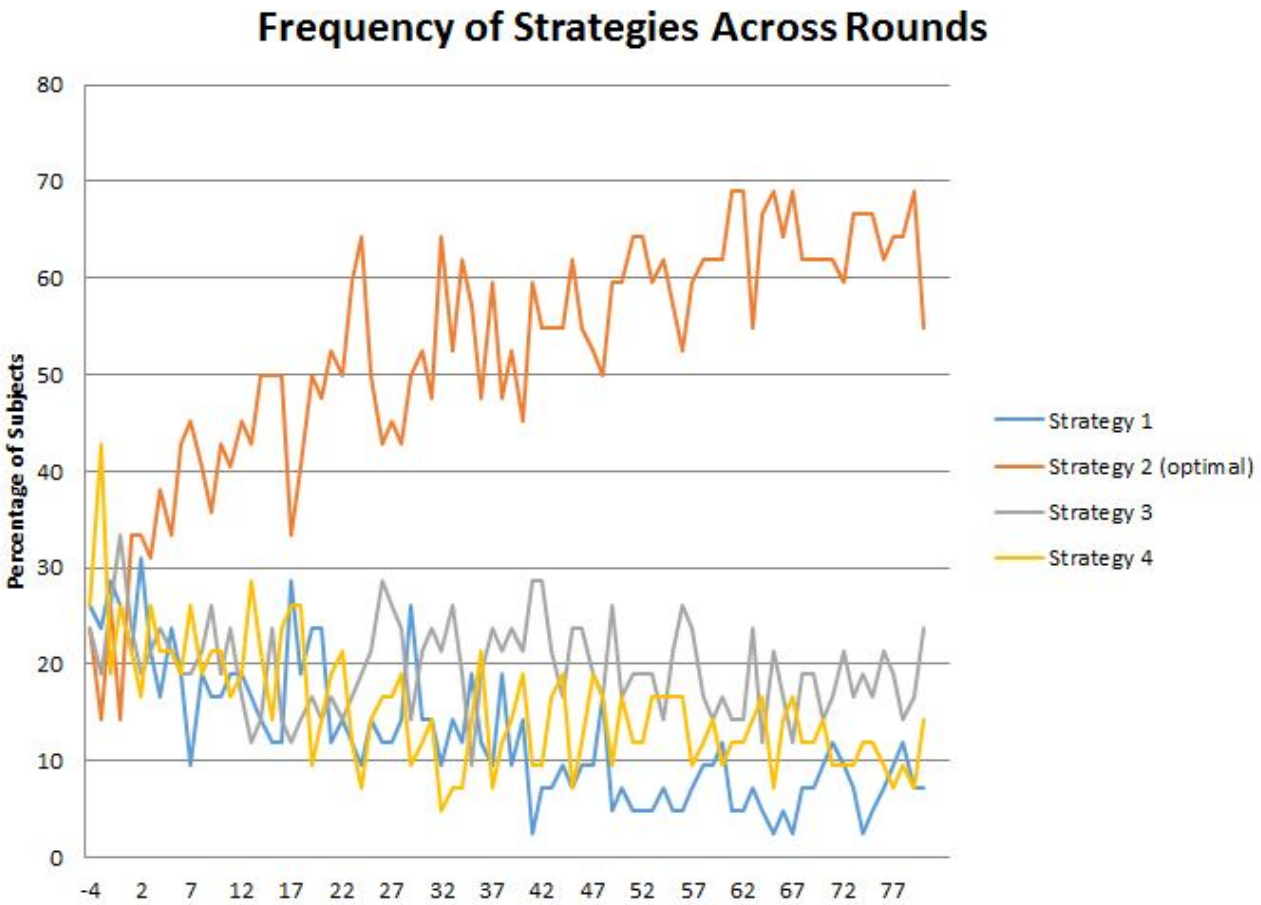
Results: Receivers

Receiver behavior was consistent across sessions and across rounds.
Theory predicted behavior accurately in 91% of rounds.

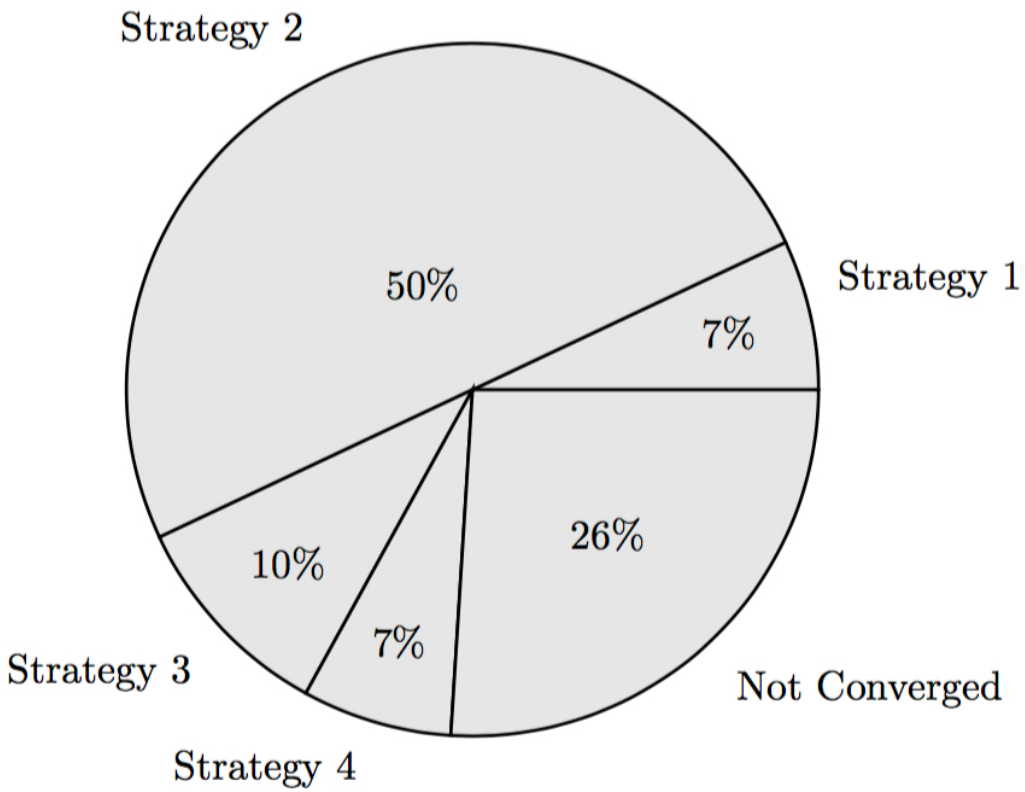
Results: Aggregate Sender Behavior

Senders chose the optimal strategy significantly more often than other strategies. The percentage of subjects that choose the optimal strategy increased with the number of rounds played converging to about 70% at the end of round 80.

Results: Aggregate Sender Behavior



Results: Individual Sender Behavior



Robustness Checks

- 6 strategy treatment.
- Receivers played as Senders.

Conclusion

- The theory is successful in predicting aggregate behavior of experienced subjects. With enough experience and feedback about payoffs, the majority of subjects learn choose the optimal strategy to persuade.
- At the individual level, there is evidence that some individuals' behaviors systematically depart from the theory.

Extensions

- Competition to persuade
- Costly Persuasion
- Information Design