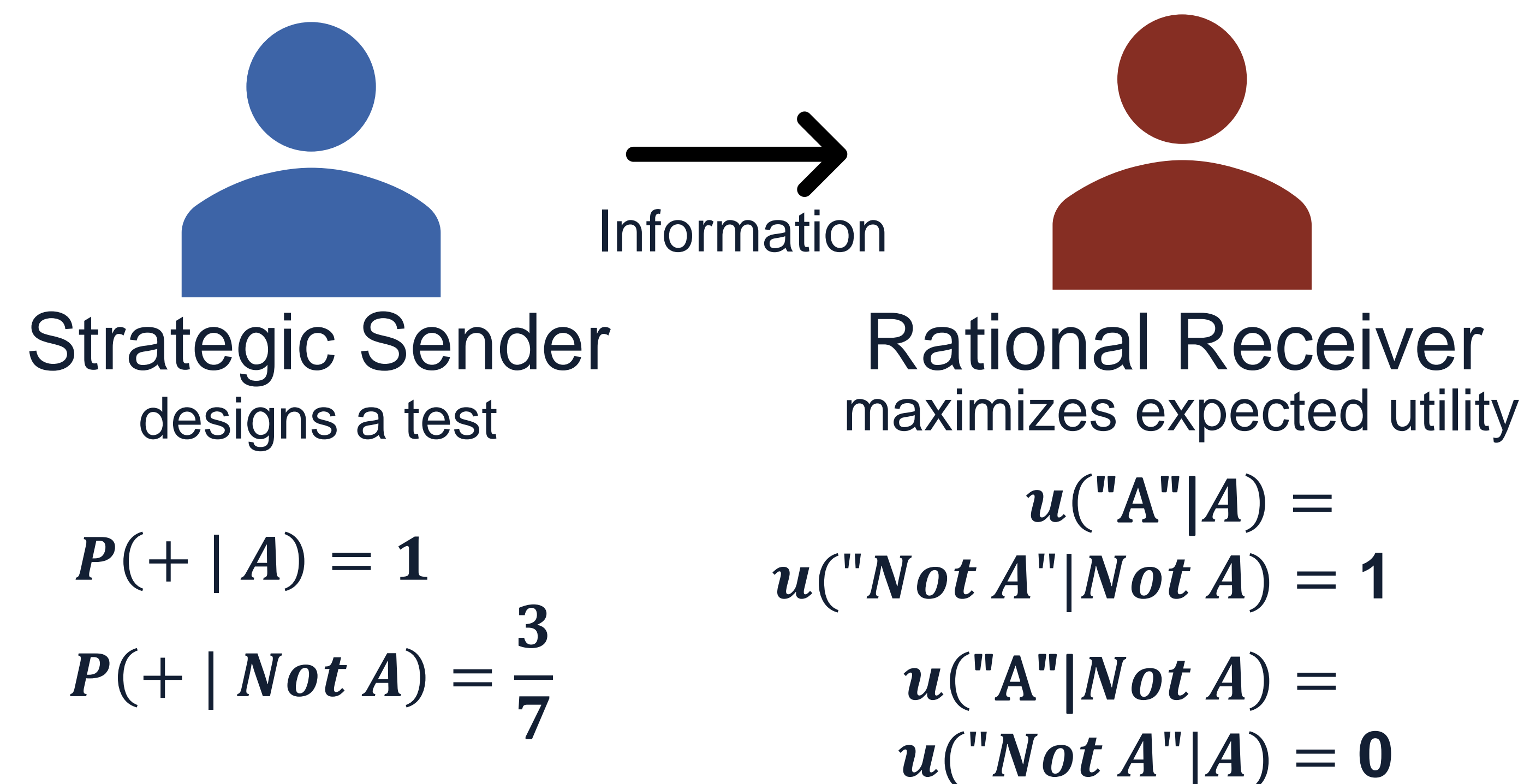


Bayesian Persuasion: Evaluating a Receiver's Decision-Making Strategy Under Persuasion Contexts

Emily N. Line, Meichai Chen, Melih Bastopcu, Raj Kiriti Velicheti, & Michel Regenwetter

Bayesian Persuasion¹

Prior Probability of Event A: $P(A) = 0.3$



$$P(A | +) = \frac{P(+ | A)P(A)}{P(+ | A)P(A) + P(+ | \text{Not } A)P(\text{Not } A)}$$

$$= \frac{1(0.3)}{1(0.3) + \frac{3}{7}(0.7)} = 0.5$$

$$P(A | -) = \frac{0(0.3)}{0(0.3) + \frac{4}{7}(0.7)} = 0$$

Rational (Bayesian) Receiver

Does not care about Sender's utility.

Claims "A" if and only if test result is +.

However, $P(+)$ = 0.6, whereas $P(A)$ = 0.3.

Makes wrong claim with probability $0.6 - 0.3 = 0.3$.

Research Questions

1. What decision strategies do people use?
2. Does the presence of a sender affect a receiver's decision strategy, and how?
3. Would knowledge of the sender's utility affect a receiver's decision strategy, and how?

Probability Strategies

Bayesian	Uses Bayes' Theorem.
Prior Only	Selects most likely outcome only based on prior.
Misinterpretation of Likelihoods	Ignores the prior and treats newly revealed evidence as the sole source of information.
Skepticism	Adjusts the numerator of Bayes' Theorem downward for + test results.

Utility Strategies

Expected Utility	Maximizes expected payoff (EU).
Spite	Maximizes subjective EU, which is affected by spite and sender EU.

Experiment Phases & Example Vignette

Phase 1 (No Sender)

Your car might need a part replaced. You run a test to help determine if you should replace the part.



P(Broken): 60%

P(Positive Test | Broken): 65%

P(Positive Test | Not Broken): 40%

Phase 2 (Sender Included)

Now, a mechanic strategically selects a test in hopes of convincing you to replace the part. Payoff table shows what you gain if you decide accurately.

		Your Payment Outcomes	
		Not Broken	Broken
Your Decision	Replace	\$0.35	\$0
	Don't Replace	\$0	\$0.35

Phase 3 (Sender's Utility Included)

Now, another payoff table shows what mechanic gains if they persuade you.

		Your Payment Outcomes		Mechanic Payment Outcomes	
		Not Broken	Broken	Not Broken	Broken
Your Decision	Replace	\$0.35	\$0	\$0	\$0
	Don't Replace	\$0	\$0.35	\$35.00	\$35.00

Joint Predictions Across Stimuli

3 example stimuli with test outcome +	Bayes	Prior Only	Mis. Of Likelihood
$P(A)$: 60% $P(+ A)$: 65% $P(+ \text{Not } A)$: 40%	"A"	"A"	"A"
$P(A)$: 20% $P(+ A)$: 76% $P(+ \text{Not } A)$: 1%	"A"	"Not A"	"A"
$P(A)$: 30% $P(+ A)$: 84% $P(+ \text{Not } A)$: 44%	"Not A"	"Not A"	"A"

Order-Constrained Analyses²

Majority (Supermajority) Specification

Deterministic (fixed) preference within an individual. Observed choices are error-prone (noisy). Upper bound of 50% (10%) on error rates.

Mixture Specification

Probabilistic (variable/uncertain) preference within an individual. Observed choices are error-free. The probability distribution over permissible preferences (within and/or across strategies) is unconstrained.

References

¹Kamenica, E., & Gentzkow, M. (2011). *Amer. Econ. Review*, 101, 2590-2615.

²Regenwetter, M. et al. (2014). *Decision*, 1, 2.

²Zwilling, C. E. et al. (2019). *J. of Math. Psych.*, 91, 176-194.

Acknowledgements

Army Research Office under MURI Grant Number W911NF-20-1-0252 (Co-PI: M. Regenwetter)

neuline2@illinois.edu

