Persuasion with Rational Inattention

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Motivation

"In an information-rich world, most of the cost of information is the cost incurred by the recipient. It is not enough to know how much it costs to produce and transmit information; we must also know how much it costs, in terms of scarce attention, to receive it."

– Herbert Simon (1971)

Leading Examples:

- Info management in organizations: Give the boss "all the details" or just an "executive summary"?
- Advertising in the "attention economy": How to attract consumers' money *and eyeballs*?

Premise

- Communication is a fundamental economic "transaction"
  - Sender has info, Receiver has decision-making power
- Receiver's limited attention is a primary "transaction cost"
  - Receiver **privately bears** a cost to process Sender's messages $\implies$ moral hazard
- Information disclosure plays a dual role
  1. Persuasion: misaligned preferences over **actions**
  2. Attention manipulation: misaligned preferences over **information/attention**

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Summary of Results

- Question: What is optimal form of communication in an information-rich world?
  1. How does this depend on preference (mis)alignment?
  2. . . . on Sender's commitment power? (Bayesian persuasion vs. cheap talk)
  3. . . . on richness of underlying uncertainty?
- Main Insights:
  1. **Aligned:** simple messages to focus Receiver's attention $\Longrightarrow$ minimize mistakes
     Misaligned: detailed messages to exploit Receiver's inattention $\Longrightarrow$ induce mistakes
     Both: provide more info in order to attract Receiver's attention
  2. *Even under aligned preferences*, commitment has value b/c Sender will exaggerate
  3. *Under aligned preferences*, attention manipulation driven by multi-tasking aspect of Receiver's attention choice

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Related Literature

- **Bayesian persuasion:** Rayo-Segal (2010), Kamenica-Gentzkow (2011), Dworczak-Martini (2018)
- **Rational inattention:**
  - **Single agent:** Matejka-McKay (2015), Caplin-Dean (2015), Caplin-Dean-Leahy (2018a,b)
  - **Interactive:** Matejka-McKay (2012), Matejka (2015), Martin (2017), Ravid (2018), Yang (2018)
- **RI & BP:** Gentzkow-Kamenica (2014), Matyskova (2018), Lipnowski-Mathevet-Wei (2018)
- **Costly communication:** Dewatripont-Tirole (2005), Dessein-Galeotti-Santos (2016)

Baseline Model (with commitment)

1. State of nature $S \sim G \in \Delta(\mathcal{S})$, where $\mathcal{S} = [\underline{s}, \bar{s}]$
2. **Sender** commits to persuasion strategy $(\mathcal{X}, \pi)$
   - $x \in \mathcal{X}$ is a signal
   - $\pi : \mathcal{S} \to \Delta(\mathcal{X})$
3. **Receiver** chooses an attention strategy $(\mathcal{M}, \mu)$ — given $(\mathcal{X}, \pi)$, *before signal realized*
   - $m \in \mathcal{M}$ is a perception
   - $\mu : \mathcal{X} \to \Delta(\mathcal{M})$
   - **Moral hazard:** attention cost — function of *both* $(\mathcal{X}, \pi)$ and $(\mathcal{M}, \mu)$
4. Given perception $m \in \mathcal{M}$ (and induced posterior re: state), Receiver chooses action $a \in \{0, 1\}$
5. Material payoffs realize
   - Receiver has utility $u_R(a, s) := \mathbf{1}_{a=1} \cdot s$
   - Sender has affine utility $u_S(a, s) := \alpha \cdot \mathbf{1}_{a=1} + \beta \cdot u_R(a, s)$

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Assumption: RI Cost Function

- $S \to X \to M$ forms Markov chain
- Attention cost $\propto$ **mutual information** between X and M:

$$I(X;M) = \underbrace{I(S;M)}_{\text{direct learning about state}} + \underbrace{I(X;M|S)}_{\text{tracking additional noise in signal}}$$

- Sender chooses "state space" and "prior" for Receiver's RI problem

Lemma ("Revelation Principle")

It is WLOG to identify signals with their induced posterior means about state, i.e.,

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$$x := \mathbb{E}[s \mid x]$$

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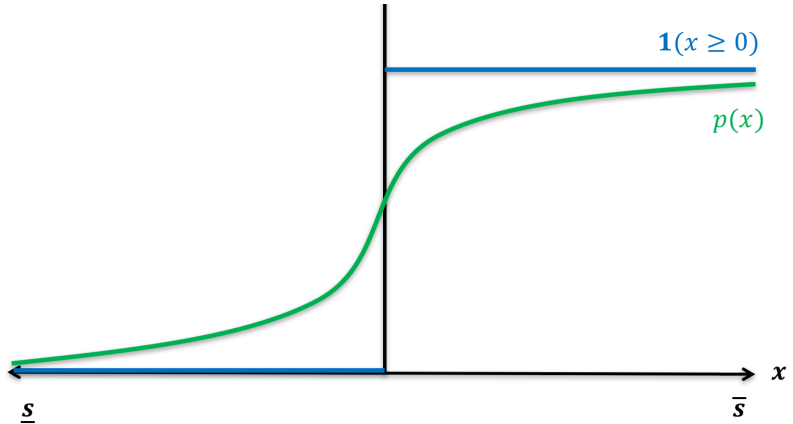
Stochastic Choice (for *fixed* persuasion strategy)

1. Receiver makes mistakes: $0 < p(x) < 1$
2. **Local Attention Intensity** is single-peaked & smoothed: $\frac{\partial p(x)}{\partial x} \propto \mathbb{V}(a \mid x) > 0$



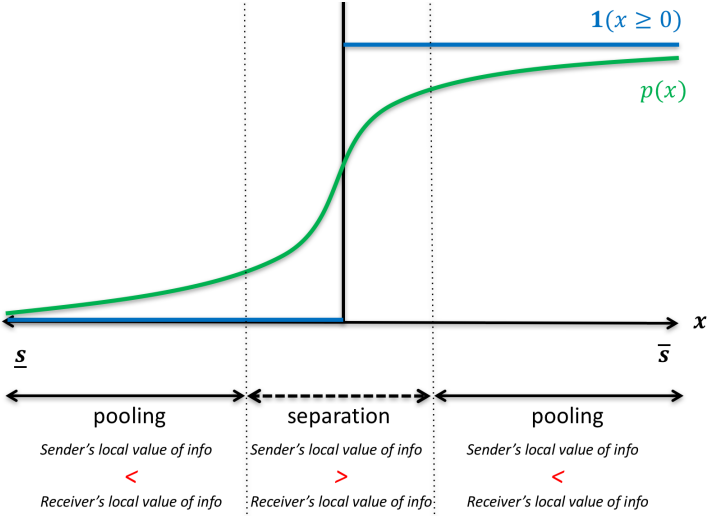
Aligned Preferences

- Same material preferences: $u_S(a, s) = u_R(a, s) = \mathbf{1}_{a=1} \cdot s$
- Leading Example: Should you give the boss "all the details" or just an "executive summary"?

- Competing intuitions:
  1. Fully disclose the state to (i) give Receiver "largest feasible set" and (ii) attract his attention
  2. Make direct recommendation to make "processing" easier for Receiver

Aligned Preferences: Continuous State

Key feature: simple messages focus Receiver's attention on the "right aspects" and minimize mistakes



Aligned Preferences: Benchmarks

General model with state space $\mathcal{S}$ and action space $\mathcal{A}$ compact metric, utility functions continuous.

1. Receiver faces pure capacity constraint: $I(X;M) \leq C$
   - **Fact:** Full disclosure always optimal.
   - "Proof:" Receiver has free disposal of information, so give him largest feasible set
   - **Intuition:** attention manipulation hinges on extensive margin of Receiver's attention choice
2. State is binary: $|\mathcal{S}| = 2$
   - **Theorem** (partial): If $|\mathcal{S}| = 2$, then full disclosure is always optimal. If $|\mathcal{S}| \geq 3$, there are examples with two actions s.t. full disclosure strictly suboptimal.
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Remarks and Next Steps

- Not in talk:
  - Proof ideas — mostly based on LP & first-order approach
  - Misaligned preferences
  - Limited commitment/cheap talk communication
  - Comparative statics
- Work in progress:
  1. Multiple Senders who compete for Receiver's attention (joint with Dong Wei)
  2. Dynamic information disclosure (no restriction to one-shot communication)
- Open questions:
  1. Further extensions and applications of model?
  2. Message space design (beyond mutual info cost)?
  3. Mechanism/market design for RI agents (multiple Receivers, other instruments)?

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Appendix

State-Independent Preferences

- Sender cares only about probability of action: $u_S(a, s) = \mathbf{1}_{a=1}$
- Leading Example: profit-maximizing seller advertises a good with fixed price (e.g., Amazon's product recommendations)

State-Independent Preferences: Binary State (1/2)

Key feature #1: provide more info than free-attention solution to attract Receiver's attention

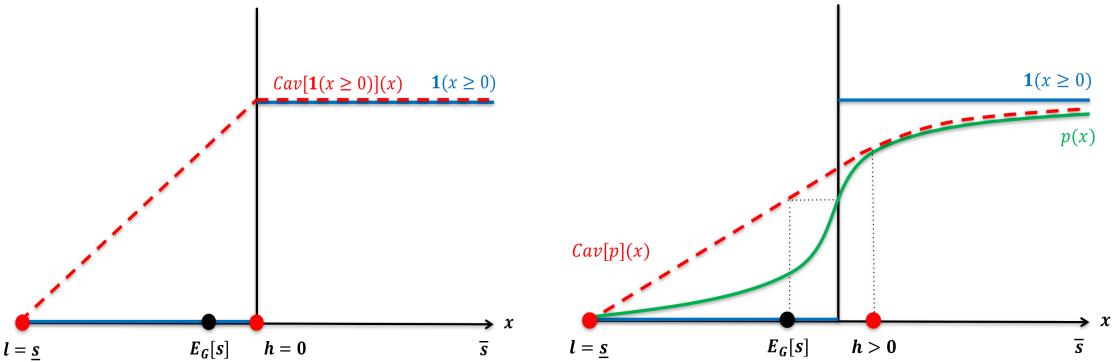

Figure: Optimum when attention is free (left) and when it is costly (right).

State-Independent Preferences: Binary State (2/2)

Key feature #2: Receiver's entire best-response curve is endogenous to Sender's persuasion strategy

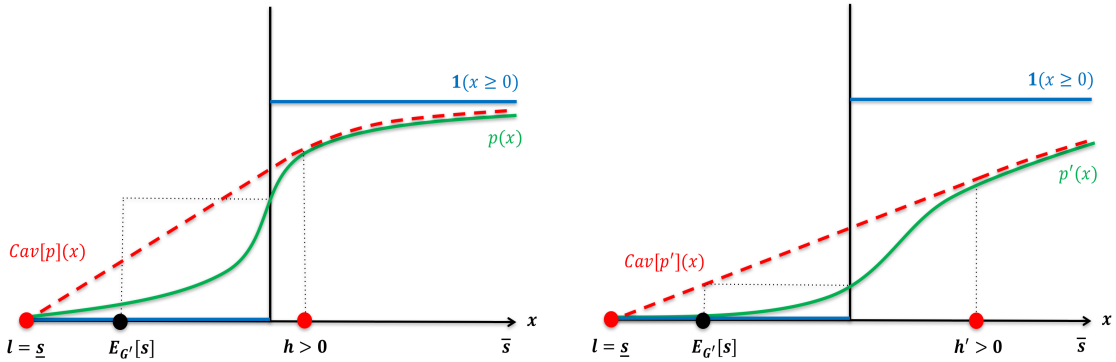

Figure: Optimum against fixed SCR (left) and incorporating IC constraint (right).

State-Independent Preferences: Continuous State

Key feature: detailed messages to exploit Receiver's inattention and induce mistakes

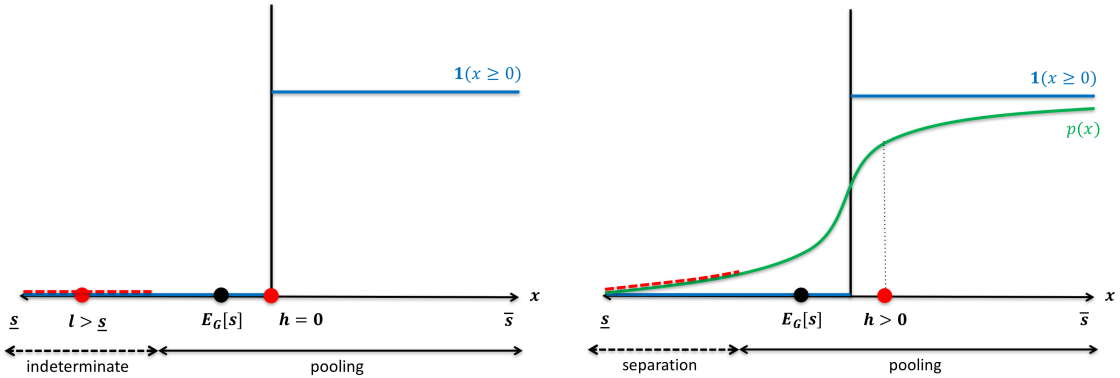

Figure: Optimum when attention is free (left) and when it is costly (right).

Aligned Preferences: No Commitment (cheap talk)

- Sender can, at most, truthfully convey the sign of the state
  - Endogenous restriction to direct recommendation
  - **Driving force:** incentive to exaggerate always hindrance to communication