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?
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 \(\Rightarrow\) **moral hazard**

Information disclosure plays a **dual role**
- **Persuasion**: misaligned preferences over actions
- **Attention manipulation**: misaligned preferences over information/attention
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- **Persuasion**: misaligned preferences over **actions**
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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 $\implies$ minimize mistakes
   
   **Misaligned:** detailed messages to exploit Receiver’s inattention $\implies$ induce mistakes

2. **Both:** provide more info in order to attract Receiver’s attention

3. Even under aligned preferences, commitment has value b/c Sender will exaggerate

4. 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)


- **Costly communication:** Dewatripont-Tirole (2005), Dessein-Galeotti-Santos (2016)
Baseline Model (with commitment)

1. State of nature $S \sim G \in \Delta(S)$, where $S = [s, \bar{s}]$

2. **Sender** commits to persuasion strategy $(\mathcal{X}, \pi)$
   - $x \in \mathcal{X}$ is a signal
   - $\pi : S \rightarrow \Delta(\mathcal{X})$

3. **Receiver** chooses an attention strategy $(\mathcal{M}, \mu)$ — given $(\mathcal{X}, \pi)$, before signal realized
   - $m \in \mathcal{M}$ is a perception
   - $\mu : \mathcal{X} \rightarrow \Delta(\mathcal{M})$
   - **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 $u_R(a, s) := 1_{a=1} \cdot s$
   - Sender has affine utility $u_S(a, s) := \alpha \cdot 1_{a=1} + \beta \cdot u_R(a, s)$
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Assumption: RI Cost Function

- \( S \rightarrow X \rightarrow M \) forms Markov chain
- Attention cost \( \propto \textbf{mutual information} \) between \( X \) and \( M \):
  
  \[
  I(X; M) = I(S; M) + I(X; M|S)
  \]
  
  direct learning about state \hspace{1cm} \text{tracking additional noise in signal}

- Sender chooses “state space” and “prior” for Receiver’s RI problem

Lemma (“Revelation Principle”)

\( \text{It is WLOG to identify signals with their induced posterior means about state, i.e.,} \)

\[
\mathcal{X} := S \\
x := \mathbb{E}[s \mid x]
\]
Assumption: RI Cost Function

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

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

$$\mathcal{X} := S$$
$$x := \mathbb{E}[s \mid x]$$
Stochastic Choice (for fixed persuasion strategy)

1. Receiver makes mistakes: $0 < p(x) < 1$

2. **Local Attention Intensity** is single-peaked & smoothed: \[
\frac{\partial p(x)}{\partial x} \propto \mathbb{V}(a | x) > 0
\]
Aligned Preferences

- Same material preferences: $u_S(a, s) = u_R(a, s) = 1_{a=1} \cdot s$

- 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 $S$ and action space $A$ 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: $|S| = 2$
   - **Theorem (partial):** If $|S| = 2$, then full disclosure is always optimal. If $|S| \geq 3$, there are examples with two actions s.t. full disclosure strictly suboptimal.
   - **Intuition:** attention manipulation hinges on multi-tasking aspect of Receiver’s attention choice
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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: $u_S(a, s) = 1_{a=1}$

- 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).
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).
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