Rationally Inattentive Preferences

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The Rational Inattention Hypothesis

Agents need information to make better choices.

However, getting information requires attention and attention is a costly resource.

So agents optimally allocate their attention to get the information they need most.

There is a trade-off between value and costs of information.

Rational Inattention in Economics

The origin: Simon (1955).

Value of information: Marschak and Radner (1972).

Bounded rationality: Lipman (1995), Rubinstein (1998).

An Information-theoretic approach: Sims (2003).

Economic applications (survey): Veldkamp (2011).

Psychological evidence (survey): Pashler (1999).

Four Theoretical Questions

- Is information theory the right way to think about inattention?
- Is it possible to falsify the rational inattention hypothesis?
- How to calibrate models of choice under rational inattention?
- When an agent is more attentive than another agent?

Choice Problem

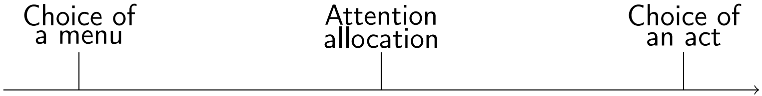
A DM chooses today among sets of alternatives: the sets are called menus and the alternatives are called acts.

Tomorrow the DM will select an act from the menu chosen today: the outcome of the selected act will depend on the state of the world.

Today the DM does not know which is the state of the world.

Nevertheless, after the choice among menus, she can get some information to reduce the uncertainty and improve her choice from the menu.

Timeline



We are interested in the choice among menus.

Given a menu, choice among acts: Caplin and Dean (2013), Ellis (2012).

Menu-choice literature: Kreps (1979).

Acts, Menus, Prior Beliefs and Tastes

- Ω is a finite set of states of the world.
- X is a convex set of outcomes.
- $f : \Omega \to X$ is an act.
- A menu F is a finite set of acts.
- $\bar{p} \in \Delta(\Omega)$ represents the DM's prior beliefs over Ω.
- $u : X \to \mathbb{R}$ is an affine utility function (with unbounded range).

Channels

A channel is a probability measure π on $\Delta(\Omega)$ such that

$$\bar{p} = \int_{\Delta(\Omega)} p\,\pi(dp). \tag{1}$$

A channel specifies the probability of obtaining a posterior p by updating prior $\bar{p}$ after the arrival of new information.

Condition (1) is the martingale property of posteriors: the expected information conveyed by the channel coincides with the prior information.

We denote by $\Pi(\bar{p})$ the set of channels corresponding to prior $\bar{p}$.

Ranking Menus

The value $V(F)$ of menu F is the real number

$$\max_{\pi \in \Pi(\bar{p})} \left[\int_{\Delta(\Omega)} \max_{f \in F} \left(\int_{\Omega} u(f(\omega))\, p(d\omega) \right) \pi(dp) - c(\pi) \right].$$

The map $c : \Pi(\bar{p}) \to [0, \infty]$ is an information cost function.

The parameters of the choice criterion are $(u, \bar{p}, c)$.

Information Cost Functions

- c is weakly lower semicontinuous and convex.
- $c(\pi) = 0$ whenever $\pi(\{\bar{p}\}) = 1$.
- c is monotone wrt the Blackwell order.

Recall that π is more informative than ρ if

$$\int_{\Delta(\Omega)} \phi(p)\, \pi(dp) \geq \int_{\Delta(\Omega)} \phi(p)\, \rho(dp)$$

for all continuous and convex functions $\phi : \Delta(\Omega) \to \mathbb{R}$.

$V(F)$ as a Variational Problem

Observe that the function

$$\pi \mapsto \int_{\Delta(\Omega)} \max_{f \in F} \left(\int_{\Omega} u(f(\omega))\, p(d\omega) \right) \pi(dp) - c(\pi)$$

is concave and weakly upper semicontinuous.

$V(F)$ as a variational problem.

In a different settting, Maccheroni, Marinacci and Rustichini (2006) study preferences with a variational representation.

Adapting their methods, we provide an axiomatic foundation for V, the main contribution of this paper.

Contributions

Denote by $\succsim$ a preference on menus.

- Necessary and sufficient conditions on $\succsim$ such that

  $$F \succsim G \quad \Leftrightarrow \quad V(F) \geq V(G) \quad \forall F, G$$

  for some $(u, \bar{p}, c)$.

- $(u, \bar{p}, c)$ are uniquely identified and elicitable by observing $\succsim$.

- Behavioral measures of comparative inattention.

Aversion to Randomization

Consider $\alpha \in [0, 1]$ and a pair of menus F and G. Set

$$\alpha F + (1-\alpha)G = \{\alpha f + (1-\alpha)g : f \in F \text{ and } g \in G\}.$$

Then

$$F \sim G \quad \Rightarrow \quad F \succsim \alpha F + (1-\alpha)G.$$

Rationally inattentive preferences admit a costly contemplation representation (Ergin and Sarver, 2011).

First Alternative

- The DM allocates her attention.
- She picks an act f from menu F and an act g from menu G.
- A coin with bias α is tossed.
- If the coin comes up head, she gets $f(\omega)$.
- if the coin comes up tails, she gets $g(\omega)$.

Second Alternative

- A coin with bias α is tossed.
- The DM allocates her attention.
- If the coin came up heads, she picks $f \in F$ and gets $f(\omega)$.
- If the coin came up tails, she picks $g \in G$ and gets $g(\omega)$.

Dominance

Consider a pair of menus F and G. Suppose that, for each $g \in G$ there is $f \in F$ such that $f(\omega) \succsim g(\omega)$ for each $\omega \in \Omega$. Then $F \succsim G$.