Skewness and Preferences for Non-Instrumental Information

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CCC conference
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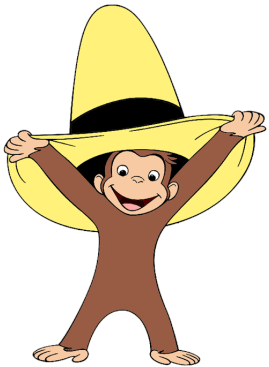
Curiosity, Creativity, and Complexity



Demand for Information

- In Economics,
  - Information is desirable only when it can help them make better decisions
  - Demand for Instrumental Information

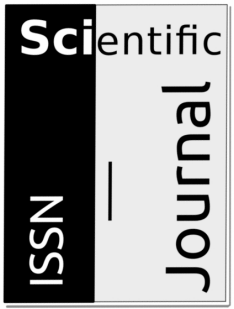
- Recent research from Biology, Psychology, Neuroscience, and Economics
  - Information itself is intrinsically valuable, even if it cannot alter future events
  - Demand for Non-instrumental Information
  - Early versus Late (more versus less informative)

What We Do?

1. What type of Non-instrumental information? (Skewness)
2. How much Non-instrumental information? (Informativeness)
3. How are these two related?

Hypothetical Scenario

YOUR PAPER



Hypothetical Scenario

TWO PROFESSORS

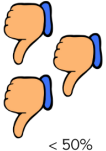
PAUL

NELL

Hypothetical Scenario

Two Professors

Paul



< 50%

Nell

100%

(Acceptance)

Hypothetical Scenario

Two Professors

Paul

< 50%

100%

(Acceptance)

Nell

0%

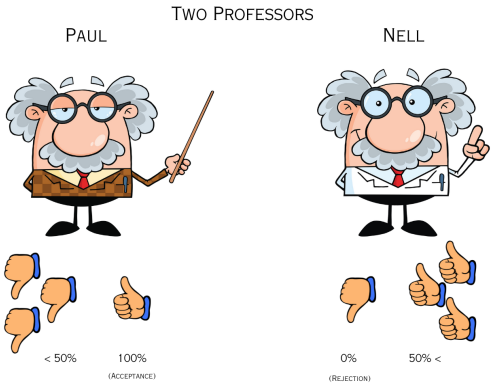
50% <

(Rejection)

Hypothetical Scenario

- Positively skewed (Paul): Eliminates more uncertainty about a desired outcome if it generates a good signal, but unlikely to generate a good signal

- Negatively skewed (Nell): Eliminates more uncertainty about an undesired outcome if it generates a bad signal, but unlikely to generate a bad signal



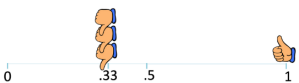
Hypothetical Scenario

- Same Mean and Same Variance

Two Professors

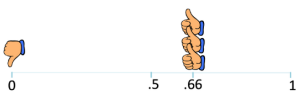
Paul

3/4 * 33.3% + 1/4 * 100% = 50%



Nell

1/4 * 0% + 3/4 * 66.6% = 50%



Why We Do This?

- Common in many settings: Medical tests, bosses, news, earnings guidance...
- Belief-based utility: Information impacts utility through expectations
- People may avoid information, even when it is useful

What We Did

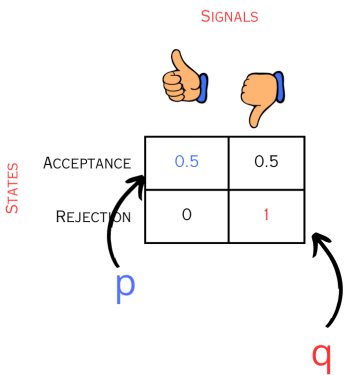
- Conduct three lab experiments (1182 participants)
  - Experiment 1 (700, between-subject design)
  - Experiment 2 (250, within-subject design)
  - Experiment 3 (232, between-subject design)
- Two field studies (1,226 individuals)
  - Alzheimer's Disease (626, stated preferences)
  - IQ Test (600, stated preferences)

Lab Experiment 1

PAUL

3/4 * 33.3% + 1/4 * 100% = 50%

SIGNAL STRUCTURE (p,q)



Lab Experiment 1

Two Professors

Paul

Signals

States		Signals	
		0.5	0.5
	Acceptance		
	Rejection	0	1

(0.5,1)

Nell

Signals

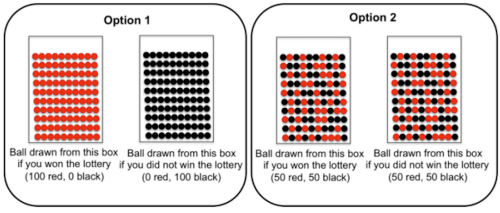
States		Signals	
		1	0
	Acceptance		
	Rejection	0.5	0.5

(1,0.5)

Lab Experiment 1

- Period 0
  - Risky lottery with binary outcomes: H (\$10) and L (\$0)
  - chance of winning 50%
- Period 1
  - Two signals: G (Good) and B (Bad)
  - Information structures (p, q) where $p = p(G|H)$ and $q = p(B|L)$
  - Make pairwise choice(s) between (p, q) versus (p', q')
  - "Willingness to Pay" for $x \in [0, 50]$ cents, accept to see a ball drawn from alternative instead
  - Receive a signal. Realizations are G (good) or B (bad). Sit with posteriors for approx. 30 minutes
- Period 2
  - Observe whether the ticket won; receive payment

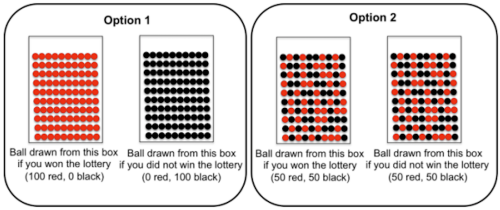
Lab Experiment 1



50% red, 50% black
Black: 0% win
Red: 100% win

50% red, 50% black
Black: 50% win
Red: 50% win

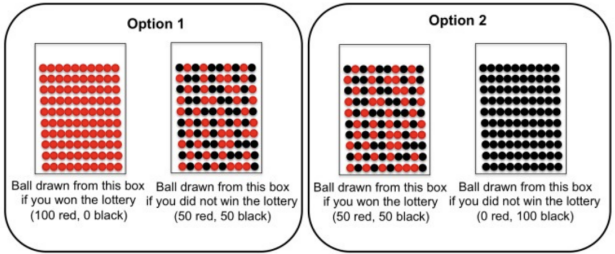
Lab Experiment 1



N	Preferences	Percentage	p-value	Info. Premia
Early vs. Late				
79	$(1,1) \succ (0.5,0.5)$	70%	0.001	7.6¢

Representation of information structures

- Choice between negatively $(1, 0.5)$ (Nell) and positively $(0.5, 1)$ (Paul) skewed options with same posterior mean and variance



Lab Experiment 1

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Early vs. Late				
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Positively Skewed vs. Negatively Skewed				
78	$(0.5,1) \succ (1,0.5)$	79%	0.000	20.5¢
78	$(0.6,0.9) \succ (0.9,0.6)$	74%	0.000	12.3¢
83	$(0.3,0.9) \succ (0.9,0.3)$	67%	0.002	7.5¢

Lab Experiment 1

N	Preferences	Percentage	p-value	Info. Premia
Positively Skewed vs. Late				
75	$(0.5, 1) \succ (0.5, 0.5)$	87%	0.000	24.2¢
68	$(0.3, 0.9) \succ (0.5, 0.5)$	82%	0.000	15.5¢
Negatively Skewed vs. Late				
57	$(1, 0.5) \succ (0.5, 0.5)$	72%	0.001	11.3¢
60	$(0.9, 0.3) \succ (0.5, 0.5)$	77%	0.000	7.6¢
(Symmetric) Gradual vs. Late				
63	$(0.79, 0.79) \succ (0.5, 0.5)$	81%	0.000	16.3¢
59	$(0.63, 0.63) \succ (0.5, 0.5)$	75%	0.000	13.8¢

Lab Experiment 1

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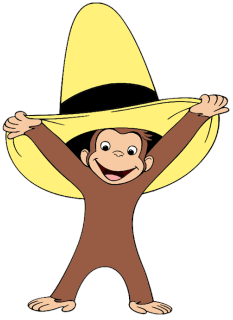
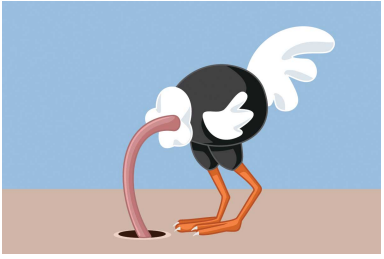
What We Found

- Widespread preference:
  1. Positively skewed (Paul) over Negatively skewed (Nell) (controlling for informativeness)
  2. More information over Less information
  3. Subjects trade-off informativeness and skewness

Experiment 2

- Within-subject design and multiple questions
- Whether positively skewed signals may be a remedy for information avoidance
- Classify participants as "information takers" (Early $>$ Late) and "information avoiders" (Early $<$ Late)





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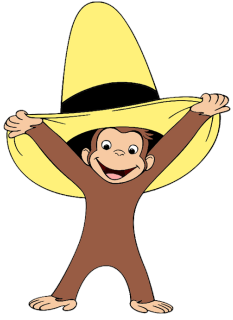
N	Preferences	Percentage	p-value
Information Takers			
92	$(0.76, 0.76) \succ (0.3, 0.9)$	71%	0.000
104	$(0.67, 0.67) \succ (0.1, 0.95)$	64%	0.002
Information Avioders			
27	$(0.55, 0.55) \succ (0.3, 0.9)$	33%	0.974
27	$(0.66, 0.66) \succ (0.5, 1)$	56%	0.351

Experiment 2

- Information Takers exhibit monotonic preferences
  - They prefer More Information over Positive Skew
- Information Avioders exhibit non-monotonic preferences
  - They prefer Positive Skew over Less Information



Experiment 3

- Experiment 3 (varies prior): subjects exhibit a preference for positive skew for all priors, stronger for high priors
- Preferences robust to prior

From Lab to Field

- Benefits of lab come from control
- Non-instrumental information
- Set known priors
- Control informativeness
- Identify preferences for skewness
- Do findings generalize to field contexts where information may be useful, but is avoided?

Follow-up Field Studies

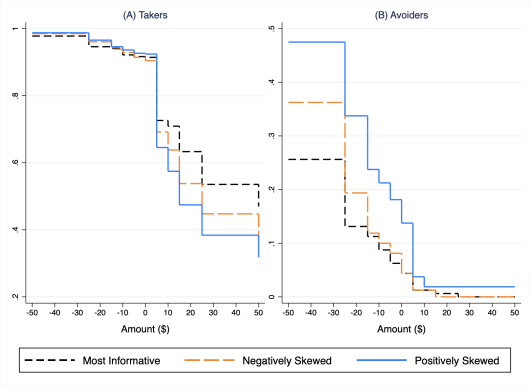
- Focus on settings where information avoidance documented as a concern (health, intelligence)
- Provide natural information structures: (1) no information, (2) very informative signal, (3) positively skewed, less informative signal, (4) negatively skewed, less informative signal
- Minimize confounding preferences for skewness vs. informativess

Alzheimer's Disease Study

- 626 MTurkers, 40 years or older (avg. 53 yo)
- APOE gene pairs, three variants (neutral, risky, protective)
- Natural context for partially informative skewed signals, with common priors
  - Neg. Skew: Carry (at least one copy of) risky variant
  - Pos. Skew: Carry (at least one copy of) protective variant
  - Most Info: Exact combination of genes
- Negative skew arguably more instrumental
- Willingness to pay $X, X ranging -50 and 50

Alzheimer's Disease Study

- Those who want to learn about exact combination of genes (takers) do not tradeoff information and skewness
- Among avoiders, 19% indicate demand for positive skew (only 4% for negative) and 9.25% would even pay for it



IQ Test Study

- 600 MTurkers first take a test (fluid intelligence: verbal and visual reasoning)
- We elicit individual priors μ regarding their rank among 100 randomly chosen participants
- Personalized information structures, with $topcut_\mu = \mu - \delta_\mu$ and $bottomcut_\mu = \mu + \delta_\mu$ where $\delta_\mu = \frac{1}{4} min\{\mu, 100 - \mu\}$

NoInfo	Receive no information about how your score ranks you relative to other people
MostInfo	Learn whether your score ranked $topcut$ or better, ranked between $topcut + 1$ and $bottomcut - 1$, or ranked $bottomcut$ or worse
PosSkew	Learn whether your score ranked $topcut$ or better
NegSkew	Learn whether your score ranked $bottomcut$ or worse

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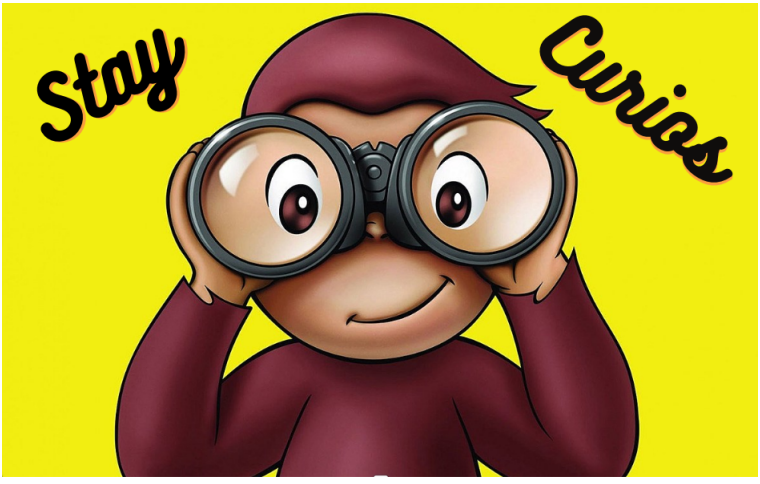
- Elicit (incentivized) ranking of information structures
  - 1st ranked 60%, 2nd ranked 30%, 3rd ranked 10%, 4th ranked 0% chance of being implemented

IQ Test Study

- Positive skew and full info are similarly preferred
- 82% most info $>$ no info
- 81% pos. skew $>$ no info
- 75% neg. skew $>$ no info
- Among avoiders, positive skew is the best kind of information
- Among 32.7% of avoiders who do not rank no info as 1st choice, big majority (74%) ranks pos. skew 1st
- Providing pos. skew in addition to the most info. one would increase information uptake from 82.2% to 86.5%

Implications

- Models of intrinsic information preference
- Large informational premia implies important role of belief-based preferences
- Positive skew reducing information resistance
- Provides support for (Caplin and Eliaz, 2003; Eliaz and Spiegler, 2006; Schweizer and Szech, 2013; Dillenberger and Segal, 2017)
- Implies restrictions on commonly used Kreps-Porteus preferences where $u_1 \circ u_2^{-1}$ is inverse S-shaped
- Information Design
- When accuracy is achieved at a cost, maximize positive skew for any given level of accuracy
- When multiple signals can be offered, adding a positively skewed information structure to a fully revealing option increases number of individuals acquiring information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