Betrayal Aversion, Probability Neglect and Blindness to the Advantages of Ambiguity

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Rational Analysis

- Probabilities are critical
- Subjective probability
- Bayesian analysis
- Choices depend on payoffs and probabilities

  NOT on Framing or Source of Uncertainty

- Probability: “Subjective degree of belief in a proposition” proposed by **John Maynard Keynes** in the early 1920s.
- Concept extended by
  - **Bruno de Finetti** in Italy (*Fondamenti Logici del Ragionamento Probabilistico*, 1930) and
  - **Frank Ramsey** in Cambridge, England (*The Foundations of Mathematics*, 1931)
- **De Finetti:** A gamble will pay $1 if there was life on Mars 1 billion years ago, and $0 if there was not, and tomorrow the answer will be revealed. You know that *your opponent* will be able to choose either to buy or sell this gamble. Answer will be revealed tomorrow.

Sources for Talk

- Betrayal Aversion
  - "Betrayal Aversion: Evidence from Brazil, China, Oman, Switzerland, Turkey, and the United States," Iris Bohnet, Fiona Greig, Benedikt Herrmann, and Richard Zeckhauser, *American Economic Review* 98(1), 2008, 294-310.
  - "Trust and the Reference Points for Trustworthiness in Gulf and Western Countries," Iris Bohnet, Benedikt Herrmann, and Richard Zeckhauser, *Quarterly Journal of Economics*, forthcoming.
- Probability Blindness
  - "Overreaction to Fearsome Risks," Cass R. Sunstein and Richard Zeckhauser, *Environmental and Resource Economics*, forthcoming.
  - "Dreadful Possibilities, Neglected Probabilities," Cass R. Sunstein and Richard Zeckhauser, in *The Irrational Economist*, Erwann Michel-Kerjan and Paul Slovic (eds.), New York: Public Affairs Press, 2010.
- Blindness to the Advantages of Ambiguity
  - Work underway with Stefan Trautmann (Tilburg)

Trust and Betrayal:

Evidence Across Nations

Iris Bohnet, Fiona Greig, Benedikt Herrmann

and Richard Zeckhauser

Harvard University

Willingness to Take Risk

- Traditional decision analysis/economic theory:

  Attitudes to risk

- But what if the agent of uncertainty is a person rather than nature?

  Behavioral economics on *social* versus *natural* risks:

  Attitudes to betrayal

- Social risks include:
  - Speculative bubbles, HIV, terrorism…
  - Principal-agent relationships, asymmetric information, incomplete contracts:

    Trust interactions

Risks of Betrayal versus Natural Risks

- Payoffs to other(s):

  Social preferences

- Agent of uncertainty:

  Causal attributions (intentions) beyond outcome-based preferences

- **Hypothesis**

  Holding payoffs to others constant, if people have an aversion to betrayal, they will be less willing to take risks in a trust situation than in an equivalent situation where chance determines the outcome.

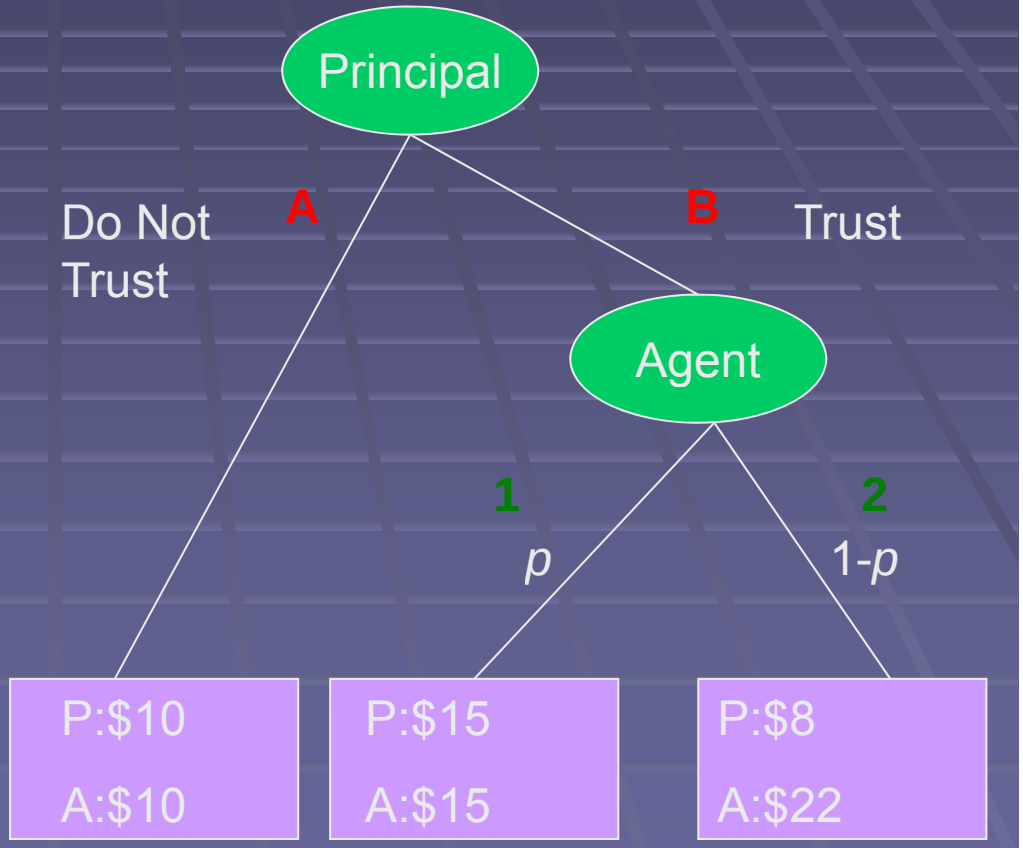
Trust Game

Principal confronted with a sure outcome and a lottery, A and B.

Principal does not know p, the probability that Agent chooses 1 if Principal chooses B.

Probability that makes the lottery actuarially fair:

p'=.29



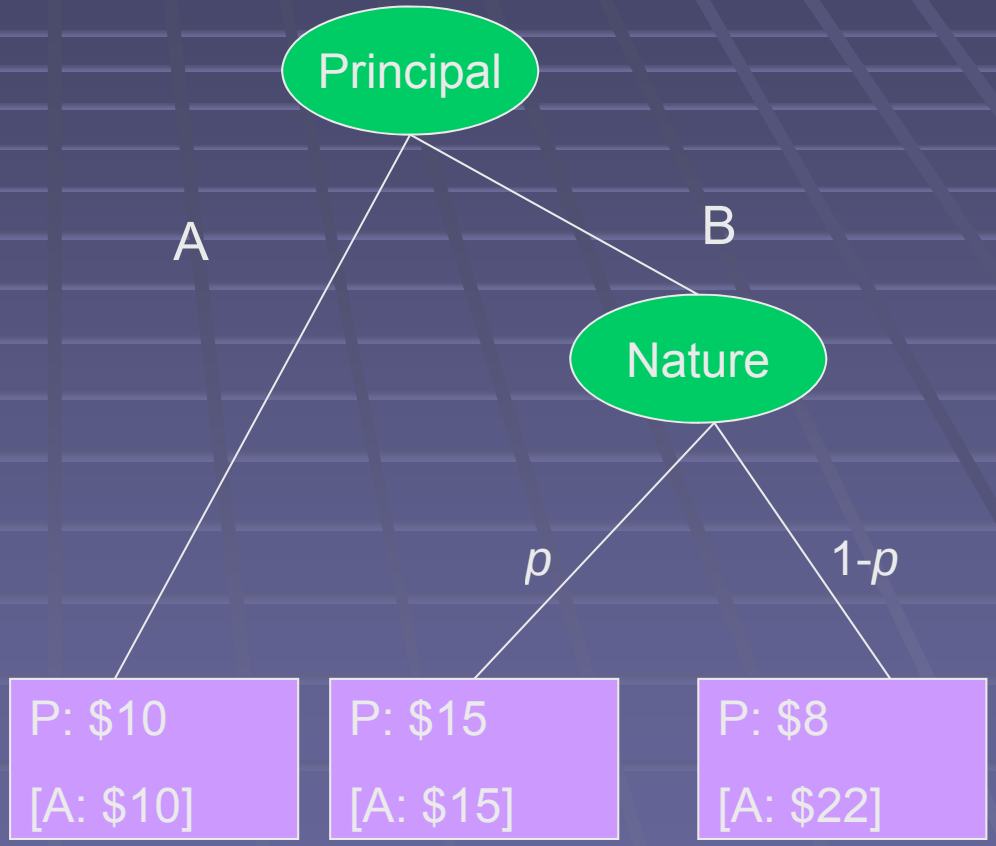
Risky Dictator Game (RDG) and Decision Problem (DP)

Principal chooses between sure thing and lottery.

The agent of risk is nature.

Principal does not know the probability of getting the higher outcome in the lottery, p.

Principal's decision affects Agent's payoffs in RDG but no second person is involved in DP.



Measuring Betrayal Aversion

- Compare behavior in TG and RDG:
  Attitudes to betrayal.
- Compare behavior in RDG and DP:
  Social preferences (incl. efficiency concerns).
- Compare behavior in DP and probability that makes lottery actuarially fair:
  Risk preferences.

MAP

- Introduce new methodology to measure willingness to take risk under different circumstances:

  With MAPs (minimal acceptable probabilities) we measure how high the likelihood of getting the better outcome (15,15) minimally has to be for the principal to choose the risky over the sure outcome.

- For example, in a binary-choice trust game, we ask principals (in neutral language):

  "Out of 100 people, how many would minimally have to be trustworthy for you to be willing to trust?"

  → MAP: Minimal Acceptable Probability

- Compare principals' MAPs to p*, the fraction of trustworthy agents:

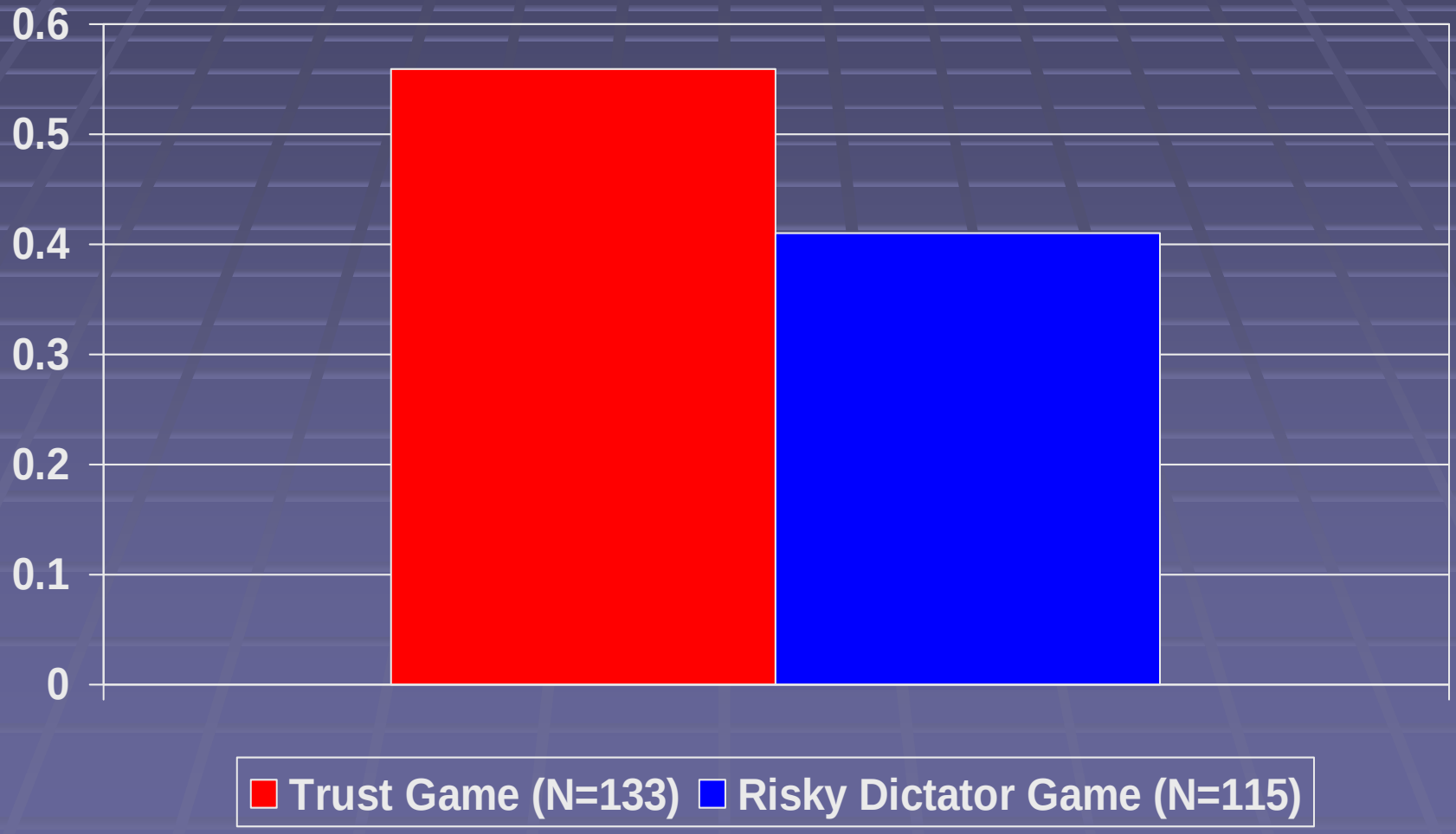
  We simultaneously ask agents (in neutral language):
  "If your principal trusted you, would you be trustworthy?" (strategy method)

Experimental Details

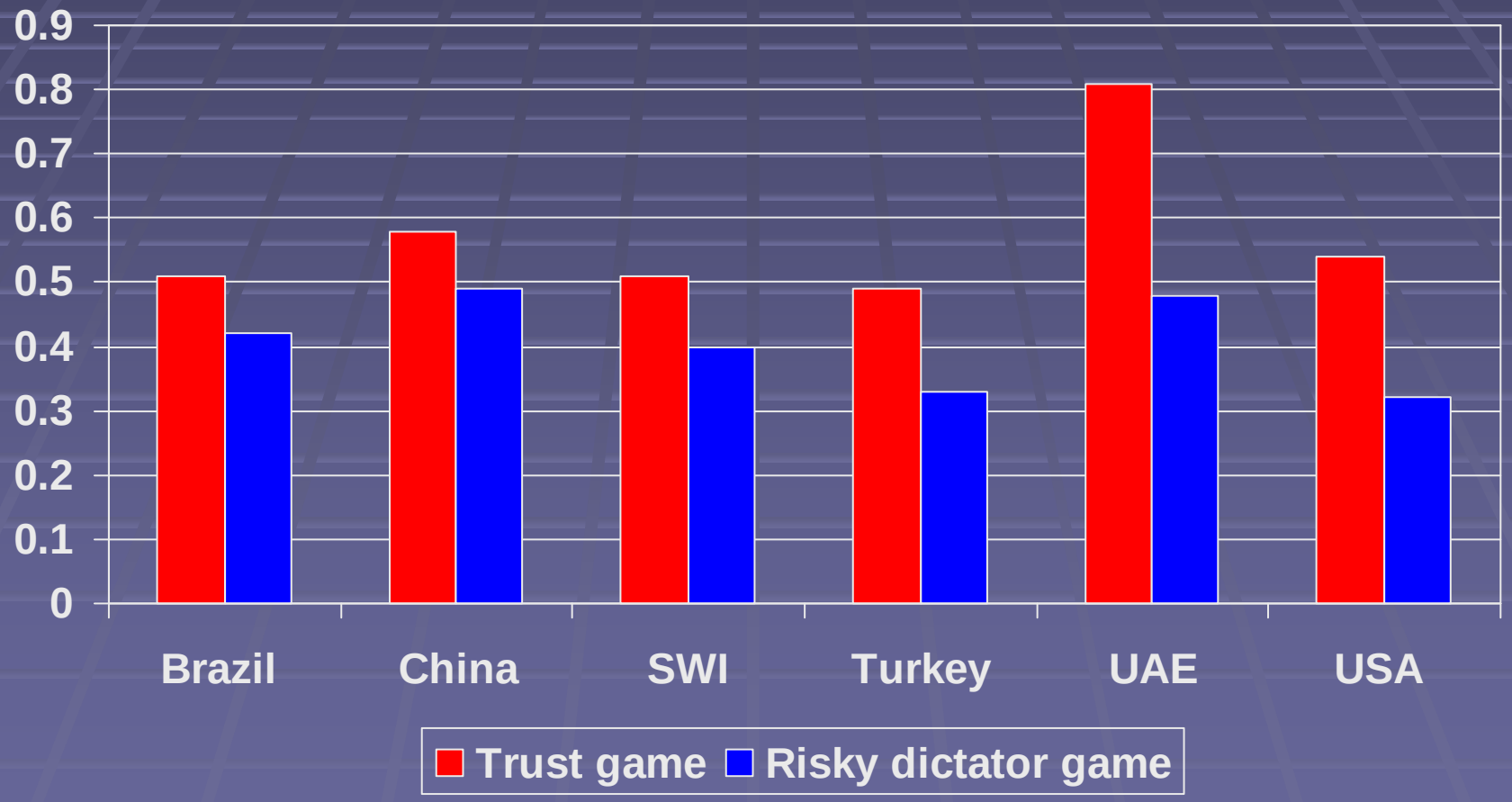
- Design: Between-subjects, one-shot, anonymous.
- Subjects: To establish generality of betrayal aversion, experiments run in very different places. 614 students at universities in Brazil (Rio), Switzerland (Zürich), United Arab Emirates (Al-Ain), and United States (Boston). Now replicated in China, Kuwait, Saudi Arabia, and Turkey.
- Incentives: Preserving PPP (practically: opportunity cost of time).
- Instructions translated (and back-translated) into respective languages.

Result 1: Subjects are betrayal averse.

MAPs in TG and RDG: $MAP_{TG} > MAP_{RDG}$



Betrayal Aversion by Country
(no cross-country differences in p*~0.33)



Determinants of MAPs (OLS)

	MAP	MAP	MAP	MAP
Trust	0.153***	0.161***	0.123***	0.119***
Decision	0.074	0.051	0.034	0.025
Women		0.073**	0.076	0.090***
Brazil		0.036	0.039	0.037
China		0.054	0.054	0.035
SWI		0.047	0.047	0.037
Turkey		-.006	-0.003	-0.002
UAE		0.223***	0.113**	No
Interact.		No	Yes	No

Conclusions

- People are less willing to take risk when the agent of uncertainty is another person rather than nature: betrayal aversion.
  - → Behavioral economics: People do not only care about outcomes but also about how outcomes come to be (e.g., Rabin 1993).
- People are slightly more willing to take risk when another person benefits from risk taking: positive social preferences; and generally are risk averse.
  - → Behavioral economics: People care about payoffs to others and/or about efficiency (e.g., Fehr and Schmidt 2002 for a survey).
- The RDG and the MAP elicitation procedure may prove to be useful innovations to examine willingness to take risk under different conditions.

Probability Neglect

"…the only thing we have to fear is fear itself — nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance."

Franklin Delano Roosevelt

First Inaugural Address, March 1933

Table 1. Willingness to Pay in Dollars for Elimination of Arsenic Risks

Harvard Law School Results, 2008
Mean (Median)
[Number of Subjects]

Probability	Unemotional description	Emotional description
1/100,000	241.25 (100) [20]	250 (100) [13]
1/1,000,000	59.21 (25) [19]	211.67 (200) [15]

From: "Overreaction to Fearsome Risks," Cass R. Sunstein and Richard Zeckhauser, *Environmental and Resource Economics*, forthcoming.

Table 2. Demand Price to Accept a Painful But Non Dangerous Electric Shock

Harvard Law School Results, 2008
Mean (Median)
[Number of Subjects]

Probability	Shock Today	Shock in a Year (Anxiety)
100%	1283.33 (50) [12]	1966.43 (100) [14]
1%	661.41 (50) [23]	824.05 (50) [21]

From: “Overreaction to Fearsome Risks,” Cass R. Sunstein and Richard Zeckhauser, *Environmental and Resource Economics*, forthcoming.

Blindness to the Benefits of Ambiguity

With Stefan Trautmann (Tilburg)

Risk vs Ambiguity in Decision under Uncertainty

Risk:

- all probabilities objectively known
- tools: expected value, exp utility, risk aversion; prospect theory, probability weighting
- not very common in real world decision

Uncertainty (hence Ambiguity):

- labor: prob that you find a better paying job?
- finance: prob that price of asset A increases by 4%?

  => subjective probabilities all we have

Risk vs Ambiguity in Decision under Uncertainty

Ambiguity:

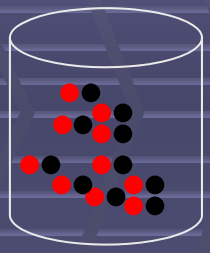
- probabilities unknown
- Savage 1954: subjective expected utility:
  ambiguity = risk, subjective probabilities
- Knight 1921, Keynes 1921, Ellsberg 1961:
  ambiguity ≠ risk : “ambiguity attitudes”
- Choquet EU: non-addidive (subjective) probability; maximin EU (non-unique), ….
- Main assumption (based on emp. evidence): Pessimism/ambiguity aversion

Ellsberg paradox.

Two urns with 10 balls.

Known urn_k

10 R
10 B



Unknown urn_u

20 R&B
in unknown
proportion

Ball drawn randomly from each. Events:

R_k: Ball from known urn is red.

B_k, R_u, B_u are similar.

Common preferences between gambles for $100:

$100_{R_k}\ 0 >` 100_{R_u}\ 0$ → $P(R_k) > P(R_u)$

$100_{B_k}\ 0 >` 100_{B_u}\ 0$ → $P(B_k) > P(B_u)$

$\frac{P(B_k)}{1}_{+} > \frac{P(B_u)}{1}_{+}$

What Ambiguity Aversion Explains

Unknown probability events for good outcomes are discounted/weighted

Ambiguity aversion

Empirical: lab => theory for real world problems

Has been applied to explain, e.g.,

- Home bias in investment
- Equity premium
- Value of established brands
- Underdiversification of incomes risks

Why Ambiguity Aversion?

In typical lab experiment does not make much sense

In real world situations it often does: strategic element (someone has to offer you an ambiguous alternative)

⇒Caution (mistakenly) applied to lab setting

Benefits of ambiguity in real world settings

- Theme 1–
  Learning offers better choices
- Theme 2–
  Individuals are terrible at recognizing these benefits

The Benefits of Ambiguity: Option Value of Learning Opportunities

Real life ambiguity often comes with repeated choices

If so, ambiguity about probabilities can have significant benefits.

Medical Example:

The Benefits of Ambiguity: Option Value of Learning Opportunities

- You are 35, have a chronic disease (depression, diabetes), you'll stay on a daily medication for the rest of your life.
- Your current medication works well, on 10% of days you suffer some side effects.
- A new medication has been developed which is equally beneficial in controlling condition. For some people better (side effects on 1% of days), but worse for others (20% of days) than existing medication. On average over all people tested, side effects on 15% of days.
- Do you wish to try this new medication for a month?

The Benefits of Ambiguity: Option Value of Learning Opportunities

- In a one-time decision prefer current medication (10% better than 15%).
- In repeat situation if you observe few side-effects over the month you have likely found a superior medication (1%!).
- If many side effects in a month, or later, go back to the other medication.
- Benefits from ambiguity can be large in such settings.

Cautiousness vs Blindness to the Benefits of Ambiguity

- With both caution and benefits being natural in decisions under ambiguity we would expect people making a tradeoff.
- Evidence from medical decisions even doctors are *blind* to the benefits, however (Frank-Zeckhauser 2008, depression).

  => much too little experimentation with ambiguous alternatives observed.

Cautiousness vs Blindness to the Benefits of Ambiguity

- In real-life choices difficult to distinguish. Tear apart effects of caution and of blindness to benefits; caution may be very important (ex-post blame, responsibility, need for justification).

  => This study: identify blindness to ‘option value’ of ambiguity in controlled lab setting.

Ellsberg Adapted

More abstract, more structured experiment:

- Two urn, two color problem, 2 bags with 10 (or 4) chips.
- Bet on a color to win E10.
- Let subjects assemble their urns themselves to minimize need for distrust/caution, from box with 50 chips each color.
- But: play twice with same urn with replacement after round 1
  - no learning under risk, twice 50%
  - switch to/stay with first round color under ambiguity: >50% in second round

Ellsberg Adapted

Version 1:
10 chips, EV(R)=10, EV(A)= 10.45

Version 2:
4 chips, EV(R)=10, EV(A)=11.20

Basic Repeated Ellsberg

Results:

treatment	Standard (10chip)	repeat (10chip)	repeat (4 chip)
% ambiguous	23%	41%	14%

- Repeated option no effect; no effect of 'efficiency' of repeated.
- Asked Ss to explain their choice: no suggestion of tradeoffs between caution and benefits.

Experience with Learning

It does not come naturally.

If we help them a bit?

Do first a

$\Rightarrow$ simple statistical sampling task

or

$\Rightarrow$ simpler version of Ellsberg where uncertainty resolves after first draw (ambiguous urn either all yellow or all red); marbles instead chips etc.

Idea: get them thinking about learning under ambiguity/resolving ambig/ ambiguity better

Experience with Learning

	No experience		Experience: sampling	Experience: uncertainty resolves	
treatment	repeat (10chip)	repeat (4 chip)	repeat (10chip)	repeat (10chip)	repeat (4chip)
% ambiguous	41%	14%	32%	28%	31%
Experience task 'solved'?			75% sample too little	82% take ambiguous	

positive correlation between solving first task and choosing ambiguity

When asked, risky choosers claim that the first round information is irrelevant

Who Learns What?

- Not discussed yet: who gets it right?
- Do those in ambiguous do the right thing?

  =>check optimal play under ambiguity

  =>check play under risk; as-if learning

Who Learns What?

Learning and “as-if learning”:

	No experience	Experience: sampling	Experience: uncertainty resolves
Ambiguous	60%	83%	92%
Risky	50%	24%	30%

Gambler’s fallacy

Forced Learning Two 10-chip bags, one of known composition, 5R and 5B. One made up at random.

1. Draw one chip from each bag. Note its color on this sheet. Replace it in bag.
2. Predict composition of each bag. MAJORITY OF EITHER COLOR, OR EQUAL. Will choose bag at random, 10E if correct.
3. Explain answer.

4. Choose one of the two bags. Predict color of single chip to be drawn. 10E if correct.
5. Explain answer.

Results

- 24% predict a majority in ambiguous bag and choose correctly. HURRAH.
- 36% predict wrong majority or pick wrong color from ambiguous. COMPLETELY HOPELESS 24% predict right majority, but then pick risky bag. MAYBE HOPELESS, MAYBE STRONGLY AMBIGUITY AVERSE 15% appear to learn when predict majority, and choose correctly, but explain picked majority at random. LUCKY

Conclusion

- Claim: people do not recognize learning opportunity under ambiguity that is relevant in almost all real world settings.
- Our data support this claim, but difficult to distinguish from extreme ambiguity aversion.

  => varying cost/benefits of ambiguity has no effect

  => no indication of tradeoffs made in interviews
- Giving them experience with statistical reasoning helps some, may ‘hurt’ others.

Conclusion for Talk

"Happy families are all alike; every unhappy family is unhappy in its own way."

Leo Tolstoy, *Anna Karenina*, opening line

Rational thinkers are all alike: all nonrational thinkers are nonrational in their own way.

Risks from human action count more than those from nature.

- Betrayal Aversion

Anxiety freezes our ability to think about probabilities.

- Probability Neglect

We are blind to the benefits of ambiguity.