MW24.2 Experimental Economics (SS2021)
Probability Judgment

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2. Conjunction Fallacy

Linda problem [Tversky and Kahneman, 1983]

Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

By probability, rank the following statements:

Linda is a teacher in elementary school.

Linda works in a bookstore and takes Yoga classes.

Linda is active in the feminist movement. (F)

Linda is a psychiatric social worker.

Linda is a member of the League of Women Voters.

Linda is a bank teller. (T)

Linda is an insurance salesperson.

Linda is a bank teller and is active in the feminist movement. ($T \cap F$)

$\Rightarrow$ 85% of UBC undergraduates rank $P(F) > \underline{P(T \cap F) > P(T)}$, which violates the *conjunction rule*:

$$P(T \cap F) \leq P(T)$$

$\Rightarrow$ similar results for the Bill problem (representative of an accountant, not of a jazz music player)

$\Rightarrow$ sophistication (e.g., statistics background, M.A. degree) plays no role

$\Rightarrow$ "transparent" version with only T and $T \cap F$ results in 85% violation

$\Rightarrow$ sophistication helps bring down the error rate to 36% in the "transparent" version

(T^*) Linda is a bank teller *whether or not* she is active in the feminist movement

$\Rightarrow$ 57% rank $P(T \cap F) > P(T^*)$; only 16% rank $P(T \cap F) < P(T^*)$

Linda problem [continued]:

Tversky and Kahneman [1983] suggest that the subjects commit the error because of *representativeness*.

$\Rightarrow$ 65% of the subjects find B more convincing:

A : Linda is more likely to be a bank teller than she is to be a feminist bank teller, because every feminist bank teller is a bank teller, but some women bank tellers are not feminists, and Linda could be one of them.

B : Linda is more likely to be a feminist bank teller than she is likely to be a bank teller, because she resembles an active feminist more than she resembles a bank teller.

Also, $T \cap F$ versus T^* takes care of the linguistic argument that the subjects might construe that T implies F^{-1}.

Overall, the subjects appear to notice the nested nature of the target events but do not appreciate its significance for probability assessment. The violation rate is somewhat lower (56%) if the subjects are incentivized to bet on the events, though.

Charness et al. [2010]:

* "transparent" version of the Linda problem

* incentives[1]/none $\times$ individual/duo/trio judgment

(!) no psychology students in the sample

$\Rightarrow$ error rate of only 58% in the worst case [Table 1]

$\Rightarrow$ incentives have a positive effect: error rate goes down to 33% for individuals

$\Rightarrow$ consultation has a positive effect: error rates of 48% and 26%, respectively

$\Rightarrow$ incentives reinforce the consultation effect: error rates of 13% and 10%, respectively

$\Rightarrow$ removing the word "single" from the vignette lowered the individual error rates to 36% and 28% $\leftarrow$ consistent with the representativeness hypothesis!

[1] In that treatment, the subjects were also told that there indeed *was* a correct answer to the question.

3. Monty Hall Problem

There are three doors with a prize hidden behind one of them. The subject chooses one door. The experimenter then opens one of the other two (without the prize behind it).

(?) would you like to switch to the *other* unopened door?

⇒ rational decision maker *switches*[2] thus increasing the probability of winning the prize from $\frac{1}{3}$ to $\frac{2}{3}$:

pick	·	·	stay	swtich
∨	∅	∅	win	lose
∅	∨	∅	lose	win
∅	∅	∨	lose	win

Friedman [1998]:

Run 1: classic version of the problem

* individual decision problem with cards; 10 repetitions
* prize of 40 cents versus 10 cents otherwise

⇒ 28.7% switches overall; start at $< 10\%$; stagnate at $\sim$40% [Fig. 1]

Possible explanations:

* illusion of control
* non-rational escalation of commitment (e.g., sunk cost or endowment effect)
* misinterpretation of the *non*-random nature of the information process
* probability matching

Run 2

* additional 12–15 repetitions
* one or more of the following treatments:
  (a) *intense* incentives of +100 and −50 cents
  (b) *track* performance of always/never switching
  (c) *advice* (found equally persuasive by the subjects) [p. 942]
  (d) *compare*: switch → 62% win / not switch → 31% win

⇒ switching rate starts at $< 25\%$ and grows to 40–50% [Fig. 2]

⇒ (b), (c), (d) have positive effects [Table 2]

[2]Public media discussion of the rational choice in the Parade magazine (vos Savant, 1990) generated $\sim$10K 'critical' comments with $\sim$1K of those from PhDs.

Suggested Literature

- Amos Tversky and Daniel Kahneman. Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, pages 293–315, 1983 [only pages 293–300]
- Gary Charness, Edi Karni, and Dan Levin. On the conjunction fallacy in probability judgment: New experimental evidence regarding linda. *Games and Economic Behavior*, 68(2):551–556, 2010
- Daniel Friedman. Monty Hall's Three Doors: Construction and Deconstruction of a Choice Anomaly. *American Economic Review*, 88(4):933–946, September 1998