

Effect of Religiosity on the Conjunction Fallacy

By Jordan M. Navarro

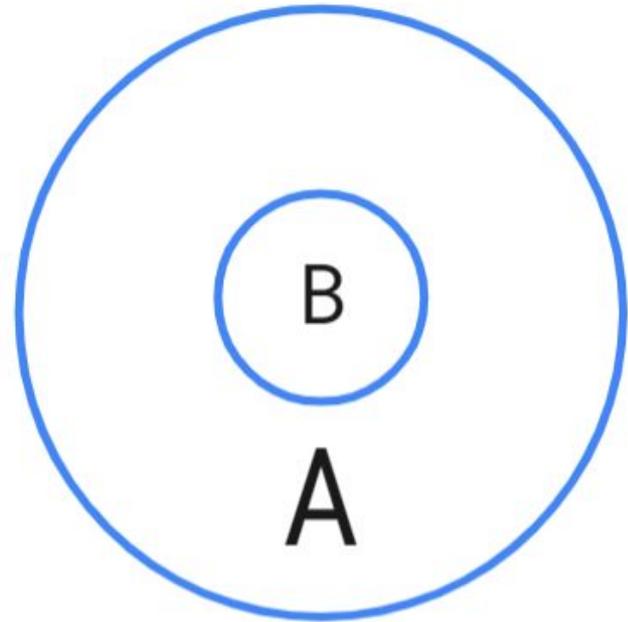
Probability

- Probability is the branch of mathematics concerned with numerical descriptions with regard to how likely some event is to occur.
- The probability of an event is expressed as a real number between 0 and 1, where 0 indicates impossibility of the event and 1 indicates certainty.



Extension Rule in Probability Theory

- One of the most fundamental laws of probability is the extension rule (Tversky & Kahneman, 1983).
- An extension of some event is a set that includes all the possible outcomes of that event.
- *Extension Rule:* If the extension of event A includes the extension of event B (that is, $\text{Ext}(A) \supset \text{Ext}(B)$), then the probability of event A will necessarily be greater than or equal to the probability of event B (that is, $P(A) \geq P(B)$).



Preliminary Example: The Linda Problem

- *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.*

Which is more probable?

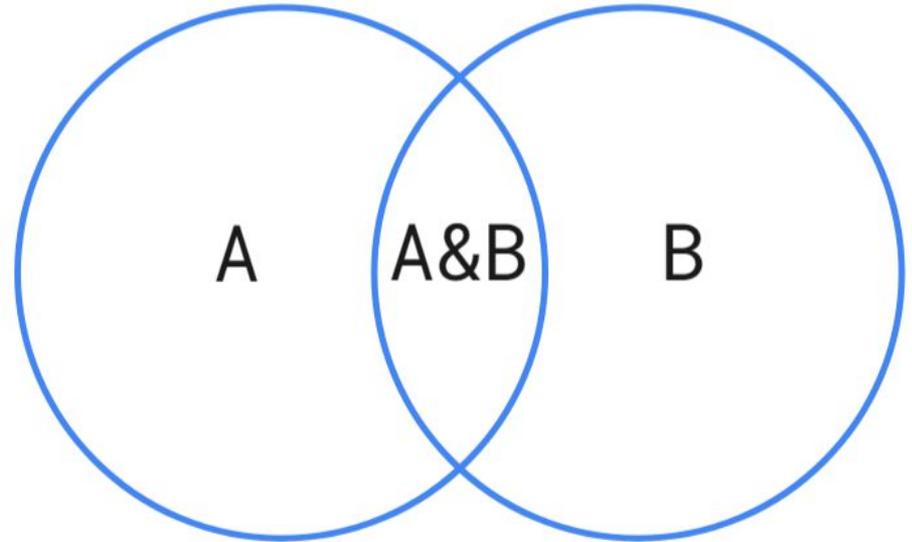
1. Linda is a bank teller.
2. Linda is a bank teller and is active in the feminist movement.

85%

of people who are presented with this puzzle indicate that the conjunction (option 2) is more probable than the single event (option 1), despite the fact that this violates the conjunction rule in probability theory (Tversky & Kahneman, 1983).

Conjunction Rule in Probability Theory

- *Conjunction Rule*: The probability of a conjunction cannot exceed the probability of any of its conjuncts.
- While it is possible for either event A or event B to obtain without both events A and B obtaining, it is impossible for both events A and B to obtain without either event A or event B obtaining.



So the tendency to commit conjunction errors such that one judges a conjunction (for example, “A and B”) to be more probable than one of its conjuncts (either “A” or “B”) is known as the conjunction fallacy.

Dual-process Theory

“one could know something intuitively, in direct experience, as one sees a paper or a desk that is immediately before one’s eyes, which he described as ‘an all around embracing’ of the object by thought, or one could know through ‘an outer chain of physical or mental intermediaries connecting thought and thing,’ as westerners know Indian tigers.” (Weed, 2008, p. 3)

- The foundations of dual-process theory likely comes from William James, an American philosopher, historian, and psychologist, and the first educator to offer a psychology course in the United States.
 - James distinguished between two ways of knowing things (Weed, 2008).
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System 1 and System 2 Thinking

System 1

- Fast
- Intuitive
- Emotional

- Its operations can be characterized as an automated mode of thinking.

System 2

- Slow
- Analytical
- Logical

- Its operations can be characterized as careful procedures which incorporate logical judgment and mental searches for additional information based on prior learning and experience (Tay et al., 2016).

System 2 is lazy.

How Does This Relate to the Linda Problem?

- Tversky and Kahneman (1983) argue that most people get this problem wrong because they rely on a heuristic procedure known as “representativeness” when making probability judgments.
- The option containing the conjunction seems more representative of Linda because it offers a seemingly higher-quality description of the sort of person that Linda would be if she was deeply concerned with issues of discrimination and social justice and participated in anti-nuclear demonstrations. However, the representativeness of some description has no bearing on the probabilities of particular alternatives, so the option containing the conjunction should still be attributed a lower probability than the option containing only one of its conjuncts.
- There appears, then, to be a connection between judgments derived from heuristic procedures and susceptibility to the conjunction fallacy.

Religiosity

I consider religiosity to be a function of both a person's general tendency to commit themselves to religious beliefs and their inclination to resign to faith-based beliefs or belief systems instead of belief systems where evidence is of paramount importance.

- Holdcroft (2006) determined that religiosity is a complex concept and difficult to define for two reasons:
 - Religiosity is found to be synonymous with such terms as religiousness, orthodoxy, faith, belief, piousness, devotion, and holiness.
 - Interest in religiosity could be found across several academic disciplines and that each approaches religiosity in a different way.
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Findings

- Shenhav et al. (2012) found a link between religiosity and intuitive thinking.
- Lu (2015) tested a prediction of Seymour Epstein's integrative theory of personality, known as "cognitive-experiential self-theory" (CEST), that suggests that people with an experiential-intuitive cognitive style are more likely to commit conjunction errors than those with an analytical-rational cognitive style, and he tested this prediction using a revised Linda problem derived from Tversky and Kahneman (1983). He found that:
 - Rational and experiential cognitive styles did not influence the propensity for committing the conjunction fallacy in a way that was statistically significant, and this is contrary to what the CEST would predict.

Findings (Cont.)

- Rogers et al. (2018) examined the extent to which belief in extrasensory perception (ESP), psychokinesis (PK) or life after death (LAD), plus need for cognition (NFC) and faith in intuition (FI), predict one's propensity for committing confirmatory conjunction errors. They found that:
 - Stronger paranormal belief was associated with committing 1.32 (as related to ESP), 3.16 (PK), or 1.27 (LAD) times more conjunction errors.
 - Those who believed in paranormal phenomena made a similar amount of conjunction errors regardless of whether the problem depicted a paranormal event or a non-paranormal one.
 - Those who believed in paranormal phenomena more strongly demonstrated more extreme confirmatory conjunction biases than those who were relatively skeptical of paranormal claims.

Findings (Cont.)

- Bakhti (2018) examined the effects of religious priming, compared with reflective priming and neutral priming, on susceptibility to the conjunction fallacy. Priming occurs when a person's exposure to a certain stimulus influences his or her response to a subsequent stimulus, without any awareness of the connection. They found that:
 - Participants who had undergone the religious prime were significantly more likely to succumb to the conjunction fallacy, compared with those who had undergone the reflective priming condition.

Findings (Cont.)

- Wabnegger et al. (2021) examined the relationship between specific beliefs (belief in conspiracy theories, religiosity) and the susceptibility to conjunction errors in specific domains. They found that:
 - The number of conjunction errors committed in the domain related to COVID-19 conspiracies was only associated with the belief in conspiracy theories, whereas the number of conjunction errors committed in the domain describing miraculous healings was only associated with general religiosity.
 - Additionally, there was no association between the assessed beliefs and conjunction errors committed in the control condition.

Findings (Cont.)

- Mahoney and DeMonbreun (1977) compared the problem-solving skills of 30 Ph.D. scientists to those of 15 conservative Protestant ministers. They found that:
 - The difference between the reasoning skills of the scientists and the nonscientists was not significant.

Conclusions

- Some articles indicate that religiosity (or, at least, a religious prime) leads people to being more likely to commit conjunction errors, other articles indicate the very opposite.
- There does seem to be a relationship between religiosity and intuitive thinking, but it is unclear whether intuitive thinking *causes* people to be more likely to commit conjunction errors.
- All of us are equally affected in terms of what the dual-process theory predicts—that is, no matter our religious status, we all deal with the processes entailed by System 1 and System 2.
- And related articles suppose that, while they might take on a different perspective of their environment, religious people reason just as effectively as those who are nonreligious.

Thank You!

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References

- Bakhti, R. (2018). Religious versus reflective priming and susceptibility to the conjunction fallacy. *Applied Cognitive Psychology*, 32(2), 186–191. <https://doi.org/10.1002/acp.3394>
- Holdcroft, B. B. (2006). What is religiosity? *Journal of Catholic Education*, 10(1), 89–103. <https://doi.org/10.15365/joce.1001082013>
- Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
- Lu, Y. (2015). Is experiential-intuitive cognitive style more inclined to err on conjunction fallacy than analytical-rational cognitive style? *Frontiers in Psychology*, 6, 1–8. <https://doi.org/10.3389/fpsyg.2015.00085>

References (Cont.)

- Mahoney, M. J., & DeMonbreun, B. G. (1977). Psychology of the scientist: An analysis of problem-solving bias. *Cognitive Therapy and Research*, 1(3), 229-238. <https://doi.org/10.1007/bf01186796>
- Rogers, P., Fisk, J. E., & Lowrie, E. (2018). Paranormal belief, thinking style preference and susceptibility to confirmatory conjunction errors. *Consciousness and Cognition*, 65, 182-196. <https://doi.org/10.1016/j.concog.2018.07.013>
- Shenhav, A., Rand, D. G., & Greene, J. D. (2012). Divine intuition: Cognitive style influences belief in God. *Journal of Experimental Psychology: General*, 141(3), 423-428. <https://doi.org/10.1037/a0025391>

References (Cont.)

- United States Mint. (2022). *Quarter*. United States Mint. United States Congress. Retrieved from https://www.usmint.gov/coins/coin-medal-programs/circulating-coins/quarter?doing_wp_cron=1651723043.1234591007232666015625
- Wabnegger, A., Gremsl, A., & Schienle, A. (2021). The association between the belief in coronavirus conspiracy theories, miracles, and the susceptibility to conjunction fallacy. *Applied Cognitive Psychology*, 35(5), 1344–1348. <https://doi.org/10.1002/acp.3860>
- Weed, L. E. (2008). The concept of truth that matters. *William James Studies*, 3, 1–24. <https://www.jstor.org/stable/26203716>

Questions?