The association between the belief in coronavirus conspiracy theories, miracles, and the susceptibility to conjunction fallacy

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Summary

Previous research has shown that people who endorse conspiracy theories are more prone to the conjunction fallacy: the tendency to perceive conjunct events as more probable than constituent events. The present study examined the relationship between specific beliefs (belief in conspiracy theories, religiosity) and the susceptibility to conjunction errors (CEs) in specific domains. A total of 500 participants was presented with brief scenarios from the domains “coronavirus conspiracy,” “miraculous healing,” and a control condition. Each scenario included one statement about a separate event and a second statement about two joint events co-occurring. The participants estimated the probability of each statement. Results showed that the number of CEs made in the coronavirus domain was only associated with the belief in conspiracy theories, while general religiosity was only associated with CEs for scenarios describing miraculous healings. The assessed beliefs were not associated with CEs made in the control condition. Results suggest that distinct beliefs are uniquely associated with the susceptibility to conjunction errors in particular domains.

KEYWORDS

conjunction fallacy, COVID-19 conspiracies, miraculous healings

1 | INTRODUCTION

Since the global outbreak of the coronavirus in 2019 (COVID-19), a plethora of conspiracy theories (CTs) has spread. This is not surprising as CTs typically arise during events in world affairs such as wars, acts of terrorism, or infectious diseases (Basham, 2003; Ross et al., 2006; van Prooijen & Douglas, 2017). Usually, conspiracy theories refer to a group of actors working together to pursue malevolent and sinister goals (Swami & Furnham, 2014).

Endorsement of conspiracy theories is a widespread phenomenon. In a study by Freeman et al. (2020), 50% of the participants endorsed conspiracy ideation. Such erroneous beliefs can have detrimental effects including open aggression or refusal of health-related interventions (Ford et al., 2013; Oliver & Wood, 2014). For instance, telecommunication equipment has been attacked due to the belief that the 5G technology is responsible for COVID-19 spreading (https://www.bbc.com/news/53191523; retrieved January 21, 2021). Another study found that belief in anti-vaccination conspiracy theories correlated negatively with the willingness to receive vaccinations (Jolley & Douglas, 2014). Such attitudes are particularly concerning during a pandemic like COVID-19.

Previous research has shown that individuals endorsing conspiracist ideation perceive a conjunct event (event 1 + 2) as more probable than a constituent event (event 1; Brotherton & French, 2014). Tversky and Kahneman (1982) labeled this logical fallacy “representativeness error” or “conjunction fallacy” and presented this in the well-known Linda scenario. They described a hypothetical woman named Linda together with some of her
characteristics. Afterward, participants were asked to judge the probability of two statements:

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 antinuclear demonstrations. A: Linda is a bank teller (constituent event). B: Linda is a bank teller and is active in the feminist movement (conjunct event).

It was revealed that the majority of the participants ranked combinations of events as more probable than single events because these combinations seem to be more representative. However, in terms of probability theory, the probability of a combination of events cannot exceed the probability of separate events. Moreover, “pure” randomness is often experienced as aversive and leads to feelings of loss of control. Beliefs in (hidden) sources of control may protect against this distress (Kay et al., 2010; Pennebaker & Stone, 2004).

The susceptibility to make conjunction errors (CEs) could also play a role in particular religious beliefs such as miraculous healings. Similar to COVID-19 conspiracy theories, the belief in divine intervention in illness is widespread. For instance, in Lourdes, a major pilgrimage site in France, over 7000 medically unexplained cures have been reported, and 70 of them have been recognized as miraculous by the Catholic church (https://www.lourdes-france.org/en/miraculous-healings/; retrieved, January 22, 2021). Interestingly, the cures mainly concerned tuberculosis (François et al., 2014), which affects the lungs similar to the new coronavirus. It has been pointed out that conspiracy beliefs, as well as religious beliefs, give a sense of meaning and control, which in turn helps to reduce the distress caused by the perception of randomness (Schielen et al., 2020; Swami et al., 2011). Interestingly, only a few studies have investigated the association between religiosity and conjunction fallacy. In a previous study by Prike et al. (2017) religiosity was positively correlated with the number of conducted conjunction fallacies. More recently, Bakhti (2018) showed that participants who were primed with religious words (e.g., pray) made more CEs compared to the priming with reflective (e.g., reason) and neutral (e.g., paper) words. The author suggested that an intuitive rather than an analytical thinking style is associated with religious propensity and thus with more CEs. However, it is important to note that the effects of priming on religious belief have failed to replicate in other studies (Chivers, 2019; Sanchez et al., 2017).

The present study sought to extend the existing knowledge about CEs by creating specific conjunction scenarios with contents concerning the coronavirus or religion (miraculous healings). It was hypothesized that the belief in conspiracy theories would be positively associated with the susceptibility to conjunction errors in COVID-19 conspiracy-related scenarios. Moreover, we hypothesized that general religiosity would be positively associated with the susceptibility to conjunction errors made in scenarios describing miraculous healings. The understanding that many co-occurring events are indeed attributable to mere coincidence rather than a causal event may help to reduce the detrimental effects, especially of (some) conspiracy theories.

2 | METHOD

2.1 | Participants

A total of 500 participants (167 male, 327 female, 6 diverse) who completely filled out an online survey were investigated. None of the participants was excluded from further analyses. Participants’ age ranged from 18 to 84 years (M = 25.86, SD = 9.98). The majority were university students (n = 428), while 59 of the participants had obtained at least a high-school diploma. The study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). Written informed consent was obtained from all subjects.

2.2 | Materials

The participants completed the following questionnaires: Generic Conspiracist Beliefs Scale (GCB): The GCB (Brotherton et al., 2013) measures the proneness to believe in conspiracy theories. The scale consists of 15 items (e.g., “The spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organizations”) rated on a five-point Likert-type scale (1: definitely not true, 5: definitely true). High scores indicate a strong belief in conspiracy theories. Internal consistency (McDonald’s omega) in the current sample was .90 (95% CI: 0.89–0.91).

Multidimensional instrument for the measurement of religious-spiritual well-being (MI-RSWB 48): In the current study the subscale general religiosity of the MI-RSWB 48 (Unterrainer et al., 2010) was used. Items (e.g., “My faith gives me a feeling of security”) are rated on a six-point Likert-type scale (1 strongly disagree, 6: strongly agree). McDonald’s omega in the current sample was 0.94 (95% CI: 0.93–0.95).

Conjunction fallacy questionnaire: For assessing the susceptibility to conjunction fallacy, we developed a total of 18 scenarios divided into three domains with six scenarios each (similar to Rogers et al., 2009). The domains consisted of scenarios related to COVID-19 conspiracies, miraculous healings, and everyday life situations (control condition). Each scenario included one statement describing a separate event and a second statement with a conjunction of the first statement with an additional statement. For each statement, the participants had to judge the probability (in percent). For each statement, the participants had to judge the probability (in percent). Whenever the given percentage for the conjunct statement (option B; probability of event 1 + 2) was higher than the percentage given for the constituent statement (option A: probability of event 1), participants committed a conjunction error. A sum score for all conjunction errors was computed (maximum: 6/domain). McDonald’s omega of the total scale was 0.83 (95% CI: 0.80–0.85).

Example scenario for COVID-19: “The Bill Gates Foundation (BGS) fights against corona. Which statement is more likely? A: BGS strives for a high vaccination rate. B: BGS strives for a high vaccination rate and thus wants to increase its wealth.
Example scenario for miraculous healings: In 2018, the Catholic church recognized a miraculous healing at Lourdes, in which the French nun Bernadette Moriau, after participating in a Lourdes pilgrimage, was healed of her paralysis. Which statement is more likely? A: Bernadette Moriau was bound to a wheelchair B: Bernadette Moriau was bound to a wheelchair and was cured of her paralysis by participating in the pilgrimage.

Example scenario for the control condition: Alfred is 23 years old, studies psychology, and plays electric bass in his spare time. Because of his interest in animals, he works in a pet store alongside his studies. Which statement is more likely? A: Alfred likes cats. B: Alfred likes cats and dogs.

2.3 | Statistical analyses

We computed a negative binomial regression to capture the association between the belief in conspiracy theories, general religiosity, and age (mean-centered predictors) and the susceptibility to make conjunction errors in three domains (coronavirus conspiracy, miraculous healings, control condition). Analyses were carried out with the GAMLj-package (General Analyses for Linear Models in jamovi; version: 2.0.5) implemented in the open statistical software jamovi (version 1.6.1.0).

3 | RESULTS

3.1 | Questionnaire data

The mean score for conspiracy beliefs was $M = 2.23$ ($SD = 0.73$; 95% CI: 2.17–2.30) and $M = 2.22$ ($SD = 1.31$; 95% CI: 2.12–2.33) for general religiosity. Both constructs showed an intercorrelation of $r = .16$ ($p < .001$).

3.2 | Susceptibility to conjunction errors

More than two-thirds of the participants (74%) made at least one CE (range: 0–15, median: 3). Further inspection of the data showed that CEs were made in each scenario (range: 5–200). Thus, all scenarios were included. The analysis of the specific domains showed that 64% made at least one CE in the COVID-19 scenarios (range: 0–6, median: 1), 51% in miraculous healing scenarios (range: 0–5, median: 1), and 48% in the control condition (range: 0–6, median: 0).

Conjunction errors committed in the COVID-19 domain were only predicted by the belief in conspiracy theories. For each increase of one point on the questionnaire, the chance of committing a CE rose by 33%. All other predictors were statistically non-significant ($p > .05$).

Conjunction errors committed in the healing scenarios were exclusively predicted by general religiosity. For each increase of one point on the scale, CEs rose by 19%. No other predictor was statistically significant ($p < .05$).

No predictor was significant for the number of CEs committed in the control condition (all $p$s > .05). Detailed results are depicted in Table 1.

4 | DISCUSSION

The present study identified unique predictors of the susceptibility for conjunction errors (CEs) in specific domains. We revealed that a higher degree in conspiracist ideation and general religiosity was associated with erroneous decisions that a conjunction of two statements (probability of event $1 + 2$) is more likely than a single statement (probability of event 1). Individuals’ endorsement of conspiracy theories predicted the number of CEs made in the COVID-19 scenarios, while general religiosity was a significant predictor for CEs made in scenarios dealing with miraculous healings. The results fit in with previous research (Brotherton & French, 2014; Rogers et al., 2009, 2011, 2013).

### Table 1

| Predictors          | Exp(B) | Confidence interval for Exp(B) | p-Value |
|---------------------|--------|--------------------------------|---------|
| **COVID-19**        |        |                                |         |
| General religiosity | 1.06   | 0.99–1.14                      | .102    |
| Belief in conspiracy| 1.33   | 1.17–1.51                      | < .001  |
| Age                 | 1.00   | 0.99–1.01                      | .393    |
| **Miraculous healing** |      |                                |         |
| General religiosity | 1.19   | 1.10–1.28                      | < .001  |
| Belief in conspiracy| 1.15   | 1.00–1.33                      | .058    |
| Age                 | 1.00   | 0.99–1.01                      | .719    |
| **Control**         |        |                                |         |
| General religiosity | 1.07   | 0.98–1.18                      | .140    |
| Belief in conspiracy| 1.17   | 0.99–1.39                      | .065    |
| Age                 | 1.01   | 1.00–1.02                      | .067    |

Note: Exp(B) = odds ratio; bold: statistically significant ($p < .05$) effect.

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that revealed an enhanced susceptibility to CEs in participants who believe in conspiracy theories and paranormal events (e.g., psychokinesis).

For believers with a high degree in those trait-like variables, specific domains may be more representative or prototypical and are therefore subjectively more likely. This perception of enhanced representativeness possibly triggers faster but error-prone conclusions and neglects the necessity to rely on objective probabilistic laws. Thus, participants are less inclined to critically question their probability estimates for events that correspond to their world view and they need less evidence to draw a conclusion (French & Stone, 2014). As a result, the participants misattribute underlying causal relationships to actual independent situations (Bressan, 2002; Rogers et al., 2009; Tversky & Kahneman, 1983). In line with this interpretation, it has been revealed that people of faith and conspiracy believers tend to perceive meaningful patterns in randomly generated stimuli (Riekkilä et al., 2013; van Prooijen et al., 2018). Hadlaczky and Westerlund (2011) showed that believers and skeptics have a different conception of random events with believers requiring less evidence before detecting meaningful patterns in noise. In their study, paranormal believers were less able than skeptics to discriminate between somewhat and very remarkable coincidences, implying that believers have a lower threshold for being surprised by coincidences.

Further, we speculate that individuals with a higher degree in general religiosity or conspiracist ideation are more prone to perceive randomness in specific domains as an aversive state. Belief in an entity or group of people that exert control may, hence, serve as a coping mechanism that diminishes this negative state. The perception that such occurrences are typical can ascribe plausibility to such theories/reports (Brotherton & French, 2014) which may reduce distress. In this sense, both conspiracy theories and religious beliefs provide a sense of coherence and meaning and thereby make highly complex processes in the world easier to explain and understand.

The present study also demonstrated that the investigated specific beliefs did not increase the susceptibility to conjunction errors per se, but only in those domains with related contents. None of the cognitive constructs (general religiosity, belief in conspiracy) was associated with the number of CEs made in the control scenarios. This is in contrast to previous literature that found general effects of conspiracy theory beliefs and the propensity to commit conjunction errors (Brotherton & French, 2014; Prike et al., 2017; Rogers et al., 2009, 2011, 2016, 2018). The majority of the sample consisted of university students, of those psychology students with a solid statistical background were the largest group (~20%). Rogers et al. (2009) showed that participants with qualifications in statistics and/or psychology committed fewer conjunction fallacies and were rather classified as “non-believers.” Consistently, the current sample consisted of fairly skeptical individuals characterized by relatively low scores in general religiosity and conspiracist ideation, who moreover committed only a relatively low number of conjunction errors. This could indicate that only when a certain level in conspiracist ideation and general religiosity is exceeded, the propensity to perceive ostensible causal connections across further domains increases. This fits nicely with the idea that believers find the second option describing the conjunct event less remarkable and surprising because it confirms their worldview. Such a worldview might explain why more extreme believers are characterized by an increased propensity to commit conjunction errors in general (Rogers et al., 2017).

We have to mention some limitations of the current study. As mentioned above the sample consisted mainly of university students, thus results cannot be generalized to the general population. Further, a relatively low number of conjunction errors was committed. Consequently, we modeled the data by using a negative binomial regression which is generally used for over-dispersed count outcomes with excessive zeros. The current study assessed participants’ self-reports on general religiosity. Religious affiliation data were not collected due to the relatively homogenous distribution of denominations (Roman Catholic; ~75%) in Austria. Future studies could investigate whether individuals with different types of religious affiliations differ in their proneness to make conjunction errors. Moreover, it would be interesting to compare individuals who believe that a higher being exists but does not directly intervene (i.e., Deists) with individuals who believe in an intervening god (i.e., Theists). Finally, it remains questionable whether the susceptibility to conjunction errors is a result or cause of general religiosity/conspiracist ideation. This could be investigated in longitudinal studies. Intervention studies would be helpful to elucidate whether information provided about conjunction errors can reduce the susceptibility for conspiracy beliefs.

In conclusion, the current investigation showed that a high degree in conspiracist ideation and general religiosity was associated with an enhanced probability to fall victim to the conjunction fallacy in specific domains (coronavirus conspiracy, miraculous healings). Training in statistics and probability theory may reduce the propensity to commit conjunction fallacies (Morier & Borgida, 1984).

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CONFLICT OF INTEREST
The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT
Data is available under following url: https://osf.io/h846s/.

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