

Belief in Conspiracy Theories and Susceptibility to the Conjunction Fallacy

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Summary: People who believe in the paranormal have been found to be particularly susceptible to the conjunction fallacy. The present research examines whether the same is true of people who endorse conspiracy theories. Two studies examined the association between conspiracist ideation and the number of conjunction violations made in a variety of contexts (neutral, paranormal and conspiracy). Study 1 found that participants who endorsed a range of popular conspiracy theories more strongly also made more conjunction errors than participants with weaker conspiracism, regardless of the contextual framing of the conjunction. Study 2, using an independent sample and a generic measure of conspiracist ideation, replicated the finding that conspiracy belief is associated with domain-general susceptibility to the conjunction fallacy. The findings are discussed in relation to the association between conspiracism and other anomalous beliefs, the representativeness heuristic and the tendency to infer underlying causal relationships connecting ostensibly unrelated events. Copyright © 2014 John Wiley & Sons, Ltd.

A conspiracy theory can be defined as an unverified and relatively implausible allegation of conspiracy, claiming that significant events are the result of a secret plot carried out by a preternaturally sinister and powerful group of people (Brotherton, 2013). Such theories are a prominent feature of contemporary culture. Substantial numbers of people believe conspiracy theories regarding the role of the US government in the 9/11 terrorist attacks, the death of Princess Diana and the reality of anthropogenic climate change, to give just three popular examples (e.g. Gardiner & Thompson, 2012; Stempel, Hargrove, & Stempel, 2007; Williams, 2013; Wood, Douglas, & Sutton, 2012). With the rapid spread of ideas enabled by the internet, conspiracy theories are now often quick to arise and spread in the wake of any significant event (e.g. Abad-Santos, 2013; Holpuch, 2013).

Conspiracy theories are sometimes regarded as benign or even potentially beneficial (e.g. Pigden, 2007). Yet, belief in conspiracy theories can have detrimental consequences, both for individuals and for the wider community. For instance, people who believe that HIV/AIDS is part of a population-control conspiracy are less likely to adhere to treatment programmes or use preventative measures (e.g. Bogart, Galvan, Wagner, & Klein, 2011; Bogart, Wagner, Galvan, & Banks, 2010), and people who believe that pharmaceutical companies are hiding evidence that vaccines cause autism are more likely to refuse vaccination (Hilton, Petticrew, & Hunt, 2007; Kata, 2010; Salmon et al., 2005). More generally, exposure to conspiracy theories is associated with decreased civic engagement (Butler, Koopman, & Zimbardo, 1995; Jolley & Douglas, 2013) and, in some cases, prejudice, radicalisation and violence (Bartlett & Miller, 2010; Bilewicz, Winiewski, Kofta, & Wójcik, 2013; Swami, 2012).

Given the prevalence and potential consequences of conspiracy theories, a social-scientific understanding of the processes governing the formation, maintenance and transmission of conspiracy theories is required. Until recently, conspiracy theories have been largely neglected by psychologists. However, interest has increased rapidly over the last few years. A number of recent studies have found relationships with

personality traits, including interpersonal trust, paranoia, schizotypy, self-esteem and authoritarianism (Darwin, Neave, & Holmes, 2011; Newheiser, Farias, & Tausch, 2011; Stieger, Gumhalter, Tran, Voracek, & Swami, 2013; Swami & Furnham, 2012; Swami, 2012; Swami et al., 2011, 2013; Swami, Chamorro-Premuzic, & Furnham, 2010). However, correlations with broader personality traits, such as the Big Five, are small and somewhat unreliable (e.g. Bruder, Haffke, Neave, Nouripanah, & Imhoff, 2013; Furnham, 2013; Imhoff & Bruder, 2013; Swami & Furnham, 2012).

A small handful of studies have looked at the role of reasoning biases and heuristics in conspiracist ideation (Douglas & Sutton, 2011; McHoskey, 1995). In particular, conspiracist beliefs may be, at least in part, a product of a bias towards seeking or accepting explanations that are proportional to the consequences of the event in question (LeBoeuf & Norton, 2012; Leman & Cinnirella, 2007; McCauley & Jacques, 1979). According to this heuristic, mundane events may have mundane causes, but significant events require significant causes. This bias can be explained in terms of the representativeness heuristic: the automatic assumption that 'like causes (or is caused by) like' (Kahneman & Tversky, 1972; Teigen, 2004). As conspiracy theories usually explain momentous events in terms of a proportionally vast, sinister conspiracy, they adhere to the representativeness assumption and thus may be more intuitively plausible than rival explanations.

The conjunction fallacy

The representativeness heuristic may also play a role in the *conjunction fallacy*. The conjunction fallacy is a specific error of probabilistic reasoning whereby people overestimate the likelihood of co-occurring events. The phenomenon was explored by Tversky and Kahneman (1983). Participants were presented with a brief personality sketch describing a hypothetical individual, Linda. The description was constructed to be stereotypically representative of an active feminist and unrepresentative of a bank teller: '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.' Following this description, participants rated the

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likelihood of a number of statements about Linda, including three key propositions: (i) Linda is an active feminist; (ii) Linda is a bank teller; and (iii) Linda is a bank teller and an active feminist. Thus, participants judge the likelihood of two singular, constituent propositions (one representative and one unrepresentative) and a conjunction of the two propositions. Participants who select the conjunctive statement as being more likely than either individual constituent statement have fallen victim to the conjunction fallacy; a conjunction cannot be more probable than one of its constituents, because the former is necessarily a more restrictive set of possibilities than the latter (however, see Gigerenzer, 1991; Wolford, Taylor, & Beck, 1990).

Using several variations of the Linda scenario, Tversky and Kahneman (1983) found that typically between 50% and 90% of participants committed the conjunction fallacy. These figures have generally been borne out by subsequent research using a wide variety of conjunction scenarios (Agnoli & Krantz, 1989; Fiedler, 1988; Fisk & Pidgeon, 1996, 1997, 1998; Rogers, Davis, & Fisk, 2009; Rogers, Fisk, & Wiltshire, 2011; Tversky & Kahneman, 1983; Wolford et al., 1990). The effect appears to be strongest when the conjunction suggests a motive or causal relationship (Nestler, 2008; Tversky & Kahneman, 1983).

Tversky and Kahneman (1983; see also Kahneman & Frederick, 2002) argue that the fallacy is a product of the representativeness heuristic.¹ In the case of the fictitious Linda, the objectively restrictive conjunctive description (Linda is a feminist bank teller) may seem more subjectively representative of the described individual and thus more intuitively plausible than the singular, unrepresentative (though objectively more inclusive) component description (Linda is a bank teller). This reasoning defies objective laws of probability but satisfies the representativeness heuristic.

The conjunction fallacy and anomalistic beliefs

Anomalistic beliefs are those that defy conventional understanding of reality, including (but not limited to) belief in the paranormal and conspiracy theories (French & Stone, 2014). The representativeness heuristic has been argued to account, at least in part, for paranormal beliefs (Blackmore & Troscianko, 1985; Brugger & Taylor, 2003; Gilovich & Savitsky, 2002; Lupfer & Layman, 1996; Rogers et al., 2009, 2011; Tobacyk & Wilkinson, 1991). In particular, three studies have explored the relationship between susceptibility to the conjunction fallacy and belief in the paranormal. In the first study (Dagnall, Parker, & Munley, 2007), participants were asked to rate the likelihood of various outcomes of a local football match: (i) Team A score first; (ii) Team A score first and win; (iii) Team A score first and lose; and (iv) Team A score first and the game is drawn. Contrary to expectations, there was no difference in conjunction error rates between paranormal believers and nonbelievers. However, this study has been criticised on the grounds that the sample consisted only of psychology students (who are not representative of the general population in terms of statistical

sophistication), limitations of the measure of paranormal belief employed (the Revised Paranormal Belief Scale: Tobacyk, 1988) and the use of a single conjunction item relating to a football match (Rogers et al., 2009).

Rogers et al. (2009) aimed to overcome these limitations by controlling for participants' training in statistics, using a superior measure of paranormal beliefs (Thalbourne & Delin, 1993), and creating a more sophisticated measure of susceptibility to the conjunction fallacy. This measure consists of paranormal-themed items (such as an apparently precognitive dream) and neutral items (involving, for example, a case of food poisoning). A significant relationship was reported between belief in the paranormal and susceptibility to the conjunction fallacy. Participants who indicated stronger paranormal belief committed more conjunction errors on the paranormal-themed items and also on neutral items. The finding was replicated by Rogers et al. (2011). These findings suggest that paranormal believers are especially prone to the conjunction fallacy and that susceptibility to the fallacy is to some extent domain-general, affecting all conjunctive judgements regardless of context (paranormal or otherwise).

The findings may reflect the tendency among paranormal believers to base judgements on their subjective perception of the representativeness of certain coincidences rather than on objective probabilistic laws (Rogers et al., 2009). Believers appear to look beyond 'mere coincidence' and instead attribute an underlying causal relationship to co-occurring events (Blackmore & Troscianko, 1985; Bressan, 2002; Brugger & Taylor, 2003; Gilovich & Savitsky, 2002). The imagined causal relationship adds to the subjective representativeness of conjunctive events, making them appear more probable than the component events (Nestler, 2008; Rogers et al., 2009; Tversky & Kahneman, 1983). For instance, if a person prone to perceiving separate events as causally related were to have a dream about an old friend only to run into the same person the next day, they may attribute the experience to an underlying paranormal cause. A person less susceptible to this bias may be more likely to attribute the experience to mere coincidence.

Despite the similarity between conspiracist, paranormal and other anomalistic beliefs in terms of being unwarranted and extraordinary claims, little research to date has investigated whether conspiracy theories are associated with similar psychological factors as other anomalous beliefs. However, it seems reasonable to suggest that the tendency to fall victim to the conjunction fallacy may play a similar role in conspiracist ideation as in paranormal beliefs. A general characteristic of conspiracy theories is the presumption that ostensibly unrelated events are causally related by a conspiracist narrative (Keeley, 1999). That is, disparate details surrounding an event are woven together and attributed to the machinations of a conspiracy. To take one example, some conspiracy theories surrounding the assassination of President John F. Kennedy point out that the video of the event shows a man conspicuously opening an umbrella moments before the gunshots. According to the conspiracy theory, the two events are causally related: the umbrella was a signal to the assassin(s) (Posner, 1994). The tendency to perceive conjunctive events as having an underlying causal relationship may make

¹ Other potential explanations of the conjunction fallacy have been offered (e.g. Fisk, 2004), but exploration of these hypotheses is beyond the scope of the current research.

conspiracist explanations appear more subjectively representative of events in general and thus more subjectively probable than alternative explanations.

Studies suggesting that belief in the paranormal correlates with endorsement of conspiracy theories (Darwin et al., 2011; Newheiser et al., 2011; Stieger et al., 2013; Swami et al., 2011) further support the assertion that similar cognitive factors may contribute towards both paranormal and conspiracist beliefs. Given evidence that the representativeness heuristic may influence the adoption of conspiracist explanations in other ways (Douglas & Sutton, 2011; LeBoeuf & Norton, 2012; Leman & Cinnirella, 2007), the conjunction fallacy seems a likely candidate in the search for cognitive correlates of conspiracist ideation. Finding a relationship between conspiracism and the conjunction fallacy would add to the small body of literature concerning the role of cognitive biases in conspiracist ideation and would support the notion that psychological factors that influence supernatural beliefs may also influence conspiracist beliefs.

Overview and hypotheses

The present studies represent the first examination of the relationship between conspiracist ideation and individual differences in susceptibility to the conjunction fallacy. Using an existing measure of susceptibility to the conjunction fallacy (Rogers et al., 2009), as well as eight newly created conspiracy-themed conjunction vignettes, Study 1 tests a number of hypotheses in a sample ($N=91$) of the general public. Firstly, it is hypothesised that, consistent with previous findings (Rogers et al., 2009, 2011), paranormal believers will commit more conjunction errors than nonbelievers. Secondly, the hypothesis is extended to conspiracy believers; that is, it is hypothesised that people who endorse various popular conspiracy theories more strongly will commit more conjunction errors. Finally, it is hypothesised that if the bias is domain-general, as in previous research (Rogers et al., 2009, 2011), conspiracy believers should make more conjunction errors on all conjunction vignette types (conspiracy vs paranormal vs neutral). Given the importance of replicating novel psychological findings (see French & Stone, 2014), Study 2 aims to demonstrate the relationship between conspiracy beliefs and the conjunction fallacy using a generic measure of conspiracism and an independent sample ($N=95$) of undergraduate students.

STUDY 1

Method

Participants

An opportunity sample of 91 members of the general public (40 women; 51 men) was recruited from various locations in London, UK. Participant age ranged from 18 to 73 years [$M=35.0$, standard deviation (SD)=14.3; no age data for five participants]. Most participants were educated to at least A2 level or equivalent (79.5%). A substantial minority had obtained at least A2 level qualifications in maths, statistics and/or psychology (32.5%).

Design

A correlational design was employed. The variables of interest were belief in the paranormal, endorsement of conspiracy theories and susceptibility to the conjunction fallacy in three contexts—neutral, conspiracy and paranormal.

Additionally, for the purpose of replicating the analyses performed by Rogers et al. (2009, 2011), quasi-independent variable (IVs) were created out of the conspiracy and paranormal belief variables by using median split analysis to classify participants alternately as paranormal believers versus nonbelievers and conspiracy believers versus nonbelievers. Separate analysis of variance (ANOVA) analyses were used to examine the two belief-type variables. In the first analysis, paranormal believer type (believer vs nonbeliever) constituted the belief group IV. In the second analysis, this IV reflected conspiracy theory believer type (believer vs nonbeliever). In both cases, the within-subjects dependent variable was the number of conjunction fallacies of each type (neutral, conspiracy and paranormal) made by each participant.

Materials

Conspiracy endorsement questionnaire. Conspiracist ideation was assessed using an existing measure of endorsement of various real-world conspiracy theories (Douglas & Sutton, 2011). The measure presents statements relating to various popular conspiracy theories, including the deaths of Princess Diana and President Kennedy, 9/11, climate change, the European Union, HIV/AIDS, the moon landings, Jonestown and the existence of aliens (e.g. 'There was an official campaign by MI6 to assassinate Princess Diana, sanctioned by elements of the establishment'). Participants rate the extent to which they agree with each statement on a 7-point Likert Scale (ranging from 1 'strongly disagree' to 7 'strongly agree'). In addition, to obtain a more rounded evaluation of conspiracist ideation, participants are asked to rate how plausible, convincing, worth considering, interesting and coherent they find each statement on 7-point scales (labelled 1 'not at all' to 7 'very much'). Responses to all items are pooled to provide an overall conspiracist ideation score for each participant. Cronbach's alpha for the measure was high ($\alpha = .96$).

Paranormal belief. A version of the Australian Sheep-Goat Scale (ASGS; Thalbourne & Delin, 1993) was used to assess belief in the paranormal. This is a widely used, psychometrically sound measure of paranormal beliefs, consisting of 18 statements assessing acceptance of extrasensory perception, psychokinesis and life after death as genuine phenomena (e.g. 'I believe in the existence of ESP'). Following Rogers et al. (2009, 2011) and others (Roe, 2002; Thalbourne, 1998, 2003), a 7-point Likert response scale was used (ranging from 1 'strongly disagree' to 7 'strongly agree'; $\alpha = .93$).

Extended scenario judgements questionnaire. An extended version of the scenario judgements questionnaire (SJQ) created by Rogers et al. (2009) was employed to assess susceptibility to the conjunction fallacy. The original scale consists of 16 conjunction vignettes. Each vignette describes a situation, followed by three statements pertaining to the situation: two component statements, plus a conjunction of the two.

Participants rate the ‘chances in 100’² that each of the three statements is true. A conjunction fallacy error is made when the third (conjunction) statement is rated as being more likely than one or both of the singular constituent statements.

Of the 16 original vignettes, eight describe neutral events, whereas eight were designed such that the conjunction statement could imply that a paranormal event had taken place. As an example of a paranormal vignette, ‘Leanne arrives home late one evening after visiting her sister, who lives six miles away, and goes to bed. Leanne rarely has nightmares, but this night she is awakened by a particularly frightening dream.’ Participants are asked to rate the probability that (i) Leanne dreams that a house is on fire; (ii) a fire breaks out in Leanne’s sister’s house; and (iii) Leanne dreams that a house is on fire, and a fire breaks out in Leanne’s sister’s house. Neutral items pertained to the outcome of a horse race and the clientele of a café, for example. As an example, ‘A group of students go to a popular pub after a lecture. The pub is only a five minute walk from the university and it is also close to town. There is a beer garden outside the pub.’ Participants rate the probability that (i) it is a warm summer’s day; (ii) there are people sitting in the beer garden; and (iii) it is a warm summer’s day, and there are people sitting in the beer garden.

In addition to the original 16 items, eight new vignettes were created for the current study, each with a conspiratorial theme. The subject matter was designed to resemble typical allegations of popular conspiracy theories, such as pharmaceutical companies, politicians and industries covering up information that might damage their reputation. In each case, the conjunction statement could imply that a conspiracy had taken place. As an example, ‘Patrick works for a pharmaceutical company testing the efficacy and side-effects of some of the drugs they manufacture. He discovers that one of their widely available over-the-counter drugs is associated with an increased risk of heart disease.’ Participants rate the likelihood that (i) Patrick’s data were lost after an IT failure affecting his computer; (ii) Patrick is taken off the project; and (iii) Patrick’s data were lost after an IT failure affecting his computer, and Patrick is taken off the project. Thus, the conjunctive response option could imply a causal narrative in which the computer failure and Patrick’s removal from the project reflect an intentional cover-up orchestrated by Patrick’s superiors to conceal the damaging evidence. To give another example, ‘Josh has a doctorate in engineering and has been inventing products and gadgets in his spare time for several years. After patenting a few unsuccessful products, Josh is now on the verge of perfecting a device which will increase the fuel efficiency of any car by 500%.’ The response options were (i) the CEOs of several major petrol companies hold a meeting in which they discuss the implications of Josh’s invention; (ii) Josh is found dead in his home before patenting the invention; and (iii) the CEOs of several major petrol companies hold a meeting in which they discuss the implications of Josh’s invention, and Josh is found dead in his home before patenting the invention.

² Although Rogers et al. (2009) employed a more explicitly frequency-based estimate (phrased as ‘the number out of 100 occurrences’) in addition to the ‘chances in 100’ response format, their analyses showed no difference between the two response formats. Accordingly, only the latter was used in the current study.

An example (neutral) item (on which a conjunction error was not made) was included at the start of the extended SJQ (E-SJQ) to ensure participants understood the task instructions. In order to counterbalance order effects, a second version of the E-SJQ, with the order of items reversed, was created.

Demographics. Participants were asked to indicate their gender, age, highest qualification generally and highest qualification in mathematics, statistics and/or psychology to date. Both general qualifications and qualification in maths, statistics and psychology were rated on a 6-point ordinal scale, with the labels 1 ‘no qualifications’, 2 ‘GCSE level’, 3 ‘A2 level’, 4 ‘undergraduate degree’, 5 ‘professional/postgraduate degree’ and 6 ‘other’ level of qualification.

Procedure

Participants were tested individually and completed the questionnaire in a single sitting. Participants were initially told that the questionnaire was a survey of opinions, beliefs and judgements; the phrase ‘conspiracy theory’ was not mentioned. Those who agreed to take part were given a questionnaire pack containing an informed consent sheet, the conspiracy endorsement questionnaire (CEQ), ASGS, E-SJQ and demographics questionnaires. To control for potential order effects, the order of the CEQ, ASGS and E-SJQ was reversed in half of the questionnaire packs, and the different versions were distributed randomly. Participants were instructed to complete all questionnaires as quickly as possible; however, no time limit was given. No reward was offered.

Results

Belief in the paranormal

Australian Sheep–Goat Scale scores were coded such that higher scores reflected stronger paranormal belief, and a mean score was computed for each participant (potential range = 1–7; actual range = 1.00–6.11; median = 2.22). In line with Rogers et al. (2009) and others (Dagnall et al., 2007; Wiseman, 1995), median split analysis was used to reclassify participants as either paranormal believers ($M = 3.41$; $SD = 1.02$; $n = 47$) or nonbelievers³ ($M = 1.53$; $SD = 0.37$; $n = 44$).

Belief in conspiracy theories

Conspiracy endorsement questionnaire scores were (re)coded such that higher scores reflect stronger endorsement of conspiracy theories. A mean score for each conspiracy item was calculated for each participant by averaging their responses to the six associated rating scales. Initial screening showed that a large proportion of cases (24 cases, 26.4%) were missing data for the item concerning the Jonestown mass suicide conspiracy theory. In addition, several participants indicated in writing that they were not aware of this conspiracy theory and so declined to answer. For these reasons, the item was dropped. Some proportion of the sample agreed at least moderately (i.e., had an average score above 4, the mid-point of the scale) with each of the remaining 16 conspiracy items (Table 1). A mean CEQ score was computed for each

³ It would be more appropriate to refer to ‘moderate’ versus ‘low’ believers; however, the ‘believer/nonbeliever’ terminology is retained here for convenience, as per previous research (Rogers et al., 2009).

Table 1. Average endorsement of conspiracy theories (i.e. proportion scoring above the mid-point)

Item	(%)
8. Princess Diana's death was an accident (% who disagree).	79.1
6. There was no conspiracy involved in the assassination of John F. Kennedy (% who disagree).	54.9
1. The idea that the world is headed for catastrophic climate change is a fraud.	42.5
3. The European Union is trying to take control of the UK.	41.8
4. The 'science' behind climate change is at least dubious.	37.4
10. Scientists are creating panic about climate change because it is in their interests to do so.	28.6
2. One or more rogue 'cells' in the British Secret Service constructed and carried out a plot to kill Princess Diana.	26.7
17. Governments are suppressing evidence of the existence of aliens.	23.3
13. The American moon landings were faked.	21.1
9. The AIDS virus was created in a laboratory.	19.8
5. There was an official campaign by MI6 to assassinate Princess Diana, sanctioned by elements of the establishment.	16.7
7. 'Climate change' is a myth promoted by the government as an excuse to raise taxes and curb people's freedom.	16.5
11. The attack on the Twin Towers was not a terrorist action but a governmental conspiracy.	15.6
14. Princess Diana had to be killed because the British government could not accept that the mother of the future king was involved with a Muslim Arab.	14.6
12. Business enemies of Dodi Fayed and his father Mohammed Al Fayed assassinated Dodi, with the death of Princess Diana a cover-up for their operation.	7.9
15. A governmental exercise was behind the suicide at Jonestown.	7.5
16. Princess Diana faked her own death so she and Dodi could retreat into isolation.	4.4

participant by averaging their 16 conspiracy item scores (potential range = 1–7; actual range = 1.14–4.79; median = 3.02). CEQ scores correlated significantly with ASGS scores, $r = .36$, $p < .01$. Median split analysis reclassified participants as either conspiracy believers ($M = 3.60$; $SD = 0.47$; $n = 46$) or nonbelievers ($M = 2.30$; $SD = 0.51$; $n = 45$).

Conjunction fallacies

Inspection of individual E-SJQ items showed that some proportion of the sample made conjunction errors for each of the 16 original items (range 5.5–53.8%). In addition, some proportion of the sample made conjunction errors on each of the newly created conspiracy conjunction items (range 29.7–41.8%). Thus, all items were deemed suitable for inclusion in subsequent analyses. A large proportion (69.2%) of the sample made at least one conjunction error for paranormal items (range = 0–8; $M = 2.04$), a slightly greater proportion (76.9%) for conspiracy items (range = 0–8; $M = 3.01$) and a greater proportion still (87.9%) for neutral items (range = 0–8; $M = 3.12$). The average number of conjunction errors made by participants across all 24 items was 8.17, with 93.4% of the sample making at least one error.

Bivariate correlations were calculated to examine the relationships between the number of conjunction fallacy errors a participant made, their belief in conspiracy theories and their belief in the paranormal. The correlations are shown in Table 2. Conspiracist ideation correlated significantly with susceptibility to the conjunction fallacy overall and individually in all three domains. The correlation with paranormal conjunction items was slightly weaker than correlations with neutral and conspiracy items; however, comparing the correlations using Fisher's r -to- z transformation shows that the correlations do not differ significantly in size ($z = 0.88$, $p = .38$). Correlations between paranormal belief and conjunction errors were slightly smaller and failed to reach statistical significance; however, the correlations overall and with neutral and paranormal-themed conjunction items approached significance ($p = .06$, $p = .08$ and $p = .06$, respectively).

Table 2. Correlations between conspiracist ideation, belief in the paranormal and number of conjunction errors

Conjunction type	Belief type	
	Conspiracy	Paranormal
Neutral	.36**	.19
Paranormal	.24*	.20
Conspiracy	.36**	.13
Overall	.37**	.20

Note: $N = 91$.

**Correlation is significant at the level $p < .01$.

*Correlation is significant at the level $p < .05$.

In addition, to reproduce the type of analysis performed by Rogers et al. (2009, 2011), two separate ANOVA tests were used to investigate paranormal beliefs and conspiracist beliefs in relation to susceptibility to the conjunction fallacy. Contrary to Rogers et al. (2009) but consistent with previous findings (e.g. Tversky & Kahneman, 1983), level of highest qualification in maths, statistics and/or psychology did not correlate significantly with number of conjunction errors made [$r(89) = .16$, $p = .14$], and so, this was not controlled for in subsequent analyses.

Firstly, a 2 paranormal belief group (believer vs nonbeliever) \times 3 event type (neutral vs paranormal vs conspiracy) mixed ANOVA was performed on the number of conjunction errors made. Mean and SD scores are shown in Table 3. The main effect of paranormal belief group was small but significant [$F(1,89) = 5.29$; $p < .05$; $\eta_p^2 = .06$], with believers making more conjunction errors than nonbelievers. The interaction between event type and belief group emerged as nonsignificant [$F(1,89) = 0.87$; $p = .35$; $\eta_p^2 = .01$].

Secondly, a 2 conspiracy belief group (believer vs nonbeliever) \times 3 event type (paranormal vs conspiracy vs neutral) mixed ANOVA was performed. Mean and SD scores are also shown in Table 3. The main effect of belief group emerged as significant [$F(1,89) = 9.90$; $p < .01$; $\eta_p^2 = .10$], with believers making more conjunction errors than nonbelievers.

Table 3. Mean number of conjunction fallacy errors by belief type, event type and overall

Event type	Paranormal belief				Conspiracy belief				Overall (N = 91)	
	Nonbelievers		Believers		Nonbelievers		Believers			
	(n = 44)		(n = 47)		(n = 45)		(n = 46)			
	M	(SD)	M	(SD)	M	(SD)	M	(SD)		
Neutral	2.47	2.27	3.73	1.74	2.65	1.96	3.59	2.14	3.12	2.10
Paranormal	1.62	2.20	2.42	2.07	1.55	1.75	2.51	2.42	2.04	2.16
Conspiracy	2.62	2.65	3.37	2.48	2.39	2.37	3.61	2.65	3.01	2.58
All	6.73	6.25	9.52	5.38	6.59	5.25	9.71	6.24	8.17	5.95

Note: SD, standard deviation.

The interaction between event type and belief group emerged as nonsignificant [$F(1,89) = 0.26; p = .77; \eta_p^2 = .00$].

As the same participants contributed to both analyses, both ANOVAs produced a significant main effect of conjunction event type [$F(2, 178) = 16.48; p < .001; \eta_p^2 = .16$]. Bonferroni-corrected pairwise comparisons between the three event types showed a significant difference between paranormal and neutral event types [$t(90) = 5.26, p < .01$], with participants generally making more errors on neutral items than paranormal items. A significant difference was also found between conspiracy items and paranormal items [$t(90) = 4.69, p < .01$], with participants making more errors on conspiracy items than paranormal items. The difference between conspiracy items and neutral items was nonsignificant [$t(90) = 0.56, p = .58$]; that is, conspiracy and neutral items evoked similar number of conjunction fallacy errors.

Discussion

The current findings partially replicated previous research showing that people with stronger belief in the paranormal tend to make more conjunction fallacy errors (Rogers et al., 2009, 2011). Bivariate correlations between paranormal belief and conjunction errors in certain contexts were positive but small, only bordering on statistical significance. However, a significant relationship did emerge from the type of ANOVA analysis used by the original researchers. Given that the relationship observed in the current study was in the same direction and of a comparable size to that observed in previous research (Rogers et al., 2011), it seems appropriate to view the current findings as a qualified replication. The failure of the correlations to reach statistical significance may be a product of the smaller sample size employed by the current study.

Importantly, the present findings suggest that there may be a stronger, more reliable relationship between susceptibility to the conjunction fallacy and conspiracist ideation; people who indicated stronger endorsement of various popular conspiracy theories committed more conjunction fallacy errors across all three conjunction contexts.

In addition and consistent with previous findings (Rogers et al., 2009, 2011), participants on the whole made fewer errors on paranormal-themed items as compared with neutral or conspiracy-themed items. This implies that, in general, contextual factors can influence the strength of conjunction biases. Somewhat unexpectedly, there was no difference in

conjunction error rate between neutral and conspiracy-themed items—both invoked more conjunction errors than paranormal items. A possible explanation for this pattern of results is that paranormal explanations clearly violate common understandings of reality, and so, people are more hesitant to adopt a paranormal attribution (see Lupfer & Layman, 1996). Allegations of conspiracy, on the other hand, do not contradict the laws of physics. Most conspiracy theories depart from reality in more subtle ways, such as in postulating preternaturally competent conspirators (Bale, 2007; Keeley, 1999).

At any rate, such contextual factors do not appear to differentially affect believers versus nonbelievers. Paranormal believers demonstrated a consistently greater rate of conjunction violations as compared with nonbelievers across all three conjunction item types, not only paranormal items. Similarly, the correlations between conspiracism and each of the conjunction event types did not significantly differ in size; that is, conspiracist beliefs were associated with more conjunction errors consistently across all conjunction item types—the effect was not limited to conspiratorial items. This implies that individual differences in susceptibility to the conjunction fallacy are domain-general. It does not seem to be the case that some unique feature of conspiracist narratives preferentially invokes the fallacy in conspiracy believers. Rather, it seems that individuals who are prone to making conjunction errors in general are more accepting of conspiracy theories, perhaps because such theories often rely on a confluence of events being subsumed under a singular narrative. In this way, conspiracy theories may appear more representative of events in general to individuals who typically perceive conjunctions as being more representative than singular events.

Overall, the current findings are largely consistent with the hypothesis that individual differences in susceptibility to the representativeness heuristic and the conjunction fallacy in particular may influence the formation or maintenance of anomalous beliefs. The significant correlation between conspiracist ideation and paranormal beliefs observed in the present study, as well as previous research (Darwin et al., 2011; Newheiser et al., 2011; Swami et al., 2011), adds support to the idea that similar factors give rise to both kinds of anomalous belief.

Some limitations are worth noting. Examination of endorsement ratings for the various conspiracy theories raises some potential issues of concern regarding the measurement

of conspiracist ideation. After reverse coding, a negatively phrased item referring to the death of Princess Diana ('Princess Diana's death was an accident') scored the highest conspiracy endorsement rating (that is, most participants disagreed that her death was an accident). This figure is at odds with most conspiracy survey results (e.g. Gardiner & Thompson, 2012), as well as with the lower endorsement figures for other items concerning Princess Diana in the current study. It is possible that the item is too vaguely worded. People may disagree that the death was an accident yet may not necessarily endorse a conspiratorial explanation—they may see the fatal crash as having been caused by the chasing paparazzi or the reckless actions of the chauffeur. It is also possible simply that the negative phrasing itself influenced participants' responses in an unanticipated way. This illustrates the difficulties with measurement devices that refer to specific real-world conspiracy theories, where item wording may influence responses in unintended ways⁴ (see Brotherton, French, & Pickering, 2013).

Study 2 was conducted, in part, to overcome these limitations by using a generic measure of conspiracist ideation. The second study also employed a different sample population—university psychology undergraduates, as is typical of most psychological research—to test whether the relationship between conspiracist ideation and susceptibility to the conjunction fallacy can be replicated within an independent sample. Moreover, bearing in mind the relatively small size of the observed relationships in the current study and the importance of replicating small and novel effects (see French & Stone, 2014), Study 2 also serves simply as a test of the reliability of the observed relationship. Given that the relationship between paranormal belief and conjunction errors appears to be less substantial than that between conspiracism and conjunction errors, paranormal beliefs and conjunction items were not included for further study.

STUDY 2

Method

Participants

Ninety-five first-year psychology undergraduate students (76 women and 19 men) completed the questionnaire in return for course credit. The majority were of British (63.2%) or other European nationality (26.3%). Participant age ranged from 18 to 44 years ($M = 21.1$, $SD = 5.3$).

Design

As in Study 1, a correlational design was employed. The variables of interest were conspiracist ideation and susceptibility to the conjunction fallacy in two contexts—neutral and conspiracy. Again, to reproduce the type of analysis used by Rogers et al. (2009), a quasi-IV was formed by performing a median split on the conspiracism variable, dividing the sample into conspiracy believers versus nonbelievers.

⁴ However, exclusion of this item did not substantively affect the outcome of the previously reported analyses.

Materials

Generic Conspiracist Beliefs Scale (Brotherton et al., 2013). Conspiracist beliefs were measured using a validated measure of generic conspiracist ideation. The Generic Conspiracist Beliefs Scale (GCB) assesses the extent to which an individual believes that the kind of conspiratorial activity postulated by popular conspiracy theories occurs routinely in the world but without reference to specific events (example item: 'The government permits or perpetrates acts of terrorism on its own soil, disguising its involvement'). Participants rate the extent to which they agree with each statement on a 5-point Likert Scale (1 'definitely not true', 2 'probably not true', 3 'not sure/cannot decide', 4 'probably true' and 5 'definitely true'). Cronbach's alpha for the scale was high (.88).

Modified scenario judgements questionnaire. Susceptibility to the conjunction fallacy was again measured by way of an adapted version of the SJQ (Rogers et al., 2009). In the current study, the eight neutral and eight conspiracy-themed conjunction items from Study 1 were administered; however, the eight paranormal items were omitted.

Procedure

Undergraduate students were approached to take part in research following a lecture on an unrelated topic. Volunteers were given the questionnaire as part of a larger questionnaire package. Again, the word 'conspiracy' was not mentioned in the information sheet given to participants prior to filling in the questionnaire. The order of items in the modified SJQ (M-SJQ) was reversed for half of the participants; however, the M-SJQ was always presented before the GCB. Participants were instructed to complete all questionnaires as quickly as possible; however, no time limit was given.

Results

Belief in conspiracy theories

A mean GCB score was computed for each participant (potential range = 1–5; actual range = 1.47–4.33; median = 3.00). Men and women did not differ in terms of conspiracist beliefs [$t(93) = .83$, $p = .41$], and there was no correlation between GCB scores and age [$r(93) = -.07$, $p = .50$]. Median split analysis reclassified participants as either conspiracy theory believers ($M = 3.42$; $SD = 0.38$; $n = 49$) or nonbelievers ($M = 2.41$; $SD = 0.39$; $n = 46$).

Conjunction fallacies

The majority (93.7%) of the sample made at least one conjunction fallacy error among the 16 M-SJQ items. The average number of conjunction errors made by participants across all 16 items was 7.73 ($SD = 3.89$). Inspection of individual M-SJQ items showed that some proportion of the sample made conjunction errors for each of the 16 items (range 17.9–64.2%). A large proportion (92.6%) of the sample made at least one conjunction error for neutral items ($M = 3.99$; $SD = 2.02$), with a slightly lower proportion (90.5%) for conspiracy items ($M = 3.75$; $SD = 2.27$).

Total number of conjunction errors correlated significantly with GCB scores [$r(93) = .29$, $p < .01$]; stronger endorsement of conspiracy theories was associated with a greater

number of conjunction errors. Looking at conjunction vignette types individually, GCB scores correlated significantly (and positively) with both neutral [$r(93) = .21, p < .05$] and conspiracist conjunction errors [$r(93) = .30, p < .01$]. Again, Fisher's r -to- z transformation shows that the correlations do not differ significantly in size ($z = 0.65, p = .51$).

As per Rogers et al. (2009, 2011), a 2 conspiracy belief group (believer vs nonbeliever) \times 2 event type (neutral vs conspiracy) mixed ANOVA was performed on the number of conjunction errors made. The main effect of conspiracy belief group was significant [$F(1, 93) = 5.62; p < .05; \eta_p^2 = .06$], with believers making slightly more conjunction errors in total ($M = 8.61; SD = 3.72$) than nonbelievers ($M = 6.78; SD = 3.88$). The main effect of conjunction event type was nonsignificant [$F(1, 93) = 1.83; p = .18; \eta_p^2 = .02$]; whereas slightly fewer errors were made on conspiracy-themed items ($M = 3.75; SD = 2.27$) than neutral items ($M = 3.99; SD = 2.02$) on the whole; this difference did not reach significance. The interaction between event type and belief group also emerged as nonsignificant [$F(1, 93) = 1.50; p = .22; \eta_p^2 = .02$].

Discussion

As in study 1, the current study found that people who display stronger conspiracist ideation tend to make more conjunction fallacy errors than people who are more sceptical about conspiracy theories. Once again, item context did not appear to influence the rate of conjunction violations. Both conspiracy-themed and neutral items invoked similar rates of conjunction violations on the whole, and conspiracist ideation correlated positively and to the same extent with the number of errors on both conspiracy-themed and neutral items. Moreover, the size of the observed association was comparable with the relationships observed in Study 1. In total, these findings add support to the idea that conspiracist beliefs are a product, in part, of a domain-general greater susceptibility to the conjunction fallacy and thus perhaps representativeness heuristic in general.

A limitation worth noting is that the power of the study and particularly the ANOVA analysis may have been slightly reduced by the lack of variation in GCB scores. Only one scale point separated the 'believers' group from the 'nonbelievers' group. This is likely a result of the relatively homogenous sample used. A stronger effect may have been seen with a more heterogeneous group of participants in terms of beliefs about conspiracy theories. That a difference between the believers and nonbelievers group in terms of number of conjunction errors made was still observed despite the homogeneity of the current sample suggests that it is a robust effect.

GENERAL DISCUSSION

The main aim of the present research was to test the hypothesis that people who endorse anomalous beliefs and conspiracy theories in particular are more susceptible to the conjunction fallacy. Two studies, using independent samples and different measurement devices, found support for this notion.

Consistent with previous research (Agnoli & Krantz, 1989; Fiedler, 1988; Fisk & Pidgeon, 1996, 1997, 1998; Rogers et al., 2009, 2011; Tversky & Kahneman, 1983; Wolford et al., 1990), people on the whole committed a sizeable number of conjunction errors, regardless of the context in which the conjunction was presented. The finding that believers in the paranormal make a greater number of conjunction errors (Rogers et al., 2009, 2011) was replicated using the same type of analysis used by the authors of the original study; however, correlational analysis taking into account all of the variation in paranormal belief scores produced results only bordering on statistical significance. This may be viewed as a qualified replication of the effect.

Crucially, individuals who indicated stronger endorsement of specific popular conspiracy theories (Study 1), as well as generic conspiracist ideas (Study 2), committed a greater number of conjunction violations than people who indicated lower conspiracist ideation. This trend was largely unaffected by context. The conjunction error rate among believers was higher to the same extent across neutral and paranormal-themed conjunction scenarios, as well as conspiracy-themed items. The only apparent effect of conjunction context concerned the paranormal-themed items. Believers and nonbelievers alike made fewer conjunction errors on paranormal-themed items than on neutral or conspiratorial items.

Lower conjunction violation rates for paranormal scenarios as compared with nonparanormal items have also been observed in previous research (Rogers et al., 2009, 2011). One possible explanation for this is that paranormal scenarios are perceived to some extent as inherently implausible, as they contradict mainstream materialist views of reality. Consistent with this suggestion, previous research has found that supernatural attributions are invoked less frequently than naturalistic explanations (Lupfer & Layman, 1996). Conspiratorial scenarios, however, do not possess the same obvious implausibility. Real conspiracies take place in the world routinely. The kinds of claims commonly referred to as 'conspiracy theories' diverge from real, mundane conspiracies in more subtle ways, such as in postulating preternaturally powerful and evil conspirators, ignoring more plausible explanations and distorting contrary evidence (Aaronovitch, 2009; Bale, 2007; Barkun, 2003; Brotherton, 2013; Keeley, 1999).

However, it is possible that the conspiracy-themed conjunction items used in the current study did not clearly differentiate between mundane conspiratorial activity and the kinds of implausible machinations postulated by typical conspiracy theories. The novel conspiracy-themed items used in the present research were designed such that the conjunction response option implied that some kind of sinister conspiracy had taken place. Efforts were made to ensure that these items reflected the themes evidence in prototypical popular conspiracy theories, primarily the covering up (in some cases by lethal means) of inconvenient truths. The actors behind the various implied conspiracies were the kinds of groups typically guilty of such misdeeds according to popular conspiracy theories, such as government officials, the pharmaceutical industry and secret societies. Future research may seek to systematically vary the implied perpetrators or the scale of the alleged conspiracy and its consequences to see if such factors have an effect on conjunction violation rates.

At any rate, the increased rate of conjunction violations across neutral and paranormal conjunction items, as well as the novel conspiracy-themed items, suggests that the relationship between conspiracist ideation and the conjunction fallacy is reliable.

One possible explanation for greater susceptibility to the conjunction fallacy among people who believe conspiracy theories is that, similar with those who believe in the paranormal (e.g. Blackmore & Troscianko, 1985; Bressan, 2002; Brugger & Taylor, 2003), conspiracy believers have a biased conception of randomness, according to which coincidences are rarely mere chance occurrences. Rather, causal relationships are inferred, which render conjunctive events as more subjectively representative and thus more plausible than singular events (Nestler, 2008; Tversky & Kahneman, 1983). Conspiracy theories often hinge on the idea that many disparate and ostensibly unrelated facts are in fact causally related by a conspiratorial plot. Thus, the tendency to perceive such conjunctions as being typical or representative may imbue such theories with plausibility.

Yet it is unclear whether susceptibility to the conjunction fallacy causes or conversely is caused by endorsement of conspiracy theories. Given that susceptibility does not appear to be domain-specific and that another product of the representativeness heuristic, the proportionality bias, has been implicated in the formation of conspiracist beliefs (LeBoeuf & Norton, 2012; Leman & Cinnirella, 2007), the former seems plausible. However, it is worth noting that the two causal directions are not mutually exclusive: a reciprocal process may occur, whereby a biased conception of randomness predisposes an individual towards accepting conspiracy theories, which reinforces a worldview in which ostensibly unrelated events have hidden causal connections.

As a general issue, the endorsement figures for the various conspiracy theories measured in Study 1 are worthy of discussion. Conspiracy theories regarding the reality of anthropogenic climate change were among the most strongly endorsed. The theory that the AIDS virus was deliberately created in a laboratory was also endorsed by just under one-fifth of the sample. Both of these theories have been shown to have potentially hazardous consequences—the former in terms of intentions to reduce one's carbon footprint (Jolley & Douglas, 2013) and the latter in terms of sexual risk factors (e.g. Bogart et al., 2011). The prevalence of misguided and potentially dangerous beliefs makes understanding the psychological origins an important objective. Thankfully, the recent surge in psychologists taking an interest in conspiracist beliefs suggests that progress is being made.

Summary and conclusions

Under conditions of uncertainty, people's statistical intuitions are often at odds with objective laws of probability. In particular, people often misperceive the co-occurrence of the ostensibly unrelated events as being more likely than the occurrence of either component alone. The current findings suggest that people who endorse conspiracy theories more strongly are particularly susceptible to this 'conjunction fallacy'. Taken together with previous research, this provides further evidence that conspiracy theories, similar with other anomalous beliefs, are associated with reasoning

biases and heuristics. Thus, research into the psychological antecedents, correlates and functions of conspiracist beliefs may be productively subsumed into the wider framework of anomalistic psychology.

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