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Paranormal belief and errors of probabilistic reasoning: The role of constituent conditional relatedness in believers' susceptibility to the conjunction fallacy

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ABSTRACT

The present study examines the extent to which stronger belief in either extrasensory perception, psychokinesis or life-after-death is associated with a proneness to making conjunction errors (CEs). One hundred and sixty members of the UK public read eight hypothetical scenarios and for each estimated the likelihood that two constituent events alone plus their conjunction would occur. The impact of paranormal belief plus constituents' conditional relatedness type, estimates of the subjectively less likely and more likely constituents plus relevant interaction terms tested via three Generalized Linear Mixed Models. General qualification levels were controlled for. As expected, stronger PK beliefs and depiction of a positively conditionally related (verses conditionally unrelated) constituent pairs predicted higher CE generation. ESP and LAD beliefs had no impact with, surprisingly, higher estimates of the less likely constituent predicting *fewer* - not more - CEs. Theoretical implications, methodological issues and ideas for future research are discussed.

1. Introduction

The veracity of reported paranormal experiences remains a hotly debated topic (e.g., Krippner & Friedman, 2010) which, if ever verified, would have profound implications for the so-called "hard problem" of consciousness research; how physical brain processes give rise to subjective experiences. Extrasensory perception (ESP; defined as the alleged ability to obtain information without recourse to the known senses or through logical inference), psychokinesis (PK; the alleged ability to influence physical systems directly through mental processes) and life after death (LAD: the notion that some disembodied aspect of human personality or consciousness survives bodily death, at least for a time) all challenge pre-existing doctrines in which mental states are either dismissed (materialism) else seen to be a mere by-product of neurological processes (epiphenomenalism). If consciousness can survive bodily death then, by definition, a physical brain is not required for subjective mental states to be experienced. Regardless of their veracity ostensibly paranormal experiences tend to have significant impact on a person's worldview and self-concept (Cardeña, Lynn, & Krippner, 2014).

Skeptics - and in particular anomalistic psychologists - try to understand paranormal beliefs and experiences by recourse to known physical and/or psychological processes. Factors known to underlie at least some types of paranormal endorsement are both varied and complex (French & Stone, 2014; Irwin, 2009), and presently include demographic background (e.g., gender, ethnicity); facets of personality (e.g., openness to experiences, fantasy proneness) and individual differences (e.g., scientific education, religiosity);

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psychobiological composition (e.g., temporal lobe liability, hemispheric dominance); socio-cultural influence (e.g., from peers, the media); developmental variation (e.g., childhood trauma, propensity for magical thinking); innate evolutionary processes (e.g., anthropomorphism, agency misperceptions); and finally, both clinical and sub-clinical psychopathology (e.g., neuroticism, schizotypy, dissociativity, psychosis). To date, there is much evidence to suggest believers are prone to a variety of cognitive "deficits" (Irwin, 2009), arguably the most robust of which relates to errors of probabilistic reasoning (for a review see Rogers, 2015).

Whilst most people are poor intuitive statisticians (Diaconis & Mosteller, 1989) this seems especially true of paranormal believers (for a review see Rogers, 2015). For example, it is often claimed paranormal believers "look beyond chance" to causally explain what are essentially chance outcomes (misattribution hypothesis; Wiseman & Watt, 2006). According to Bressan (2002) paranormal believers possess a comparatively lax internal representation of what constitutes randomness and as such, usually require less *objective* evidence of relatedness before they will misperceive a subjectively meaningful - hence causal - relationship onto otherwise unrelated events; a process Shermer (2011) has termed "patternicity". Believers' proneness to patternicity is associated with either left visual field/ right hemisphere dominance (e.g., Pizzagalli, Lehmann, & Brugger, 2001) else right hemisphere overactivation (e.g., Brugger et al., 1993) and, in turn, appears unduly influenced by extraneous factors such as the "observability" of potential causes (Bressan, 2002; although see Rogers, Qualter, & Wood, 2016). As Rogers (2015) asserts, it seems paranormal believers' LVF/RH dominance and/or RH overactivation leads them to misperceive random events as being (causally) connected in some a meaningful way.

Such misattributions of randomness seem relevant to believers' susceptibility to a more specific bias the so-called *conjunction fallacy*; the tendency to misjudge independent yet co-occurring (conjunctive) events as being more likely than either constituent event alone (Tversky & Kahneman, 1982, 1983; see also Fisk, 2017). When thinking about a long-lost friend (constituent 1) is quickly followed, for no observable reason, by the same friend unexpectedly telephoning (constituent 2), many people will judge the co-occurrence of these two events (thinking about the friend and then the friend telephoning) more likely than either singular constituent event alone (cf. Rhine-Feather & Schmicker, 2005). Such conjunctions are reminiscent of reported paranormal experiences such as extrasensory perceptions and thus should be more pronounced in those with stronger paranormal beliefs.

1.1. Paranormal belief and the conjunction fallacy

A number of studies suggest adult paranormal belief is associated with more conjunctive errors (CEs) regardless of whether events are depicted within an ostensibly paranormal or clearly non-paranormal context, the implication being that believers are especially prone to a context-neutral or generic conjunction fallacy (Brotherton & French, 2014; Dagnall, Drinkwater, Denovan, Parker, & Rowley, 2016; Prike, Arnold, & Williamson, 2017; Rogers, Davis, & Fisk, 2009; Rogers, Fisk, & Lowrie, 2016; Rogers, Fisk, & Wiltshire, 2011). Other work has found no such relationship (Dagnall, Denovan, Drinkwater, Parker, & Clough, 2016; Dagnall, Drinkwater, Parker, & Rowley, 2014; Dagnall, Parker, & Munley, 2007) with Dagnall et al. (2014) claiming believers' are susceptible only to misperceiving randomness.[1]

In the aforementioned study, Rogers et al. (2011) explored believers' fallacy proneness further by testing belief-based differences in likelihood estimates relating to each constituent event. Contrary to expectations, paranormal believers deemed the two singular constituents just as likely as did paranormal skeptics. Based on the tacit assumption that constituent and conjunctive events are linearly related, Rogers et al. (2011) also explored belief-based differences in the perceived strength of constituent-conjunction relationships. Such a relationship is indicated by the homogeneity of regression slope between estimates of (a) the subjectively less likely (LL) constituent[2] and (b) the conjunctive term. No such differences emerged, with the perceived strength of constituent-conjunction relationships unaffected by paranormal belief status.

Despite these negative findings, other research - outside the realm of adult paranormality - suggests that the perceived conditional relatedness of constituent pairs will sometimes impact on CE generation. It is to this literature that discussion now turns.

1.2. The conditional relatedness of constituent events

According to Tversky and Kahneman (1983) the conjunction fallacy usually reflects implicit knowledge of category norms. In such

[1] It should be noted that a number of studies have examined confirmatory and other the reasoning biases inherent in paranormal *scepticism*. Koehler (1993), for instance, found scientists and other professional Skeptics judged the relevance, methodological rigour and presentational quality of research to be higher in studies where results were consistent with (confirmed) their prior belief concerning the veracity of extrasensory perception (ESP), with few recognising their assessment of study quality was influenced by study outcome. Roe (1999) reports similar belief-congruency biases amongst undergraduates classified as believers or disbelievers according to their score on a popular paranormal belief scale (one standard deviation above verses below the mean respectively). More recently, Irwin (2015) employed a task - the viewing of seemingly genuine photographic evidence of self-levitation - specifically designed to evoke a novel paranormal belief/disbelief in real time and found the intensity of newly evoked *dis*beliefs correlated with a preference for rational-analytic thinking whereas newly evoked beliefs, by comparison, did not. According to Irwin, disbelievers were more inclined to adopt analytic-rational thinking style "as a matter of habit" (p. 137) and the implication being that traditional paranormal belief measures might obscure certain cognitive processes associated only with paranormal scepticism. However, in follow-up work Irwin, Dagnall, and Drinkwater (2017) found correlations between paranormal belief and cognitive measures such as thinking style, aberrant salience and emotion-based reasoning were, in absolute terms, just as strong for believers as they were for skeptics leading these authors to conclude paranormal belief and scepticism *do* lie on the same unidimensional continuum.

[2] The subjectively less likely (LL) constituent event is itself defined by one of two ways. Assuming estimates of the first constituent exceed those of the second [p(A) > p(B)] then, for conditionally unrelated constituents LL reflects whichever of the two singular constituents is assigned the lower probability value, in this case p(B). However, when constituents are conditionally positively related, LL may sometimes be based on the conditional event p(B|A) [i.e. the second constituent given prior occurrence of the first]. Since estimates for the conditional event will, by definition, be higher than those of the singular constituent [p(B|A) > p(B)] such as situation is more likely to give rise to CEs (cf. Fisk, 2002; Fisk & Pidgeon, 1998).