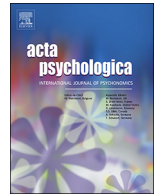




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The relationship between anomalistic belief and biases of evidence integration and jumping to conclusions

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ABSTRACT

Biases in the assessment and integration of evidence are likely contributors to anomalistic (e.g., paranormal, extra-terrestrial) beliefs because of the non-evidence based nature of these beliefs. However, little research has examined the relationship between anomalistic beliefs and evidence integration biases. The current study addressed this gap by examining the relationship between anomalistic belief and four such biases; bias against disconfirmatory evidence (BADE), bias against confirmatory evidence (BACE), liberal acceptance bias, and the jumping to conclusions bias (JTC). Standard BADE scenarios were used to measure BADE, BACE, and the liberal acceptance bias. Participants were given three pieces of evidence, one at a time, and required to rate several alternative explanations. The JTC was measured using two draws-to-decisions tasks (beads and emotionally salient), and participants also completed measures of anomalistic belief and delusion-proneness. Results showed that liberal acceptance was the only evidence integration bias that significantly predicted greater overall anomalistic belief. However, this relationship was no longer significant once delusion proneness was controlled for. Additionally, BADE significantly predicted experiential (but not other types of) anomalistic beliefs even after controlling for delusion proneness. We propose that liberal acceptance may lead people to form anomalistic beliefs on the basis of little evidence, and that stronger BADE may make these beliefs highly resistant to change.

1. Introduction

The majority of the general public in the United States and the United Kingdom believes in at least one type of anomalistic phenomena, and anomalistic beliefs also are common throughout Latin-America, Southern Europe, and North-Western Europe (Höllinger & Smith, 2002; Moore, 2005; Pechey & Halligan, 2011; Shannon-Missal, 2013). Anomalistic belief is a broad term that refers to any belief that contradicts the current scientific understanding of reality (French & Stone, 2014). Research typically focuses on paranormal beliefs (e.g., extra-sensory perception), but other non-evidence based beliefs, such as belief in alien visitation or certain conspiracy theories, also fall under the anomalistic umbrella. Given that anomalistic beliefs are not supported by rigorous evidence or science, it is important to use known or knowable physical and psychological factors to explain their high levels among the general population (French, 2001). One area that has provided some potential explanations for why people hold anomalistic beliefs is cognitive bias and reasoning ability. Specifically, previous research has found that people with higher levels of anomalistic belief may be especially prone to some cognitive biases and are more likely to make reasoning errors (e.g., Dagnall, Drinkwater, Donovan, Parker, &

Rowley, 2016; Lawrence & Peters, 2004; Rogers, Fisk, & Wiltshire, 2011; Wiseman & Watt, 2006). The current study expanded on this research by investigating whether anomalistic belief is related to several cognitive biases that typically are studied in relation to delusion-proneness and schizotypy; that is, the bias against disconfirmatory evidence (BADE), the bias against confirmatory evidence (BACE), liberal acceptance, and the jumping to conclusions (JTC) bias.

People exhibit a BADE when they do not adequately *reduce* their initial likelihood judgements about an event or outcome after they have been provided with new information that contradicts their initial judgement (Moritz & Woodward, 2006; Woodward, Moritz, Menon, & Klinge, 2008). The BACE is also a bias against updating judgements, however, it is a bias against adequately *increasing* likelihood judgements for an event or outcome when provided with evidence that supports it (Moritz & Woodward, 2006; Sanford, Veckenstedt, Moritz, Balzan, & Woodward, 2014). The liberal acceptance bias occurs when someone has a lowered decision threshold and is more receptive to improbable outcomes (Moritz et al., 2017). Finally, people demonstrate the JTC bias when they reach a conclusion after having received very little information (Fine, Gardner, Craigie, & Gold, 2007; Huq, Garety, & Hemsley, 1988). These biases primarily have been found to be related

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to greater delusion proneness and schizotypy in healthy populations (Buchy, Woodward, & Liotti, 2007; Colbert & Peters, 2002; Woodward, Buchy, Moritz, & Liotti, 2007; Zawadzki et al., 2012) as well as to schizophrenia and the presence of delusions in clinical populations (for recent meta-analyses see Fine et al., 2007; McLean, Mattiske, & Balzan, 2016). However, a small amount of work has shown that anomalistic belief is related to greater JTC bias (Irwin, Dagnall, & Drinkwater, 2012; Irwin, Drinkwater, & Dagnall, 2014). One key aim was to look at the relationship between anomalistic beliefs and these biases because the JTC and liberal acceptance biases may contribute to the development of anomalistic belief and the BADE and BACE may then help to maintain those beliefs in the face of contradicting evidence.

A second aim of the current study was to use the recently developed Anomalistic Belief Scale (ABS; Prike, Arnold, & Williamson, 2017) to provide a more fine-grained understanding of any relationship found between anomalistic belief and the above-mentioned biases. The ABS has four factors; experiential belief, psi (i.e., paranormal) belief, extra-terrestrial belief, and life after death belief. Thus, the ABS allows us to examine whether it is overall anomalistic belief that is associated with the four biases, or only a specific subset(s) of anomalistic belief. Using a more nuanced analysis is important because recent research has shown that the relationship between anomalistic belief, bias, and reasoning performance may depend on specific type(s) of belief (Dagnall et al., 2016; Rogers, Fisk, & Lowrie, 2016). For example, Dagnall et al. found that, although there was a negative relationship between performance on a conjunction fallacy task and anomalistic belief, this relationship occurred only for the Traditional Paranormal Beliefs factor of the Revised-Paranormal Belief Scale and not for the New Age Philosophy factor. Relatedly, recent work with the ABS found that only beliefs about experiencing anomalistic phenomena (e.g., “I have seen at least one UFO in the sky that I believe was an extra-terrestrial space ship”) were related to performance on a conjunction fallacy task, whereas theoretical anomalistic beliefs (e.g., “I believe extra-terrestrials have visited earth”) were not (Prike et al., 2017).

Liberal acceptance and the JTC bias potentially contribute to the formation of anomalistic beliefs because they lead people to consider implausible options and to accept conclusions without requiring much supporting evidence. For example, a person may have a dream about an event and then when a similar event occurs they may conclude that they have some form of precognition. However, if the person had engaged in a more thorough consideration of the evidence and been less willing to consider such an implausible option, then s/he probably would have concluded either that precognition is not the likely explanation or at least that there is insufficient evidence to support a precognition interpretation. Once an anomalistic belief is considered and accepted, BADE and BACE biases may contribute to the maintenance of those beliefs. That is, BADE and BACE biases may make people less willing to adjust their beliefs when presented with new evidence and, given the non-evidence based nature of anomalistic beliefs, it is plausible that anomalistic believers are more prone to these biases. Similar arguments have been proposed in the delusions literature: Both liberal acceptance and JTC contribute to the initial formation of delusions (Fine et al., 2007; Moritz et al., 2017), and BADE and BACE biases subsequently help to maintain delusions and make them resistant to change (Moritz et al., 2017; Woodward et al., 2007). Because all of these biases have been proposed to contribute to the formation and maintenance of beliefs, it was important to consider them all within the one study to examine whether they each make a unique contribution or if the relationship primarily is driven by only a subset of the biases.

There is some existing evidence for a positive relationship between anomalistic beliefs and the JTC bias. Specifically, Irwin et al. (2012) and Irwin et al. (2014) found that participants who were higher in anomalistic belief were more prone to the JTC bias. However, one potential issue with these studies is that they mainly focused on self-report (vs. behavioural) measures of the JTC bias (Irwin et al., 2012), although Irwin et al. (2014) did include two trials of the beads task in

their second experiment. Nonetheless, this potential relationship warrants further investigation because if believers are prone to reaching conclusions quickly (i.e., without fully considering other available evidence), then this tendency may provide a partial explanation for how some people come to hold anomalistic beliefs.

Previous research also suggests that people who hold anomalistic beliefs may be biased in the way that they interpret evidence. For example, Jones and Russell (1980) found that anomalistic believers described demonstrations of extrasensory perception as having been successful regardless of whether the demonstration was a success or failure. In contrast, non-believers accurately reported the extrasensory perception demonstration as having succeeded when it was successful and as having failed when the demonstration was unsuccessful. Wiseman, Greening, and Smith (2003) also found that anomalistic believers were more likely to report a séance as having been successful even when it was not. Similarly, Russell and Jones (1980) found that anomalistic believers were more likely to report that scientific abstracts supported their beliefs even if they did not, whereas non-believers accurately remembered whether the article was supportive or un-supportive of paranormal phenomena.

Although there already is some evidence that anomalistic believers are biased in the way that they interpret evidence, one potential issue with this previous research is that it relied on participants' pre-existing beliefs that often are strongly held and highly resistant to change (Jones & Russell, 1980; Russell & Jones, 1980; Wiseman et al., 2003). In contrast, the BADE paradigm, which also provides measures of BACE and liberal acceptance, does not rely on pre-existing beliefs. Instead, participants are given a short description of a person or event, followed by several options/explanations that they rate the likelihood of. Thus, participants develop a belief about the most likely option based on the initial short description, but then they are subsequently provided with additional evidence that suggests an option that initially seemed implausible is actually the correct answer. For example, in one BADE scenario participants are initially provided with the information “Andrea has made some new friends,” which may make the option that “Andrea has just started going to university” seem likely. However, as additional information is provided, such as “Andrea's new friends control every single aspect of her life” and “Andrea has very suddenly cut off all contact with her family,” this initial option becomes less likely and the option “Andrea has joined a cult” becomes more likely to be true (Woodward et al., 2007). Participants demonstrate BADE when they inadequately reduce their likelihood ratings for the options they initially thought were likely. That is, most participants will rate the correct answer as likely after having seen all of the evidence, but participants who exhibit a BADE are less willing to reduce their likelihood rating for the option(s) they initially chose. Conversely, participants demonstrate a BACE when they are less willing to increase their likelihood rating for the correct option, despite being presented with evidence that strongly supports it.

The BADE paradigm also allows for analysis of liberal acceptance; that is, the early acceptance of hypotheses based on insufficient evidence (Moritz & Woodward, 2004). BADE scenarios all have one absurd option that is highly improbable at all stages of the task (and would usually be ruled out by most people), and liberal acceptance is calculated by averaging the likelihood ratings for these absurd options. The JTC bias is somewhat similar to the liberal acceptance bias because they both involve the acceptance or consideration of conclusions based on very little evidence. The most common JTC paradigm is the beads task in which participants are shown two jars of beads with different ratios of coloured beads (e.g., one jar with 80% yellow and 20% blue beads and the other with 20% yellow and 80% blue beads; Huq et al., 1988). Participants are then shown a series of beads one at a time and when they believe they have seen enough beads to make a decision, they choose which jar the beads were drawn from. A related JTC paradigm is the emotionally salient task, but instead of using neutral coloured beads participants are told that descriptive words are being drawn from a

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