

RESEARCH ARTICLE

Aberrant Salience and Motivation as Factors in the Formation of Belief in Scientifically Unaccepted Phenomena

HARVEY J. IRWIN

School of Behavioural, Cognitive, and Social Sciences, University of New England, Armidale, NSW, Australia
hirwin2@une.edu.au

Submitted March 15, 2014; Accepted October 28, 2014; Published December 15, 2014

Abstract—The aim of this study was to investigate relationships between the endorsement of beliefs in scientifically unaccepted phenomena and two psychological domains, namely proneness to aberrant salience and fundamental dimensions of human motivation. The project was undertaken as an online survey of 104 university students. “New Age” or paranormal beliefs were found to be related both to a proneness to aberrant salience and to a need for intimacy, but no such relationships were evident for traditional religious beliefs. The findings are discussed in terms of the psychological mechanisms that may underlie the development of beliefs in paranormal phenomena.

Keywords: scientifically unaccepted beliefs—aberrant salience—need for control—need for intimacy

Introduction

Research into the bases of belief and disbelief in paranormal phenomena is crucial to the assessment of human testimony as evidential support for paranormal phenomena and to an understanding of skeptical commentators’ reactions to claims of such phenomena. Both parapsychologists and their critics therefore have devoted considerable effort to the empirical investigation of correlates of paranormal and related beliefs (for a survey of this literature see Irwin 2009). Two potential correlates were investigated in the present study, namely, aberrant salience and basic dimensions of motivation.

Broadly speaking, either of two major cognitive systems (Stanovich & West 2000) appear to be implicated in the formation of a belief in a paranormal phenomenon. The first system engages a good deal of rational reflection. Thus, many parapsychologists and some skeptics assert that their belief or disbelief is founded on a critical reading of the relevant empirical literature (Irwin 2014), and some members of the general

population also endorse a paranormal belief after thoughtful analysis of a personal experience or a secondary source (Blackmore 1984, Kennedy 2000). A second cognitive pathway is much less analytical and involves a rapid intuitive decision that some anomalous event warrants a paranormal interpretation. A substantial amount of research indicates that among the general population the intuitive–experiential route to a paranormal belief is particularly dominant (e.g., Aarnio & Lindeman 2005, Irwin & Young 2002). This view is consistent with growing evidence that in the general population the formation of paranormal beliefs has much in common with the mechanisms independently identified to underlie the development of clinically defined delusions (Irwin, Dagnall, & Drinkwater 2012a, 2012b). This is not to imply that paranormal beliefs are intrinsically false. The latter construction of delusions has now been officially abandoned (American Psychiatric Association 2013); rather, a delusion is currently defined as a belief formed without adequate scrutiny of supportive evidence and persistently held in the face of any conflicting evidence. Thus, like delusions, belief in paranormal phenomena has been found to be associated with a deficiency in subjecting inferences to adequate reality testing; specific biases in reasoning such as emotion-based reasoning and catastrophizing; inferential confusion or the inclination to draw inferences on the basis of remote theoretical possibilities; proneness to confirmation bias or the neglect of disconfirming information; and distinctive metacognitive beliefs or attitudes toward one’s thinking, particularly the tendency to focus attention on thought processes (cognitive self-consciousness) and negative beliefs about thoughts concerning uncontrollability and danger (Irwin, Dagnall, & Drinkwater 2012a, 2012b).

A behavioral characteristic increasingly promoted as a key marker of proneness to clinically defined delusions is known as *aberrant salience*. A section of the cerebral cortex dubbed the “salience network” (comprising the bilateral insula and anterior cingulate) has been shown to play a role in activating relevant brain regions for processing sensory inputs. When an anomalous experience occurs, a dysfunction in the brain’s dopamine system has been proposed to make even a small amount of evidence for an inference about the experience seem unusually salient, leading to premature conclusions and instigating psychotic perceptions and beliefs (Kapur 2003, Lau, Wang, Hsu, & Liu 2013, Palaniyappan, Mallikarjun, Joseph, White, & Liddle 2010, Poletti & Sambataro, 2013, Smeets, Lataster, van Winkel, de Graaf, ten Have, & van Os 2013, Winton-Brown, Fusar-Poli, Ungless, & Howes 2014). Aberrant salience thereby plays a crucial mediational role in the development of psychosis and other conditions in which delusions are predominant (e.g., Balzan, Delfabbro, Galletly, & Woodward 2013, Cicero,

Becker, Martin, Docherty, & Kerns 2013, Poletti & Bonuccelli 2013). This mechanism reportedly is entailed also in the formation of subclinical delusional beliefs (Balog, Somlai, & Kéri 2013). Taken in conjunction with the diverse evidence that cognitive processes associated with delusions also underlie the formation of paranormal beliefs in the general population (Irwin, Dagnall, & Drinkwater 2012a, 2012b), there are grounds here for investigating the relationship between paranormal beliefs and aberrant salience. In addition, a recent study by Irwin, Schofield, and Baker (2014) reported a positive correlation between aberrant salience and an inclination to attribute anomalous experiences to paranormal factors, a behavior which closely implicates belief in the paranormal. The following hypothesis therefore was formulated.

Hypothesis 1: The intensity of paranormal and related beliefs is positively related to proneness to aberrant salience.

A second psychological domain investigated in relation to paranormal beliefs in this study was motivation. Some instructive theoretical reviews of the possible motivation for paranormal beliefs among the general population (e.g., Krippner & Winkler 1996, Schumaker 1990) have been undertaken. Kennedy, for example, has proposed that such beliefs may be

influenced by motivations to have control and efficacy, to have a sense of meaning and purpose in life, to be connected with others, to have transcendent experiences, to have self-worth, to feel superior to others, and to be healed. (Kennedy 2005:263)

Relatively little empirical attention has been focused on this topic, but the principal motivational factor identified in the associated body of research is the need for a sense of mastery or control over life events (Greenaway, Louis, & Hornsey 2013, Irwin 1992, 2000, Keinan 2002); that is, having paranormal beliefs seems to engender an impression that one potentially has the power to control unanticipated hazards that may arise in life or to foresee such events and thereby be mentally prepared for them. The major shortcoming of this body of empirical research is that the need for control has been studied in isolation, with no account of other motivational factors for comparative purposes. The present study therefore undertook a multifactorial approach to motivation in relation to belief in the paranormal.

What are the major elements of human motivation? People have some basic bodily needs that must be met for survival; thus, we all have a need for food (nutriments), a need for water, and so on. Such physiological needs

are essentially universal and as a consequence they are of limited interest to psychologists seeking to understand the motivation of more complex human behaviors such as endorsement of paranormal beliefs. Higher-level, more uniquely human, motivations show greater variation from one person to another and thus potentially have more utility for explaining how complex behaviors are energized and directed. The taxonomy constructed by McClelland (1961, 1987) nominated the so-called “Big Three” human motives to be the need for achievement, the need for power, and the need for affiliation (see also Heckhausen & Heckhausen 2008). The *need for achievement* comprises a desire for significant accomplishment, mastering of skills, and setting high standards; the *need for power* concerns a desire for status and prestige and for having an influence over other people; and the more prosocial *need for affiliation* relates to a desire for warm interpersonal relations. The need for affiliation has since been dichotomized into the *need for affiliation* and the *need for intimacy* (e.g., see Sokolowski 2008), with the former now focused on a desire for a sense of belonging and for getting along with people in general, and the latter concerned more with the desire to establish close emotional relations with certain select people. McClelland (1987) also acknowledged that these motives can have directional components, one pertaining to the pursuit of a positive desired goal and the other pertaining to the avoidance of states that negate the positive goals. Thus, a need for achievement, for example, might be driven mainly by the desire for a sense of accomplishment or alternatively, by a desire to avoid failure. The present project took account of the four motives for achievement, power, affiliation, and intimacy and included a check for the directional component of these. In light of the dearth of multivariate motivational investigations of paranormal and related beliefs, the following prediction was formulated as an exploratory hypothesis.

Hypothesis 2: The intensity of paranormal and allied beliefs is related to some combination of a need for achievement, a need for power, a need for affiliation, and a need for intimacy.

Method

The project was a correlational study conducted as an online questionnaire survey.

Participants

The survey was completed by a convenience sample of 104 Australian university students enrolled in an Introductory Psychology course; the

students received course credit for their participation in the project but were not under any compulsion to undertake this specific survey. There were 19 males and 85 females in the sample. The mean age was 33.90 years ($SD = 10.24$), with a range of 19–65 years.

Materials

The survey inventory included a measure of aberrant salience, a measure of the intensity of beliefs in scientifically unaccepted phenomena, and finally, a multifactorial questionnaire on motivation, plus a few items on basic demographic characteristics. All participants completed these questionnaires in that order.

Proneness to aberrant salience was assessed with the *Aberrant Salience Inventory* (ASI; Cicero, Kerns, & McCarthy 2010). The ASI has 29 dichotomous (Yes/No) items surveying experiences of aberrant salience (e.g., “Do normally trivial observations sometimes take on an ominous significance?”). A total ASI score is computed as the total number of affirmative responses over the 29 items. Cicero, Kerns, & McCarthy (2010) report the scale has satisfactory convergent and discriminative validity, as well as high internal consistency.

Beliefs in scientifically unaccepted phenomena were indexed with *The Survey of Scientifically Unaccepted Beliefs* (SSUB; Irwin & Marks 2013), labeled the “Survey of Popular Beliefs” for general use. The SSUB is a 20-item, self-report, interval-level measure of the intensity of paranormal and related beliefs and was generated through a factor analysis of a wide range of beliefs in scientifically unaccepted phenomena. Responses to the SSUB items are made on a 5-point scale (1 = Strongly disagree, to 5 = Strongly agree). The SSUB comprises two scales denoted New Age Beliefs (NAB, 15 items) and Traditional Religious Beliefs (TRB, 5 items). Scores on each scale are computed as the sum of responses to the items in the respective scale and then converted to scores with interval-level measurement using the conversion table provided by Irwin and Marks (2013:Appendix 3). Scores for NAB may range from 13.37 to 36.53, and those for TRB, 15.62 to 34.12. The Rasch measures for both scales have been standardized with a mean of 25 and a standard deviation of 5. Irwin and Marks (2013) have documented the dimensional purity and other psychometric characteristics of the SSUB, and generally these appear satisfactory.

Dimensions of human motivation were surveyed with the *Unified Motives Scales* (UMS; Schönbrodt & Gerstenberg 2012). The UMS was derived from an analysis under Item Response Theory of several pre-existing motivation questionnaires supplemented by a few new items. The

statistical techniques of Item Response Theory identify a small number of items for each factor that reliably index performance on the complete set of items in that factor, thereby substantially reducing administration time in subsequent applications. Thus, the UMS measures the strength of the Achievement, Power, Affiliation, and Intimacy motives with a mere three items for each factor. For each item responses are made on a 6-point scale (depending on the item, either 0 = Strongly disagree, to 5 = Strongly agree; or 0 = Not important to me, to 5 = Extremely important to me). For each factor a total score is computed as the sum of responses to the items in that scale, and thus may range from 0 to 15. Psychometric characteristics of the four factor scores are impressive (Schönbrodt & Gerstenberg 2012). In addition, the UMS provides an additional item for assessing the directional component of performance on each of the Achievement, Power, and joint Affiliation–Intimacy dimensions; these are dubbed the Fear of Failure, Fear of Losing Control, and Fear of Rejection, respectively.

Procedure

The questionnaire inventory was administered as an online survey compiled using *Qualtrics Survey Software* (Qualtrics Labs, Provo, UT; see <http://www.qualtrics.com>). The stated aim of the study was “to survey various popular beliefs and relate them to aspects of psychological style and personal experiences” which would “help us to appreciate the role of these beliefs in people’s lives.” People aged at least 18 years were said to be eligible to take part, and their participation was anonymous and voluntary, with withdrawal from the exercise permitted at any time. The need for frankness in responding was stressed. The Qualtrics system automatically prevented participation more than once by the same person.

Recruitment was terminated soon after the target of 100 completions had been achieved.

Results

Descriptive statistics for the principal variables of the study are given in Table 1. The distribution of some of the UMS variables was significantly skewed; bivariate relationships therefore were indexed by Spearman correlation coefficients. Table 1 also presents the Spearman correlations between components of the SSUB (NAB and TRB) and both the ASI and the four factors of the UMS (Achievement, Power, Affiliation, and Intimacy). Where appropriate, Bonferroni corrections to the significance levels of these correlation coefficients have been applied on a hypothesis-by-hypothesis basis (Abramson, Wolfson, Marcotte, Grant, & HNRC Group 1999, Shaffer

TABLE 1
Descriptive Statistics and Spearman Correlations of Scientifically Unaccepted Beliefs (SSUB) with Aberrant Salience (ASI) and Motivation (UMS)

Variable	M	SD	Range	Skewness	Spearman rho	
					NAB	TRB
SSUB Components						
NAB	23.57	2.27	18–29	.04	–	.37***
TRB	23.40	5.05	16–34	.24	.37***	–
ASI	15.51	6.32	4–29	–.06	.37**	.03
UMS Factors						
Achievement	10.87	2.49	5–15	–.06	.02	.06
Power	7.32	3.14	0–15	.06	.11	.07
Affiliation	8.33	2.73	0–14	–.49*	.07	.16
Intimacy	11.18	2.68	1–15	1.03***	.25**	.21*

* $p < .05$; ** $p < .01$; *** $p < .001$ (where appropriate, corrected within each hypothesis)

1995); given that Hypothesis 2 was exploratory, however, the significance levels of correlations between SSUB components and UMI factors remain uncorrected.

Under Hypothesis 1, the intensity of beliefs in scientifically unaccepted beliefs (NAB and TRB) was proposed to be positively predicted by proneness to aberrant salience (ASI). This prediction is supported by the correlation between NAB and ASI shown in Table 1 ($\rho = .37$, corrected $p < .01$), but not by the correlation between TRB and ASI ($\rho = .03$, $p = .75$). However, given that paranormal beliefs often vary with age and gender (Irwin 2009), a more rigorous statistical test of the hypothesis would best take account also of these demographic variables. Hypothesis 1 therefore was assessed through a multiple regression analysis of NAB scores on three predictors, namely, aberrant salience (ASI), gender, and age. The regression equation was significant [$F(3,100) = 10.74$, $p < .001$; adjusted $R^2 = .221$], with independently significant contributions to the regression made by ASI ($\text{partial } r = .46$, $\text{beta} = .47$, $p < .001$), (female) gender ($\text{partial } r = .30$, $\text{beta} = .27$, $p < .01$), and to a borderline extent, age ($\text{partial } r = .30$, $\text{beta} = .18$, $p = .054$). The correlation between TRB and ASI ($\rho = .03$) does not encourage a similar regression analysis for TRB, but for the sake of completeness it may be reported that the regression of TRB on ASI, gender, and age, was not significant [$F(3,100) = .43$, $p = .73$; $R^2 = .013$]. Hypothesis 1 is confirmed for New Age or paranormal beliefs but not with respect to traditional religious beliefs.

Under the exploratory Hypothesis 2, the intensity of beliefs in scientifically unaccepted beliefs (NAB and TRB) was proposed to be

predicted by the UMI dimensions of human motivation. This prediction is supported by the correlations (see Table 1) between the Need for Intimacy and both NAB ($\rho = .25$, uncorrected $p < .01$) and TRB ($\rho = .21$, $p < .05$), although there appears to be no independent relationship for any of the other types of motivation. Again, however, a more rigorous statistical test of the hypothesis would best take account also of the demographic variables of gender and age. Hypothesis 2 therefore was assessed through multiple regression analyses of NAB and TRB scores on the four UMI components, gender, and age. As the distribution of two of the UMI factors was significantly skewed (see Table 1), bootstrapping was utilized in the analysis (1,000 samples with bias corrected and accelerated analyses); bootstrapping is a procedure for using the original sample data to estimate a variable's distribution in the population and thereby avoids the need to meet the statistical requirement for a normal distribution (IBM 2011). The regression equation for NAB was significant [$F(6,97) = 2.25$, $p < .05$; adjusted $R^2 = .068$], with independently significant contributions to the regression made by the Need for Intimacy ($\text{partial } r = .22$, $\text{beta} = .27$, $p < .05$) and (female) gender ($\text{partial } r = .22$, $\text{beta} = .22$, $p < .05$). The regression equation for TRB, on the other hand, was not significant [$F(6,97) = 1.29$, $p = .27$; adjusted $R^2 = .017$]. Hypothesis 2 is supported in that there is a relationship between New Age beliefs and the Need for Intimacy. This result nevertheless needs to be checked for the directional component of the Need for Intimacy. A post hoc computation found a significant Spearman correlation between NAB and the Fear of Rejection item of the UMI ($\rho = .37$, $p < .001$); that is, the "need for intimacy" in this context may well have been driven at least in part by the negative factor of a fear of rejection.

Discussion

The statistical analyses for Hypothesis 1 confirm that aberrant salience is a predictor of the intensity of "New Age" or paranormal beliefs, but not of the intensity of traditional religious beliefs. These findings are consistent with the observation by Irwin, Schofield, and Baker (2014) that the inclination to attribute anomalous events to paranormal processes is linked to the characteristic of aberrant salience. Given that aberrant salience is a key marker of proneness to clinically defined delusions (e.g., Winton-Brown, Fusar-Poli, Ungless, & Howes 2014), the data provide additional support for the view that in the general population the cognitive processes independently identified to underlie the formation of delusions are implicated also in the formation of beliefs in paranormal phenomena (Irwin, Dagnall, & Drinkwater 2012a, 2012b). I reiterate that this does not mean either paranormal beliefs or paranormal phenomena themselves

are intrinsically baseless; rather, the appropriate inference is that many people in the general population endorse paranormal beliefs essentially for emotional reasons rather than on the basis of critical rational scrutiny of the available evidence. At the same time the findings do signal caution in relying on human testimony about anomalous experiences as evidence for paranormal processes; the latter require empirical scrutiny from quite a different perspective.

Cognitive processes involved in the predisposition to paranormal beliefs are clearly fundamental to an understanding of this behavior, but the associated indications that paranormal beliefs spring in part from emotional considerations point in turn to the necessity of taking some account of motivational factors. There is insufficient evidence here that the fundamental human motives play a role in the formation of traditional religious beliefs; despite the significant correlation between TRB and the need for intimacy ($\rho = .21, p < .05$), this association was no longer evident when due account was taken of the demographic variables gender and age. For New Age or paranormal beliefs, on the other hand, the need for intimacy was found to be a relevant factor. Further research is required to clarify whether this relationship principally reflects the positive component of the desire to establish close relations or the negative component of a fear of being rejected by significant others. Nonetheless, the observed relationship with a need for intimacy does affirm the needs-serving role of belief in the paranormal. In addition, this appears to be the first study to identify explicitly the potential role of an intimacy motive in the development of paranormal beliefs, and future research could appropriately take greater cognizance of this factor. The effect size found for this variable ($\rho = .25$) was not high, so the contribution of the need for intimacy should not be overstated, but one must remember that many factors other than motivation are known to contribute to the development of paranormal beliefs (for a review see Irwin 2009).

The observation that a need for power was not a significant predictor of paranormal belief is surprising in light of past research suggesting the role of a need for control in this context (e.g., Greenaway, Louis, & Hornsey 2013). This is not to claim that the earlier research is refuted by my findings, but perhaps one key facet of a need for control here relates to a desire for power over other people as a means to gain and to maintain intimacy. This interpretation is consistent with Irwin's (1992) report that the motivational element of paranormal beliefs is a need for specifically *interpersonal* control. In any event the present findings do reinforce the insufficiency of studying the role of a need for control in isolation from other potential motives.

The study's limitations must also be acknowledged. The sample cannot

reasonably be regarded as strongly representative of the general population. Thus, perhaps Psychology students by their nature tend to have both strong paranormal beliefs and a high need for intimacy, although this possibility is somewhat at odds with participants' relatively skeptical performance on the SSUB (for NAB, sample $M = 23.57$ as compared with the normative population $M = 25.00$). Nonetheless, replication of the study with a more representative sample would be appropriate. In addition, the ASI, SSUB, and UMI questionnaires in the survey inventory were not counterbalanced for their order of administration. Future replications might usefully take account also of this procedural shortcoming. Finally, the UMI scales address explicit motives only, that is, the person's conscious self-perception of his or her goals and values. There remains a possibility that various implicit or ineffable motives (McClelland, Koestner, & Weinberger 1989) are also important to energizing the endorsement of paranormal beliefs.

A further potential limitation may arise from the operation of response sets. A reviewer of this paper notes that the ASI comprises items worded only in the positive direction and thus may be vulnerable to "acquiescent" response sets; that is, participants may realize they give the same answer to the first few items of this questionnaire and decide to give the same answer to subsequent items with insufficient regard to the items' content, or they may bring to the test session a habitual tendency to agree with propositions rather than taking issue with them. If a similar vulnerability obtained in the other measures used in the survey, the observed relationships between the ASI and these measures might then be a mere artefact of the operation of these response sets. On the other hand, the only context in which such an artefact could have been problematic concerns the correlations of the ASI with the SSUB scales, and the latter comprise items that are counterbalanced for the direction of their wording, that is scores on these scales are not substantially affected by acquiescence response sets. Be this as it may, further investigation of the role of aberrant salience in the formation of scientifically unaccepted beliefs might usefully employ a performance measure of aberrant salience such as that devised by Roiser, Stephan, den Ouden, Barnes, Friston, & Joyce (2009).

In a rejoinder to this analysis the reviewer argued that an acquiescence response bias may constitute the inclination "to agree with plausible-sounding items irrespective of their specific content." This perspective seems to reach far beyond the usual definition of an acquiescence response bias as occurring "when respondents agree to, or endorse items without regard to content" (Furr 2011:23), given that the plausibility of an item must necessarily take some account of content. Nevertheless, the reviewer concedes that an acquiescence response bias is unlikely to account for

the observed relationships between ASI and SSUB scores, given that the relationship was null for the Traditional Religious Beliefs SSUB scale which might be presumed to comprise relatively plausible-sounding items. The reviewer also suggested that the operation of an acquiescence response bias could be tested by comparing the ASI–SSUB relationships across gender and age on the assumption that such a response bias may on average be stronger among women and older participants. Post hoc statistical analyses found no significant variation in the relationships between ASI and SSUB scores with these demographic variables.

References

- Aarnio, K., & Lindeman, M. (2005). Paranormal beliefs, education, and thinking styles. *Personality and Individual Differences*, 39, 1227–1236. <http://www.sciencedirect.com/science/article/pii/S0191886905001601>
- Abramson, I., Wolfson, T., Marcotte, T. D., Grant, I., & HNRC Group (1999). Extending the p-plot: Heuristics for multiple testing. *Journal of the International Neuropsychological Society*, 5, 510–517.
- American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. Washington, D.C.
- Baloz, Z., Somlai, Z., & Kéri, S. (2013). Aversive conditioning, schizotypy, and affective temperament in the framework of the salience hypothesis. *Personality and Individual Differences*, 54, 109–112. <http://www.sciencedirect.com/science/article/pii/S0191886912004102>
- Balzan, R., Delfabbro, P., Galletly, C., & Woodward, T. (2013). Confirmation biases across the psychosis spectrum: The contribution of hypersalient evidence-hypothesis matches. *British Journal of Clinical Psychology*, 52, 53–69. doi:10.1111/bjc.12000
- Blackmore, S. J. (1984). A postal survey of OBEs and other experiences. *Journal of the Society for Psychical Research*, 52, 225–244. <https://www.academia.edu/3045691>
- Cicero, D. C., Becker, T. M., Martin, E. A., Docherty, A. R., & Kerns, J. G. (2013). The role of aberrant salience and self-concept clarity in psychotic-like experiences. *Personality Disorders: Theory, Research, and Treatment*, 4, 33–42. <https://www.academia.edu/2381836>
- Cicero, D. C., Kerns, J. G., & McCarthy, D. M. (2010). The Aberrant Salience Inventory: A new measure of psychosis proneness. *Psychological Assessment*, 22, 688–701. <https://www.academia.edu/5963926>
- Furr, R. M. (2011). *Scale Construction and Psychometrics for Social and Personality Psychology*. London: SAGE.
- Greenaway, K. H., Louis, W. R., & Hornsey, M. J. (2013). Loss of control increases belief in precognition and belief in precognition increases control. *PLoS ONE*, 8(8), e71327. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0071327>
- Heckhausen, J., & Heckhausen, H. (Editors) (2008). *Motivation and Action* (second edition). New York: Cambridge University Press.
- IBM (2011). *SPSS Bootstrapping 20*. Chicago, IL: Author.
- Irwin, H. J. (1992). Origins and functions of paranormal belief: The role of childhood trauma and interpersonal control. *Journal of the American Society for Psychical Research*, 86, 199–208.
- Irwin, H. J. (2000). Belief in the paranormal and a sense of control over life. *European Journal of Parapsychology*, 15, 68–78. <https://www.academia.edu/6423351>
- Irwin, H. J. (2009). *The Psychology of Paranormal Belief: A Researcher's Handbook*. Hatfield, UK: University of Hertfordshire Press.
- Irwin, H. J. (2014). The views of parapsychologists: A survey of members of the Parapsychological

- Association. *Journal of the Society for Psychical Research*, 78, 85–101.
- Irwin, H. J., Dagnall, N., & Drinkwater, K. (2012a). Paranormal belief and biases in reasoning underlying the formation of delusions. *Australian Journal of Parapsychology*, 12, 7–21. <https://www.academia.edu/6423343>
- Irwin, H. J., Dagnall, N., & Drinkwater, K. (2012b). Paranormal beliefs and cognitive processes underlying the formation of delusions. *Australian Journal of Parapsychology*, 12, 107–126. <https://www.academia.edu/4121405>
- Irwin, H. J., & Marks, A. D. G. (2013). The *Survey of Scientifically Unaccepted Beliefs*: A new measure of paranormal and related beliefs. *Australian Journal of Parapsychology*, 13, 133–167. <https://www.academia.edu/6423359>
- Irwin, H. J., Schofield, M. B., & Baker, I. S. (2014). Dissociative tendencies, sensory-processing sensitivity, and aberrant salience as predictors of anomalous experiences and paranormal attributions. *Journal of the Society for Psychical Research*, 78, 193–206.
- Irwin, H. J., & Young, J. M. (2002). Intuitive versus reflective processes in the formation of paranormal beliefs. *European Journal of Parapsychology*, 17, 45–53.
- Kapur, S. (2003). Psychosis as a state of aberrant salience: A framework linking biology, phenomenology, and pharmacology in schizophrenia. *American Journal of Psychiatry*, 160, 13–23. <http://ajp.psychiatryonline.org/data/Journals/AJP/3744/13.pdf>
- Keinan, G. (2002). The effects of stress and desire for control on superstitious behavior. *Personality and Social Psychology Bulletin*, 28, 102–108.
- Kennedy, J. E. (2000). Do people guide psi or does psi guide people? Evidence and implications from life and lab. *Journal of the American Society for Psychical Research*, 94, 130–150. <http://jeksite.org/psi/jaspr00.pdf>
- Kennedy, J. E. (2005). Personality and motivations to believe, misbelieve, and disbelieve in paranormal phenomena. *Journal of Parapsychology*, 69, 263–292. <http://jeksite.org/psi/jp05.htm>
- Krippner, S., & Winkler, M. (1996). The “need to believe.” In *The Encyclopedia of the Paranormal* edited by G. Stein, Amherst, NY: Prometheus Books, pp. 441–454.
- Lau, C.-I., Wang, H.-C., Hsu, J.-L., & Liu, M.-E. (2013). Does the dopamine hypothesis explain schizophrenia? *Reviews in the Neurosciences*, 24, 389–400. <http://www.degruyter.com/view/j/revneuro.2013.24.issue-4/revneuro-2013-0011/revneuro-2013-0011.xml>
- McClelland, D. C. (1961). *The Achieving Society*. New York: Free Press.
- McClelland, D. C. (1987). *Human Motivation*. New York: Cambridge University Press.
- McClelland, D. C., Koestner, R., & Weinberger, J. (1989). How do self-attributed and implicit motives differ? *Psychological Review*, 96, 690–702. http://lab4.psico.unimib.it/nettuno/forum/free_download/mcclelland_89_355.pdf
- Palaniyappan, L., Mallikarjun, P., Joseph, V., White, T. P., & Liddle, P. F. (2010). Reality distortion is related to the structure of the salience network in schizophrenia. *Psychological Medicine*, 41, 1701–1708. <https://www.academia.edu/392520>
- Poletti, M., & Bonuccelli, U. (2013). From aberrant salience to jumping to conclusions: Dopaminergic pathways to delusions in Parkinson disease. *Journal of Clinical Psychopharmacology*, 33, 149–151.
- Poletti, M., & Sambataro, F. (2013). The development of delusion revisited: A transdiagnostic framework. *Psychiatry Research*, 210, 1245–1259. <https://www.researchgate.net/publication/256118909>
- Roiser, J. P., Stephan, K. E., den Ouden, H. E. M., Barnes, T. R. E., Friston, K. J., & Joyce, E. M. (2009). Do patients with schizophrenia exhibit aberrant salience? *Psychological Medicine*, 39, 199–209.
- Schönbrodt, F. D., & Gerstenberg, F. X. R. (2012). An IRT analysis of motive questionnaires: The *Unified Motives Scales*. *Journal of Research in Personality*, 46, 725–742. <http://www>.

- [sciencedirect.com/science/article/pii/S0092656612001353](https://www.sciencedirect.com/science/article/pii/S0092656612001353)
- Schumaker, J. F. (1990). *Wings of Illusion: The Origin, Nature and Future of Paranormal Belief*. Buffalo, NY: Prometheus Books.
- Shaffer, J. P. (1995). Multiple hypothesis testing. *Annual Review of Psychology*, *46*, 561–584. <http://med.stanford.edu/tanglab/courses/gen245/Reading/shaffer95.pdf>
- Smeets, F., Lataster, T., van Winkel, R., de Graaf, R., ten Have, M., & van Os, J. (2013). Testing the hypothesis that psychotic illness begins when subthreshold hallucinations combine with delusional ideation. *Acta Psychiatrica Scandinavica*, *127*, 34–47. <https://www.researchgate.net/publication/225281591>
- Sokolowski, K. (2008). Social bonding: Affiliation motivation and intimacy motivation. In *Motivation and Action* (second edition) edited by J. Heckhausen and H. Heckhausen, New York: Cambridge University Press, pp. 184–201.
- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences*, *23*, 645–665. <https://www.researchgate.net/publication/12031890>
- Winton-Brown, T. T., Fusar-Poli, P., Ungless, M. A., & Howes, O. D. (2014). Dopaminergic basis of salience dysregulation in psychosis. *Trends in Neurosciences*, *37*, 85–94. <https://www.researchgate.net/publication/259586278>