

DISSOCIATIVE TENDENCIES, SENSORY-PROCESSING
SENSITIVITY AND ABERRANT SALIENCE
AS PREDICTORS OF ANOMALOUS EXPERIENCES
AND PARANORMAL ATTRIBUTIONS

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ABSTRACT

An online survey completed by 307 adults was undertaken to examine the relationship between the reporting of parapsychological experiences and three psychological dimensions, namely dissociative tendencies, sensory-processing sensitivity and aberrant salience. In contrast with most previous studies of parapsychological experiences, cognizance was taken of a distinction between a proneness to have anomalous experiences and a proneness to attribute such experiences to paranormal factors. All three psychological predictors were found to be related both to a proneness to anomalous experiences and to a proneness to paranormal attributions. Possible implications of these findings for the basis of parapsychological experiences are indicated.

INTRODUCTION

In an endeavour to understand why some people have parapsychological experiences and others do not, researchers have given a good deal of attention to the empirical identification of the psychological correlates of parapsychological experiences. Potentially, however, there is a fundamental confound in this research. When survey participants acknowledge having had a parapsychological experience they are in fact making two declarations: first, that they have had some sort of *anomalous* experience; and second, that they have interpreted this experience in paranormal terms (French & Wilson, 2007, p.13; Irwin, Dagnall & Drinkwater, 2013). Previous reports of the psychological correlates of parapsychological experiences therefore may attest to a relationship with proneness to anomalous experiences, or to a relationship with proneness to make paranormal attributions about anomalous experiences, or to relationships with both of these dimensions. Therefore, there is a need to give further empirical scrutiny to the reported psychological correlates of parapsychological experiences in order to clarify which of these two discriminable characteristics is implicated. The present study undertook to explore this issue in terms of dissociative characteristics, sensory-processing sensitivity and aberrant salience as potential predictors.

Research on the above issue has been facilitated by Irwin et al.'s (2013) construction of a procedure for yielding separate assessments of proneness to anomalous experiences and proneness to paranormal attributions. Details of this procedure are given below in the Method section, but a preliminary description at this point may assist readers to grasp the distinction between the two dimensions. Under Irwin et al.'s procedure, survey participants are given a list of various parapsychological experiences that are described phenomenologically—that is, in terms of how they are actually experienced, without any intrinsic reference to their possible paranormal bases. Thus, rather than

asking people if they have ever seen a ghost, they are asked if they have ever had an impression of a figure nearby, even though nobody could possibly have been there. If participants wish to respond affirmatively, they are asked further to clarify how they interpret their experience, that is, as one with a specified normal (nonparanormal) explanation or as one with a specified paranormal explanation. The key point here for readers to appreciate is that some people do in fact acknowledge anomalous experiences without construing them in a paranormal perspective (Baker & O’Keeffe, 2007). Under Irwin et al.’s procedure the percentage of experiences to which people respond affirmatively is deemed an index of respondents’ proneness to anomalous experiences, and the percentage of affirmed experiences interpreted in paranormal terms is an index of respondents’ proneness to paranormal attributions.

Two previous studies have investigated whether proneness to anomalous experiences (PAE) and proneness to paranormal attributions (PPA) have the same or different patterns of association with psychological variables. The precise nature of these correlates is not at issue here; the interested reader is referred to the original reports for further details. Rather, the focal concern is whether or not PAE and PPA have distinct predictors. Irwin et al. (2013) found that *both* PAE and PPA were predicted by the ‘unusual experiences’ component of schizotypal tendencies, the tendency to use emotion-based reasoning, and the tendency to suspend reality testing, although only PAE was found to correlate with an aspect of executive dysfunction, namely, self-restraint. Irwin and Wilson (2013) similarly report that both PAE and PPA were predicted by an intuitive–experiential thinking style and that neither of these was related to a rational thinking style. In summary, as far as previous research has been able to determine, with the possible exception of executive dysfunctions the psychological correlates of PAE and those of PPA therefore appear to be much the same. More comprehensive investigation of this issue nevertheless warrants cognizance of other correlates of parapsychological experiences. Three further potential predictors were studied here.

Dissociative Tendencies

Facets of the dissociative domain have been identified as correlates of parapsychological experiences. Dissociative tendencies entail an inclination to fragment or structurally separate mental processes that ordinarily would be integrated (Spiegel & Cardena, 1991). One common and non-pathological form of dissociation is psychological absorption, the capacity to become totally immersed in an activity and to be undiverted by environmental distractions (Roche & McConkey, 1990). Another instance of dissociative tendencies is known as fantasy proneness, a propensity to fantasise a large amount of the time and to be deeply absorbed in or fully experiencing what is being fantasised (Lynn & Rhue, 1988). Some dissociative tendencies, particularly absorption capacity and fantasy proneness, have been found to correlate with the report of various parapsychological experiences (e.g. Council & Huff, 1990; French, Santomauro, Hamilton, Fox & Thalbourne, 2008; Gow, Hutchinson & Chant, 2009; Irwin, 1981, 1985, 2000; Nelson, 1989; Parra & Paul, 2010; Pekala, Kumar & Marcano, 1995). Many of the studies of this association did incorporate a phenomenological definition of the targeted parapsychological experience and

to this extent they do encourage the expectation of a link between dissociative tendencies and PAE, although of course none of the studies sought specifically to tease apart the factors of PAE and PPA in this context. In one study on paranormal attributions, Sharps et al. (2010) found that dissociative tendencies correlated with the tendency to interpret as 'paranormal' some anomalous images such as photographs of ghosts, extraterrestrial aliens and strange creatures (cryptids). In addition, mention may be made of some research on the topic of belief in the paranormal. When people say they interpret an experience in paranormal terms they are in effect stating a paranormal belief. To this extent PPA is an index of proneness to believe in the paranormal. For this reason it is appropriate to note there are some reports of an association between paranormal belief and dissociative tendencies (French et al., 2008; Irwin, 1994; Rattet & Bursik, 2001; Wolfradt, 1997); such findings may be interpreted to constitute additional indications of a relationship between PPA and dissociative tendencies. On these grounds the following hypotheses were formulated:—

Hypothesis 1: Proneness to anomalous experiences is positively related to dissociative tendencies.

Hypothesis 2: Proneness to paranormal attributions is positively related to dissociative tendencies.

Sensory-Processing Sensitivity

Another reported correlate of parapsychological experiences is the trait-like dimension of sensory-processing sensitivity (SPS). People with high SPS have extremely low perceptual thresholds for both external and internal stimuli; that is, they are more responsive to subtle stimuli and they process stimuli more deeply than do other people (Aron, Aron & Jagiellowicz, 2012; Bakker & Moulding, 2012; Dunn, 2001). The so-called 'highly sensitive person' (Aron, 1996, 2010) may therefore frequently feel a need to escape the perceived bombardment of the senses, tend to be a social introvert, get easily rattled in a stressful situation, be relatively attuned to their thoughts and emotions and those of other people, be highly responsive to low doses of medication, and be prone to shyness, anxiety and depression (Aron, 2010; Aron et al., 2012). There is some suggestion that people with high SPS are also more prone to parapsychological experiences, although empirical evidence for this association appears to be limited to apparitional and allied experiences (Houran, Wiseman & Thalbourne, 2002; Jawer, 2006; Massullo, 2008). An attempted replication of this relationship by Sherwood (2012) also proved unsuccessful. In the broader context there is some anecdotal evidence that parapsychological experiences do have heightened emotional sensibilities (Greeley, 1975). Thalbourne (2010) also stressed the potential significance of an observed association between paranormal belief and hyperaesthesia, an extreme sensitivity to external stimulation. The following hypotheses nevertheless are somewhat speculative and are posed largely for exploratory purposes:—

Hypothesis 3: Proneness to anomalous experiences is related to sensory-processing sensitivity.

Hypothesis 4: Proneness to paranormal attributions is related to sensory-processing sensitivity.

Aberrant Salience

A third potential correlate of parapsychological experiences is aberrant salience. A section of the cerebral cortex dubbed the ‘salience network’ (comprising the bilateral insula and anterior cingulate) has been identified to play a role in activating relevant brain regions for processing sensory inputs. It has been proposed that when an anomalous experience occurs even a small amount of evidence for an inference about that experience seems unusually salient, owing to a dysfunction in the brain’s dopamine system, leading to premature conclusions and instigating psychotic perceptions and beliefs (Kapur, 2003; Lau, Wang, Hsu & Liu, 2013; Palaniyappan et al., 2011; Poletti & Sambataro, 2013; Smeets et al., 2013). There is now an increasing level of empirical support for the mediational role of aberrant salience in the development of psychosis and other conditions in which delusions are predominant (e.g. Balzan, Delfabbro, Galletly & Woodward, 2013; Cicero et al., 2013; Poletti & Bonuccelli, 2013). Similar mechanisms reportedly are entailed also in sub-clinical delusional beliefs (Balog, Somlai & Kéri, 2013). In this context it is notable that there are now some indications that paranormal beliefs in the general population are delusions; that is, these beliefs are generated largely in response to emotional needs and not subjected to rational assessment through reality testing (Irwin, Dagnall & Drinkwater, 2012). The occurrence of an anomalous experience and its subsequent interpretation in paranormal terms might therefore mirror the processes implicated in the development of psychotic delusions, thus suggesting the role of aberrant salience as a mediating factor. The following hypotheses were therefore posed:–

Hypothesis 5: Proneness to anomalous experiences is related to an inclination to evoke aberrant salience.

Hypothesis 6: Proneness to paranormal attributions is related to an inclination to evoke aberrant salience.

METHOD

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

Participants

The survey was completed by a convenience sample of 307 adults. There were 72 males and 235 females. The mean age was 32.09 years ($SD = 10.06$), with a range of 18–70 years. Most participants were students of the University of Derby, both on- and off-campus, but some other participants were recruited from the general population. Recruitment was undertaken during face-to-face contact or through social media, including Twitter and Facebook.

Materials

Participants were asked to complete four questionnaires, plus a few items on basic demographic characteristics. The four questionnaires, in order of presentation, respectively addressed the dissociative domain, aberrant salience, anomalous experiences, and sensory-processing sensitivity. Each of these is described below in turn.

The questionnaire used to index dissociative tendencies was the *Attentional Resource Allocation Scale* (ARAS; Carleton, Abrams & Asmundson, 2010). The ARAS comprises 15 items addressing a range of dissociative behaviours; respondents are asked how often they have each experience, using a 5-point response scale (0 = Never, to 4 = Always), when not under the influence of alcohol or drugs. A score for dissociative tendencies is computed as the sum of responses over the 15 items. In addition, the ARAS has been found have three factors: Imaginative Involvement (Absorption) as indexed by 6 items, Dissociative Amnesia (5 items), and Attentional Dissociation (4 items). Scores for each of these factors is computed as the sum of responses over the respective set of items. The internal consistency of the ARAS is satisfactory (Cronbach's $\alpha = 0.91$ for the full scale and 0.74–0.79 for the three factors), and the scale correlates well with other measures of dissociation from which the ARAS items were drawn, but additional characteristics of reliability and validity await assessment.

The dimension of aberrant salience was surveyed 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 et al. (2010) report that the scale has satisfactory convergent and discriminative validity, as well as high internal consistency (Cronbach's $\alpha = 0.89$).

The *Survey of Anomalous Experiences* (SAE; Irwin et al., 2013) comprises 20 items addressing anomalous or uncanny experiences, including apparent telepathy, clairvoyance, precognition, psychokinesis, apparitions, psychic healing, out-of-body experiences, near-death experiences, reincarnation and astrological predictions. For each item participants are presented with an anomalous experience described in purely phenomenological terms, that is, without any explicit reference to its possible paranormal basis. If participants acknowledge having had such an experience they are asked to clarify their position further by stating whether they attributed their experience to a specified paranormal process or to a specified non-paranormal process. Thus, for each item addressing an anomalous experience the respondent has three response options of the following general form: Option 1 is “Yes, and I interpreted it as a (specified) paranormal experience” (e.g. in the case of an ostensibly extrasensory dream, “Yes, and it must have been an instance of telepathy or ESP”); Option 2 is “Yes, but I interpreted it as due to (specified) normal processes” (e.g. “Yes, but it was probably just a coincidence or unwitting insight”); and Option 3 is “No”. The SAE yields two scores for each participant. First, an index of *proneness to anomalous experiences* (PAE) is computed as the percentage of “yes” responses (i.e. Option 1 or 2 in any item) made over the 20 items; thus, this score could range from 0% to 100%. Second, each participant's proneness to attribute anomalous experiences to paranormal phenomena is defined as the percentage of “yes” (Option 1 or 2) responses that were “yes, paranormal” (Option 1) responses. In any exceptional cases where not a single “yes” response is made (0 out of 0, an incalculable percentage ratio), an *a priori* decision would be made to exclude these respondents from the statistical analyses of this SAE

component on the ground that there was no basis on which to assess the degree to which they were inclined to make paranormal attributions about anomalous experiences given they had reported none. For all other participants the index for *proneness to paranormal attributions* (PPA) therefore could range potentially from 0% to 100%. Full psychometric details of the SAE have yet to be ascertained, although the internal consistency of the scale is satisfactory (Cronbach's $\alpha = 0.83$; Irwin et al., 2013), given that the experiences surveyed do vary widely in frequency.

Sensory-processing sensitivity was assessed with the 27-item *Highly Sensitive Person Scale* (HSPS; Aron & Aron, 1997). Surveying experiences of sensitivity to both internal and external stimuli, the 27 items of the HSPS have a 7-point response scale (1 = Not at all, to 7 = Extremely) and include such questions as "Do you seem to be aware of subtleties in your environment?" and "Are you made uncomfortable by loud noises?" Aron and Aron (1997) report that the scale appears unidimensional and on this basis they recommend computing an HSPS score as the sum of responses over the 27 items. Later studies (e.g. Smolewska, McCabe & Woody, 2006) have suggested that the HSPS may in fact comprise 2 or 3 distinct components (see Aron et al., 2012 for a review). Although the exact number and composition of these components have yet to be conclusively determined, it is possible that use of both the total HSPS score and Smolewska et al.'s subscale scores could prove instructive. The subscales identified by Smolewska et al. are labelled Ease of Excitation, Aesthetic Sensitivity, and Low Sensory Threshold. The uncertainty of its factorial purity notwithstanding, the HSPS reportedly has adequate reliability and content, convergent and discriminant validity (Aron & Aron, 1997; Smolewska et al., 2006).

Procedure

The questionnaire inventory was administered as an online survey on an electronic platform known as SurveyMonkey (see www.surveymonkey.com). This platform incorporates some randomization functions but if individual questionnaires in the test inventory exceed one page in length the system cannot provide counterbalancing of the order of the questionnaires' presentation; the participants were therefore required to complete the test inventory in a fixed order. The aim of the study was stated as the investigation of "how a person's anomalous or seemingly inexplicable experiences relate to aspects of their everyday thought processes". People aged at least 18 years were stated to be eligible to take part, and their participation was anonymous and completely voluntary, with withdrawal from the exercise permitted at any time. The need for frankness in responding was stressed.

Recruitment was terminated soon after the target of 300 completions had been achieved.

RESULTS

Preliminary Screening of Data

As noted in the Method section, a 'proneness to paranormal attribution' (PPA) index cannot be computed for any participant who has had no anomalous experiences. In the present sample of 307 participants, all but one reported

having had at least one such experience. Subsequent statistical analyses of PPA data are therefore based on the remaining sample of 306 people, while analyses of PAE data used the full sample of 307. The other noteworthy item of relative frequency data is that 47 of the 307 participants (15%) acknowledged at least one anomalous experience that they interpreted as having a paranormal basis. On average, the participants reported having had 8.26 of the 20 anomalous experiences, and of these 1.76 were interpreted in paranormal terms.

Descriptive Statistics

Descriptive statistics for the principal variables of the study are given in Table 1. The distributions of many of the variables were significantly skewed; bivariate relationships were therefore indexed by Spearman correlation coefficients.

Table 1

Descriptive Statistics and Spearman Correlations between Independent Variables and SAE Components, Proneness to Anomalous Experiences (PAE) and Proneness to Paranormal Attributions (PPA)

Variable	<i>M</i>	<i>SD</i>	Range	Skewness	<i>Spearman rho</i>	
					PAE	PPA
<i>SAE Components</i>						
PAE	41.29	17.48	0–90	0.27	–	0.36***
PPA	17.92	25.09	0–100	1.43*	0.36***	–
ARAS total	21.84	8.05	0–44	0.09	0.42***	0.23**
<i>Dissociative Tendencies</i>						
Imaginative Involvement	7.79	3.51	0–19	0.31*	0.38**	0.20*
Dissociative Amnesia	8.44	2.99	0–16	–0.06	0.36**	0.23**
Attentional Dissociation	5.61	2.74	0–14	0.28*	0.37**	0.19*
<i>Aberrant Salience</i>						
ASI	14.36	6.61	0–29	0.07	0.53***	0.34***
<i>Sensory-Processing Sensitivity</i>						
HSPS total	107.90	24.17	54–180	0.29*	0.32***	0.28***
Ease of Excitation	50.39	11.67	23–81	0.19	0.24**	0.23**
Aesthetic Sensitivity	26.41	6.02	11–42	–0.11	0.26**	0.25**
Low Sensory Threshold	24.01	8.73	7–46	0.33*	0.21**	0.19*

p* < 0.05 *p* < 0.01 ****p* < 0.001 (corrected within each hypothesis)

Inferential Analyses

The SAE components’ relationships with the basic demographic factors of age and gender were inspected and the only noteworthy finding was a small correlation between PAE and age (*rho* = –0.12, *p* < 0.05). This finding indicates a need to take some account of the factor of age in subsequent analyses.

Table 1 presents the Spearman correlations between the SAE components (PAE and PPA) and the predictor variables of dissociative tendencies (ARAS total, Imaginative Involvement, Dissociative Amnesia and Attentional Dissociation), aberrant salience (ASI), and sensory-processing sensitivity (HSPS total, Ease of Excitation, Aesthetic Sensitivity and Low Sensory Threshold). Bonferroni corrections were applied to the significance levels of the correlation coefficients on a hypothesis-by-hypothesis basis (Abramson et al., 1999; Shaffer, 1995).

Each of the study's stated hypotheses was assessed through multiple regression analyses. As the distribution of several of the study's variables was significantly skewed (see Table 1) bootstrapping was utilized in each 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 Corporation, 2011).

Hypothesis 1, that proneness to anomalous experiences is positively related to dissociative tendencies, was tested by performing a multiple regression of PAE scores on ARAS total scores and age. The regression equation was significant [$F(2,304) = 38.32, p < 0.001$; adjusted $R^2 = 0.201$], with ARAS total scores making an independently significant contribution to the regression (*partial* $r = 0.45$, $\beta = 0.441, p < 0.001$). This analysis confirms Hypothesis 1. A *post hoc* exploratory analysis was also undertaken to see which types of dissociative tendencies predicted proneness to anomalous experiences. A regression analysis was therefore conducted of PAE scores on Imaginative Involvement, Dissociative Amnesia, Attentional Dissociation and age. The regression equation again was significant [$F(4,302) = 19.27, p < 0.001$; adjusted $R^2 = 0.203$], with Imaginative Involvement scores making an independently significant contribution to the regression (*partial* $r = 0.20$, $\beta = 0.248, p < 0.001$) and with a contribution of borderline significance made by Dissociative Amnesia scores (*partial* $r = 0.10$, $\beta = 0.138, p = 0.077$). Thus, Hypothesis 1 is supported for the Imaginative Involvement component of dissociative tendencies and to a lesser extent the Dissociative Amnesia component.

Hypothesis 2, predicting a positive relationship between proneness to paranormal attributions and dissociative tendencies, was assessed through a multiple regression of PPA scores on ARAS total scores and age. The regression equation was significant [$F(2,303) = 8.56, p < 0.001$; adjusted $R^2 = 0.053$], with ARAS total scores making an independently significant contribution to the regression (*partial* $r = 0.22$, $\beta = 0.226, p < 0.001$). Hypothesis 2 is therefore supported. Again a *post hoc* exploratory analysis was undertaken to see which types of dissociative tendencies predicted proneness to paranormal attribution. A regression analysis was conducted of PPA scores on Imaginative Involvement, Dissociative Amnesia, Attentional Dissociation and age. The regression equation again was significant [$F(4,301) = 4.95, p < 0.01$; adjusted $R^2 = 0.062$], with Dissociative Amnesia scores making an independently significant contribution to the regression (*partial* $r = 0.12$, $\beta = 0.169, p < 0.05$) and with contributions of borderline significance made by Imaginative Involvement scores (*partial* $r = 0.10$, $\beta = 0.132, p = 0.083$) and by age (*partial* $r = 0.10$, $\beta = 0.099, p = 0.081$). Hypothesis 1 is therefore supported for the Dissociative Amnesia

component of dissociative tendencies and to a lesser extent the Imaginative Involvement component.

Hypothesis 3 posited that proneness to anomalous experiences is related to sensory-processing sensitivity and was tested via a multiple regression of PAE scores on HSPS total scores and age. The regression equation was significant [$F(2,304) = 15.33$, $p < 0.001$; adjusted $R^2 = 0.092$], with independently significant contributions to the regression made by both HSPS ($partial\ r = 0.28$, $beta = 0.283$, $p < 0.001$) and age ($partial\ r = -0.11$, $beta = -0.108$, $p < 0.05$). Hypothesis 3 is therefore confirmed. A *post hoc* exploratory analysis was also undertaken, to see which facets of sensory-processing sensitivity predicted proneness to anomalous experiences. A regression analysis was therefore conducted of PAE scores on Ease of Excitation, Aesthetic Sensitivity, Low Sensory Threshold and age. The regression equation was significant [$F(4,302) = 9.33$, $p < 0.001$; adjusted $R^2 = 0.110$], with independently significant contributions to the regression made by Ease of Excitation ($partial\ r = 0.13$, $beta = 0.169$, $p < 0.05$), Aesthetic Sensitivity ($partial\ r = 0.22$, $beta = 0.255$, $p < 0.001$), and age ($partial\ r = -0.12$, $beta = -0.118$, $p < 0.05$). Hypothesis 3 is confirmed in respect to both the Ease of Excitation and the Aesthetic Sensitivity components of sensory-processing sensitivity.

Under Hypothesis 4 proneness to paranormal attributions is proposed to be related to sensory-processing sensitivity and was evaluated through a multiple regression of PPA scores on HSPS total scores and age. The regression equation was significant [$F(2,303) = 10.48$, $p < 0.001$; adjusted $R^2 = 0.065$], with an independently significant contribution to the regression made by HSPS scores ($partial\ r = 0.25$, $beta = 0.247$, $p < 0.001$). Hypothesis 4 is therefore confirmed. A *post hoc* exploratory analysis was also undertaken, to see which facets of sensory-processing sensitivity predicted proneness to anomalous experiences. A regression analysis was therefore conducted of PAE scores on Ease of Excitation, Aesthetic Sensitivity, Low Sensory Threshold and age. The regression equation was significant [$F(4,301) = 7.07$, $p < 0.001$; adjusted $R^2 = 0.086$], with independently significant contributions to the regression made by both Ease of Excitation ($partial\ r = 0.12$, $beta = 0.154$, $p < 0.05$) and Aesthetic Sensitivity ($partial\ r = 0.21$, $beta = 0.235$, $p < 0.001$). Hypothesis 4 is confirmed in respect to both the Ease of Excitation and the Aesthetic Sensitivity components of sensory-processing sensitivity.

Hypothesis 5, that proneness to anomalous experiences is related to an inclination to evoke aberrant salience, was assessed by a multiple regression of PAE scores on ASI and age. The regression equation was significant [$F(2,304) = 61.04$, $p < 0.001$; adjusted $R^2 = 0.287$], with an independently significant contribution to the regression made by ASI scores ($partial\ r = 0.53$, $beta = 0.525$, $p < 0.001$). Hypothesis 5 is supported.

Under Hypothesis 6 proneness to paranormal attributions should be related to an inclination to evoke aberrant salience. This was tested through a multiple regression of PPA scores on ASI and age. The regression equation was significant [$F(2,303) = 22.99$, $p < 0.001$; adjusted $R^2 = 0.132$], with an independently significant contribution to the regression made by ASI scores ($partial\ r = 0.36$, $beta = 0.359$, $p < 0.001$). Hypothesis 6 is confirmed.

DISCUSSION

The primary objective of the study was to follow up the work of Irwin et al. (2013) and Irwin and Wilson (2013) by investigating whether proneness to anomalous experiences and proneness to paranormal attributions have the same or different patterns of association with psychological factors. The findings of our research are clear; with a minor difference (observed in a *post hoc* analysis) in whether imaginative involvement or dissociative amnesia is the better dissociative predictor of these dimensions, the correlates of PAE and PPA scores were precisely the same, notwithstanding the fact that the PAE correlates were always slightly stronger. The parallelism between the predictors of proneness to anomalous experiences and those of proneness to paranormal attributions accords with the findings of Irwin et al. (2013) and Irwin and Wilson (2013) for a variety of other correlates. Considered collectively, these findings might be taken to suggest that previously reported correlates of parapsychological experiences may not have been unduly compromised by investigators' failure to take account of the distinction between proneness to anomalous experiences and proneness to paranormal attributions. Admittedly there is scope for examining this distinction in relation to other claimed correlates of parapsychological experiences, but at present there are scant empirical grounds for challenging the empirical literature on parapsychological experiences for a methodological shortcoming in this regard.

At the same time the findings do prompt the question, why are the predictors of proneness to anomalous experiences so remarkably similar to those of proneness to paranormal attributions? Among members of the general population, experiential anomalies and appeal to paranormal explanations presumably spring from a common underlying personality profile. At this point the identity of such a personality factor must remain very much a matter of speculation, but surely the construct of schizotypal personality (e.g. see Claridge, 1997) should be given serious consideration in this context. That is, the presence of subclinical schizophrenic-like characteristics in the general population might well accommodate the joint occurrence of anomalous experiences (cf. Simmonds-Moore, 2009) and the inclination to interpret such experiences in paranormal terms (e.g. Irwin & Green, 1998–1999). The possibility that the dimension of schizotypal personality could provide a conceptual integration of many psychological characteristics of parapsychological experiences must nevertheless be the subject of a separate and more ambitious project.

The implications of the findings for each of the three sets of predictors now warrant attention. The observed relevance of dissociative tendencies to both anomalous experiences (Hypothesis 1) and paranormal attributions (Hypothesis 2) is consistent with a large body of earlier reports linking dissociative tendencies to both parapsychological experiences and paranormal beliefs. The dimension of psychological absorption has long been recognised to have a bearing on the incidence of parapsychological experiences (Irwin, 1985) and is confirmed here by the *post hoc* findings for the factor of Imaginative Involvement. The (*post hoc*) identification of the contribution of Dissociative Amnesia is somewhat novel; this dissociative behaviour is rather more pathological than is absorption, the most commonly reported dissociative correlate of

paranormal belief (French et al., 2008; Irwin, 1994; Rattet & Bursik, 2001; Wolfradt, 1997). Perhaps some type of dissociative amnesia is entailed in the avoidance of reality testing during the formation of paranormal beliefs. In any event this characteristic deserves closer attention in future studies of paranormal beliefs and parapsychological experiences.

The finding of a relationship between sensory-processing sensitivity and both anomalous experiences (Hypothesis 3) and paranormal attributions (Hypothesis 4) is a notable contribution to the parapsychological literature. Previous evidence of such links has been either sketchy or restricted to the context of apparitional and allied experiences (Houran et al., 2002; Jawer, 2006; Massullo, 2008), but it now seems that sensory-processing sensitivity may have a more encompassing relevance to parapsychological experiences. Further research is needed to ascertain whether the relationships with sensory-processing are founded on some unusual sensitivity to psi signals or on the more mundane hyperaesthesia, a high sensitivity to subtle environmental cues, as proposed by Houran et al. (2002), Rawcliffe (1959) and Thalbourne (2010).

Finally, both anomalous experiences (Hypothesis 5) and paranormal attributions (Hypothesis 6) were found to correlate with a measure of aberrant salience. Indeed, this variable elicited the strongest relationships of any of the predictive variables in this study and one of the strongest relationships for any individual correlate recorded in the literature on parapsychological experiences. Given independent observations of the mediational role of aberrant salience in the development of psychosis (e.g. Balzan et al., 2013; Cicero et al., 2013; Pol-etti & Sambataro, 2013) the present findings arguably reinforce the suggested association between parapsychological experiences and schizotypal processes. The authors strongly recommend further investigation of the contribution of aberrant salience to the psychological development of anomalous experiences and their interpretation in paranormal terms.

Some limitations of the study may be acknowledged. Our convenience sample may not have been representative of the population as a whole, and while there seems little reason for expecting a different pattern of results from a broader sample one should perhaps be hesitant to assume the generality of the findings. A further limitation is the incapability of the online survey platform to generate a counterbalanced order of questionnaires across the participants. Independent investigation with a different order of presentation would therefore be appropriate. In addition, the authors acknowledge that while the observed relationships are statistically significant, the effect sizes are small. Therefore the explanatory power of some of the predictors in this study should not be overstated. Finally, several of the measures used here are recently constructed and thus they may warrant further psychometric evaluation. Constructive replication of the study with alternative measures of the underlying constructs may be helpful.

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