Bial Report

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Contents

General Overview

This project[1] was comprised of two study phases.

Phase I explored the nature and composition of paranormal belief and evaluated the relationship between paranormal and anomalous beliefs. In addition to this, an investigation of the incidence/prevalence of paranormal experiences and their relationship with belief in the paranormal was undertaken.

Phase I:

- Examined the nature and structure of paranormal belief (compared a new developing measure with established, existing scales; Revised Paranormal Belief Scale and Australian Sheep Goat Scale);
- Explored the relationship between belief in the paranormal and paranormal experience(s); and
- Investigated the relationship between belief in the paranormal and anomalous/ unconventional beliefs (i.e., urban legends & conspiracies).

Phase II extended scale development and the findings of Phase I in two ways:

- The emerging paranormal measure was refined and subjected to further scrutiny; and
- Work on the relationship between belief in the paranormal and reality testing deficits was extended to include reasoning bias. Particularly, Phase II explored the degree to which believers in the paranormal demonstrate proneness to misrepresentation of chance and conjunction fallacy.

[1] The Scientific Panel approved Bial funding with the caveat that the project place less emphasis on schizotypy. Consistent with the request, the project refocused and concentrated on belief, experience and reality testing. Additionally, Phase II incorporated measures of reasoning; these afforded good publication opportunities and were pertinent to the area of research.

Phase I

Introduction

Phase I explored further the nature and composition of paranormal belief. Additionally, incidence of paranormal experience(s) and their relationship with paranormal and anomalous beliefs was investigated.

Phase I extended the work of Dagnall, Parker, Munley & Drinkwater (2010a) (Common Paranormal Belief Dimensions; a previous Bial funded project). The authors, noting continued debate surrounding the nature and structure of paranormal belief, investigated commonality (shared variance) between different (often-disparate) paranormal scales:

- Revised Paranormal Belief Scale (R-PBS) (Tobacyk & Milford, 1983; revised by Tobacyk, 1988; and Lange, Irwin, & Houran, 2000),
- Australian Sheep-Goat Scale (Thalbourne & Delin, 1993),
- Paranormal Short Inventory (PSI) (Randall, 1997),
- Manchester Metropolitan University Scale of Paranormal Belief (Foster, 2001, unpublished scale),
- Superstition Scale (Wiseman & Watt, 2004),
- Poltergeists and Hauntings Scale (Kumar & Pekala, 2001), and
- Extraterrestrial Life & UFO-Related Belief Scale (Chequers, Joseph, & Diduca, 1997).

Examination of the Poltergeists & Hauntings Scale and Extraterrestrial Life & UFO-Related Belief Scale, revealed that the measures considered only a limited range of associated phenomena. Hence, additional items were added to these scales. Consideration of common haunting reports and alien related experiences informed supplementary item generation, this ensured construct relevance and face validity.

When combined, the extant scales produced a 124 item composite measure, distributed both in paper form and electronically, via the internet. In total 1481 respondents completed the measure (538 the paper version and 933 online). Exploratory factor analysis (principal component analysis), revealed a nine-factor structure, containing item clusters measuring belief in Hauntings, Other Life, Superstition, Religious Belief, Alien Visitation, Extrasensory Perception (ESP), Psychokinesis (PK), Astrology, and Witchcraft.

Inspection of the emergent factors indicated that item clusters were conceptually coherent; composed of individual items clearly related to the factor label (face validity). Each factor possessed good internal reliability. The factors (with the exception of belief in the existence of life on other planets) demonstrated moderate to high inter-correlation, representing general belief in the paranormal. Belief in the existence of life on other planets produced only weak associations.

Dagnall, Parker, Munley, & Drinkwater (2010b) confirmed this finding; UFO-related beliefs were more highly correlated with paranormal beliefs than belief in extra-terrestrial life. Partial correlation, controlling for overlap between belief in extra-terrestrial life and UFO-related beliefs, found moderate positive correlations between UFO-related beliefs and paranormal beliefs, and weak negative correlations between belief in extra-terrestrial life and paranormal beliefs. Collectively, these findings indicated that only more extreme UFO-related beliefs were associated with paranormal belief. Hence, items assessing belief in extra-terrestrial life were not included within the current research project.

Overall, the Dagnall et al. (2010a) study suggested that the R-PBS, despite its breadth, failed to incorporate important facets of paranormal belief, such as (hauntings and alien visitation). In this context, Dagnall et al. (2010a) advocated the development of a broader measure of paranormal belief. The rationale being that alien/UFO related beliefs (*e.g.,* alien visitation and abduction share many of the features of paranormal beliefs (Lawrence, 1995a, Lawrence, 1995b). Such beliefs are unconventional, run contrary to existing scientific evidence, and are not, supported by prevailing scientific knowledge. Dagnall et al. (2010a) produced a potential structure for a revised measure of paranormal belief, which this project attempted to develop and extend further.

The principal aim of Phase I was to advance the research of Dagnall et al. (2010a, 2010b). Particularly, each paranormal subscale measure was refined; the clarity of each question was assessed, repetitions removed and item overlap reduced. Additionally, the extracted factors were composed of differing item numbers: Hauntings, 8 items; Superstition, 7 items; Religious Belief, 6 items; Alien Visitation, 8 items; ESP, 7 items; PK, 6 items; Astrology, 7 items; and Witchcraft, 3 items. To produce a balanced and representative set of subscales all eight factors were required to have eight items (the measure being composed of 64 items in

total). There are no fixed rules governing item number; within the present study, the authors attempted to balance construct breadth with the need to minimise response biases arising from boredom and fatigue (Hinkin, 1998; Schmitt & Stults, 1985). For each subscale, at least four items per scale were required to test homogeneity of variance within each latent construct (Billings & Nilan, 1985). The main concern was to retain a sufficiency of items after factor analysis and item analysis; typically, only 50% of created items feature within final scales (Hinkin, 1998). Thus, whilst measures with as few as three items can produce adequate internal consistencies (Cook, Hepworth, & Warr, 1981) more are required to tap construct breadth. In this context, Hinkin (1998) suggests four to six items for most constructs, with the final determination based upon accumulated construct evidence.

Thus, a further literature review was undertaken. Several relevant measures were found and these were considered alongside existing subscale items (astrology: Chico & Lorenzo-Seva, 2006; afterlife: Osarchuk & Tatz, 1973; superstition: Nixon, 1925; Luck: Drake & Freedman, 1997, Gilliland, 1930; ESP: Bhadra, 1966; belief in life after death: Thalbourne, 1996a; death transcendence: Van de Creek & Nye, 1993; & Witchcraft: Howe, 2005). Following item addition, subscale assessment ensured construct breadth. Finally, several subscale items were reverse/negatively worded.

Current measures of paranormal belief lack negatively keyed (reversed) items; there is a preponderance of positively worded statements, where endorsement indicates paranormal belief. Multiple positive items may incline respondents into a regularity of agreeing (or disagreeing) with scant reference or consideration to item content. Inclusion of a mixture of positive and negative items may discourage response bias (Furr, 2011). Indeed, psychometricians recommend reverse wording to prevent response biases (acquiescence, straight-line responding, etc.) (Baumgartner & Steenkamp, 2001; Churchill, 1979; Couch & Kenniston, 1960; Nunnally, 1978). Thus, within each finalised subscale there was a mixture of positive and reversed worded items.

The product of these amendments was the creation of a 64 item measure of paranormal belief (Manchester Metropolitan University New; MMU-N), containing eight subscales composed of eight items (a mixture of positive & reversed statements). To evaluate performance of the MMU-N (in Phase I) it was presented alongside the Revised Paranormal Belief Scale (R-

PBS) (Lange et al., 2000; Tobacyk, 1988; Tobacyk & Milford, 1983); and the Australian Sheep-Goat Scale (Thalbourne & Delin, 1993).

In addition to examining the nature and structure of paranormal belief, Phase I also investigated the relationship between paranormal experience(s) and belief. Paranormal experience relates to the first person experience of an event/occurrence attributed to a paranormal cause. Psychologists and parapsychologists have historically under researched this important area; the preponderance of work has centred on belief to the exclusion of experience. Indeed, since 1970, researchers outside the paranormal domain (e.g., sociologists and journalists) have undertaken the majority of projects examining psychic experiences and beliefs. Whilst, these studies have employed large representative samples, been conducted across a number of countries, and have produced informative data (Haraldsson & Houtkooper, 1991), there have been issues that restrict their usefulness. Firstly, studies have frequently used the terms belief and experience interchangeably. Secondly, experience studies have typically been merely descriptive.

For these reasons, studies have often failed to consider fully the relationship between paranormal experience and belief. Despite obvious and important differences between the terms 'belief' and 'experience' researchers have frequently obfuscated their meaning by using the words interchangeably (French & Wilson, 2006). Lack of semantic clarity has: a) proved theoretically problematic, and b) served to obscure the potentially important role that paranormal experience(s) plays in the development and maintenance of paranormal beliefs. Belief in the paranormal may arise directly from personal experience, or be informed by the reported experiences of others (French & Wilson, 2006). Whilst, it is intuitive and commonsensical to suggest that experience(s) influence level of belief, reciprocally believers may be more likely to label anomalous experiences as paranormal. Hence, the relationship between the two constructs requires disambiguation and elucidation. Indeed, several prominent studies have reported positive correlation between the two constructs (e.g., Blackmore, 1984).

Finally, there are a number of related beliefs that whilst, not paranormal may be associated with paranormal beliefs (e.g., endorsement of urban legends & conspiracy theories). These may arise from the same cognitive processes (Drinkwater, Dagnall, & Parker, 2012). Indeed, anomalous beliefs share several important features with paranormal beliefs (*cf*., Irwin's, 2009 definition of paranormality), such notions/theories/ideas are: generated within the non-scientific community, rarely subjected to scientific scrutiny, and frequently endorsed by people, who might normally be expected by their society to be capable of rational thought.

These unorthodox beliefs are important because they provide a bridge between parapsychology and anomalistic psychology. Anomalistic psychology studies extraordinary phenomena (behaviour and experience) without the supposition of 'paranormality' (French, 2001). Scientific models are used to elucidate unusual experiences; bizarre episodes being explained in terms of known psychological and physical factors. In contrast, the term paranormal experience refers to alleged experiences, which are currently beyond the understanding of conventional scientific theories. Confusion arises because strange experiences per se are not paranormal; although they are frequently mislabelled as such. Thus, Phase I examined the relationship between paranormal experiences, belief in the paranormal and anomalous beliefs.

Method

Respondents

In total 1215, participants completed the questionnaire. Ages ranged from 16 to 70 years, with a mean (*M*) of 25.13 and a standard deviation (*SD*) of 9.41; 75.7% (920) were female and 24.3% (295) were male. Female ages ranged from 16 – 67 years, *M* = 24.43, *SD* = 8.87; Males ages ranged from 17 – 70 years, *M* = 27.33 years, *SD* = 10.64. Of the total number of participants, 1093 participants (90%) completed the questionnaire in a paper-pencil form, whilst 122 (10%) completed a web based version of the questionnaire. Respondent recruitment occurred via a range of sources: undergraduate and postgraduate psychology classes, other undergraduate and postgraduate classes, through contacts at local colleges, and the wider population. Emails to staff and students at the university at MMU and posters placed around the university campus also advertised the study. Participation was voluntary and respondents could terminate their participation at any time during the study.

Materials

Phase I measures consisted of:

Extracted Paranormal Belief Factors (MMU-N)

Sixty-four item scale based on the eight paranormal factors extracted by Dagnall et al. (2010a; 2010b) (see description in background for more detail): Hauntings, Superstitions, Religious Belief, Alien Visitation, ESP, PK, Astrology and Witchcraft. Each subscale comprised eight items and contained a mixture of positive phrased and reversed items; reverse items were incorporated to reduce potential response bias (Price & Mueller, 1986). The authors considered the items carefully to ensure that reversed items would be interpreted appropriately (Hinkin, 1998). MMU-N items are presented as statements (e.g., "There is a devil" and "poltergeists exist"), which are measured on a seven point likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The subscales were conceptually coherent: possessed good face validity; being composed of individual items clearly related to the assigned factor label. In addition to this, the factors have demonstrated good to excellent external reliability (Dagnall et al., 2010a).

Revised Paranormal Belief Scale (R-PBS) (Tobacyk & Milford, 1983; revised by Tobacyk, 1988; and Lange, Irwin, & Houran, 2000)

This is a modified version of Tobacyk & Milford's (1983) Paranormal Belief Scale. The R-PBS is a self-report measure, which contains 26 questions measuring belief in seven facets of paranormal belief: Traditional Religious Belief, Psi Belief, Witchcraft, Spiritualism, Superstition, Extraordinary Life Forms, and Precognition. R-PBS items are presented as statements (e.g., "I believe in God" and "black magic really exists"), which are measured on a seven point likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Prior to analysis response scores were recoded (0-6) in line with Irwin (2009). Thus, final scores range from 0 to 156, with higher scores reflecting greater belief in the paranormal. As well as producing an overall score, the R-PBS produces individual scores for each of its seven facets.

Additionally, Lange et al. (2000) proposed an alternative two-factor solution comprising New Age Philosophy (NAP) and Traditional Paranormal Belief (TPB). NAP contains 11 items measuring belief in psi, reincarnation, altered states, and astrology, whilst the TPB assesses belief in concepts, such as the devil and witchcraft (Irwin, 2004). This factorial solution arose from a purification of the scale to correct for differential item functioning (age and gender bias). Recoding the scores in line with the Rasch scaling procedure (Andrich, 1988b) produces scores ranging from 6.85 to 47.72 on NAP and 11.16 to 43.24 on TPB.

Although, there has been debate about the nature and number of belief dimensions contained within the R-PBS (Lawrence, 1995a, 1995b, Lawrence, Roe, & Williams, 1997; Tobacyk, 1995a, Tobacyk, 1995b, Tobacyk & Thomas, 1997), the measure is conceptually and psychometrically satisfactory (Tobacyk, 2004). The R-PBS possesses adequate validity (Tobacyk, 1995a, 1995b, 2004) and good test-retest reliability (Tobayck, 2004).

Australian Sheep-Goat Scale (ASGS) (Thalbourne & Delin, 1993)

The ASGS measures belief in, and alleged experience of, the paranormal by focusing on the subset of core beliefs studied by parapsychology: extrasensory perception, psychokinesis, and life after death (Wiseman & Watt, 2006). The ASGS contains 18 items and participants are asked to respond in one of three ways: "False" (scored as zero), "?" (Don't know: scored as 1), and "True" (scored as 2). The ASGS has been Rasch scaled (Lange & Thalbourne, 2002) and possesses established reliability and validity (Thalbourne, 1995a).

Anomalous Beliefs (Urban Legends and Conspiracist Beliefs)

Urban Legends (Dagnall, Drinkwater, Parker, & Munley, 2010d; Fox Tree, & Wheldon, 2007)

Five items, derived from Dagnall et al. (2010d) and Fox Tree and Wheldon (2007), assessed belief in urban legends. These used the same 7-point likert scale as the R-PBS. Two items were reversed scored (*e.g.,* "when I hear urban legends I feel that they are untrue"). The urban legend items have previously demonstrated good internal reliability (Dagnall et al., 2010d).

Conspiracist Beliefs (Drinkwater, et al., 2012)

Five items assessed general belief in the veracity of conspiracy theories. These measured the degree to which respondents believe that conspiracy theories accurately depict real-life events and contain truthful information. Responses were measured on a 7- point Likert scale (1 indicated "strongly disagree" and 7 "strongly agree"). Low scores on these two scales suggest support for conspiracist beliefs, whilst high scores indicate endorsement of established accounts. Two reversed items control for response bias. This measure has previously shown acceptable internal reality (Drinkwater, et al., 2012).

Paranormal Experiences

Paranormal experiences were measured using an 18 item scale. First, respondents (using yes or no) indicated whether they "believe they have had a genuine paranormal experience". If they responded yes they then moved on to question 2, where a number of experiences were indicated (ESP, PK, witchcraft, OBE/NDE, haunting, contact/ communication with dead, UFO visitation, UFO sighting, astrological prediction, or other (indicate). Respondents who reported no experiences simply moved on to the next section of the questionnaire booklet.

For each experience category, respondents indicated yes or no. If respondents reported having had a particular experience they were asked to specify the frequency of occurrence, using a three point scale, where: 1 = single incident, 2 = occurred between 2 & 5 times and 3 = occurred more than 5 times. The final question asked whether respondents believed in the paranormal because of their experience(s). Responses on this item were measured on a 5 point likert scale (1 = definitely not, 2 = probably not, 3 = unsure, 4 = probably, and 5 = definitely.

Procedure

Instructions at the beginning of the questionnaire booklet informed respondents that the study was concerned with anomalous experiences and belief, and that there was no time limit for completing the questionnaire. For those who completed the online version all items were mandatory; participants could not move onto the next section without responding to every item on the page. At the end of the questionnaire, respondents were debriefed. All aspects of the study adhered to British Psychological Society (BPS) ethical guidelines.

Results

Paranormal Experience

The percentage of respondents reporting a paranormal experience was calculated. Overall, 42% of respondents reported having a paranormal experience. The most frequently reported experience was ESP 23%, and the least frequently reported was UFO visitation 1% (see table 1).

Table 1

Frequency of Respondents Reporting Paranormal Experience(s)

	Reported Experience	
Experience Type	Yes	No
ESP	281 (23%)	934 (77%)
PK	46 (4%)	1169 (96%)
Witchcraft	46 (4%)	1169 (96%)
NDE/OBE	111 (9%)	1104 (91%)
Haunting	167 (14%)	1048 (86%)
Contact with the Dead	156 (13%)	1059 (87%)
UFO Visitations	16 (1%)	1199 (99%)
UFO Sightings	60 (5%)	1155 (95%)
Astrology	185 (15%)	1030 (85%)
Other	54 (4%)	1161 (96%)
Experience	506 (42%)	709 (58%)

Looking at the reported frequency of experiences the majority of respondents reporting ESP (73%), Witchcraft (67%) and Haunting (69%) experiences claimed to have more than one experience. Reporting of PK (46% vs. 54%), Contact with the Dead (46% vs. 54%), and Astrology (44% vs. 56%), was more balanced with roughly equal proportions reporting single

vs. multiple experiences. The majority of respondents reporting NDE/OBE (63%), UFO visitation (62%) and UFO sightings (75%) reported only a single incidence (see table 2).

Table 2

Frequency of Paranormal Experience(s) (single incident, between 2-5 & more than 5)

		Experience Type		Breakdown of Multiple Experiences	
Experience Type	N	Single	Multiple	Between 2-5	More Than 5
ESP	281	77 (27%)	204 (73%)	131 (47%)	73 (26%)
PK	46	21 (46%)	25 (54%)	13 (28%)	12 (26%)
Witchcraft	46	15 (33%)	31 (67%)	18 (39%)	13 (28%)
NDE/OBE	111	70 (63%)	41 (37%)	30 (27%)	11 (10%)
Haunting	167	52 (31%)	115 (69%)	83 (50%)	32 (19%)
Contact with the Dead	156	71 (46%)	89 (54%)	61 (39%)	28 (15%)
UFO Visitations	16	10 (62%)	6 (38%)	3 (19%)	3 (19%)
UFO Sightings	60	45 (75%)	15 (25%)	10 (17%)	5 (8%)
Astrology	185	82 (44%)	103 (56%)	67 (36%)	36 (20%)
Other	54	25 (46%)	29 (54%)	16 (30%)	13 (24%)

Of the respondents claiming to have had an experience (n = 506), 43% report one experience (n = 218), whilst 57% (n = 288) report more than one experience. Within the multiple experience group, 94% (n = 270) identify between 2-5 experiences. Only 6% (n = 18) reported more than 5 experiences.

Finally, a Pearson's Product Moment correlation was conducted investigating the relationship between number of experiences reported and endorsement of the question, "Do you believe in the paranormal because of your experience(s)?" Number of experiences was positively correlated with question endorsement, r = .308, n = 506, p < .001; the higher the number of paranormal experiences the more respondents believed their experiences informed their belief in the paranormal.

Gender and Paranormal Experience

A similar proportion of males and females believed they had had a paranormal experience (males 41% vs. females 42%); chi-square test revealed no significant association between the reporting of paranormal experiences and gender, $\chi^2 = 0.102$, $df = 1$, $p = .749$. Similarly, males ($M = 0.92$, $SD = 1.48$) and females ($M = 0.93$, $SD = 1.44$) were found to report similar numbers of experiences, t (1213) = -0.112, $p = .911$, $d = .01$. A final analysis comparing the number of experiences reported by male ($M = 2.25$, $SD = 1.54$) and female ($M = 2.21$, $SD = 1.46$) experiencers also revealed no gender difference, t (1213) = 0.277, $p = .782$, $d = .03$.

The next series of analyses examined whether there were gender differences within experience type. There were gender differences for PK, UFO sightings and Astrology. A higher proportion of males reported PK experiences (6% vs. 3%), $\chi^2 = 4.928$, $df = 1$, $p = .026$; and UFO sighting (8% vs. 4%), $\chi^2 = 9.407$, $df = 1$, $p = .002$ than females. Females reported a higher proportion of astrological experiences (17% vs. 10%) than males, $\chi^2 = 8.244$, $df = 1$, $p = .004$.

There was no significant association between gender and reporting of several experience types (see table 3):

Extrasensory Perception (ESP), $\chi^2 = 0.270$, $df = 1$, $p = .549$;

Witchcraft, $\chi^2 = 0.055$, $df = 1$, $p = .682$;

NDE/OBE, $\chi^2 = 0.129$, $df = 1$, $p = .634$;

Haunting, $\chi^2 = 0.041$, $df = 1$, $p = 764$;

Contact with Dead, $\chi^2 = 3.517$, $df = 1$, $p = .061$;

UFO Visitation, $\chi^2 = 0.899$, $df = 1$, $p = .343$, and Other, $\chi^2 = 0.016$, $df = 1$, $p = .773$.

Table 3

Frequency of Respondents Reporting Paranormal Experience(s) by Gender

Experience Type	Gender		
	Male	Female	Overall
	(n = 120)	(n = 386)	(n = 506)
Experience	120 (41%)	386 (42%)	506 (42%)
ESP	72 (24%)	209 (23%)	281 (23%)
PK	18 (6%)	28 (3%)	46 (4%)
Witchcraft	10 (3%)	36 (4%)	46 (4%)
NDE/OBE	29 (10%)	82 (9%)	111 (9%)
Haunting	39 (13%)	128 (14%)	167 (14%)
Contact with the Dead	28 (9%)	128 (14%)	156 (13%)
UFO Visitations	6 (2%)	10 (1%)	16 (1%)
UFO Sightings	25 (8%)	35 (4%)	60 (5%)
Astrology	29 (10%)	156 (17%)	185 (15%)
Other	14 (5%)	40 (4%)	54 (4%)

Further chi-square tests examined whether there was an association between gender and reporting of multiple experiences (single vs. multiple experiencers). Analysis revealed no associations (significant effects) (see table 4):

ESP, male (26% vs. 74%) compared with female (28% vs. 72%), $\chi^2 = 0.005$, $df = 1$, $p = .944$;

PK, male (33% vs. 67%) compared with female (54% vs. 46%), $\chi^2 = 1.085$, $df = 1$, $p = .298$;

Witchcraft, male (10% vs. 90%) compared with female (39% vs. 61%), $\chi^2 = 1.803$, $df = 1$, $p = .179$;

OBE/NDE, male (52% vs. 48%) compared with female (67% vs. 33%), $\chi^2 = 1.558$, $df = 1$, $p = .212$;

Hauntings, male (36% vs. 64%) compared with female (30% vs. 70%), $\chi^2 = 0.287$, $df = 1$, $p = .592$;

Contact Dead, male (57% vs. 43%) compared with female (43% vs. 57%), $\chi^2 = 1.334$, $df = 1$, $p = .248$;

UFO/visit, male (33% vs. 67%) compared with female (80% vs. 20%), $\chi^2 = 1.778$, $df = 1$, $p = .182$[2];

UFO/sighting, male (60% vs. 40%) compared with female (86% vs. 14%), $\chi^2 = 3.863$, $df = 1$, $p = .049$[3];

Astrology, male (41% vs. 59%) compared with female (45% vs. 55%), $\chi^2 = .021$, $df = 1$, $p = .885$; and,

Other, male (71% vs. 29%) compared with female (38% vs. 62%), $\chi^2 = 3.534$, $df = 1$, $p = .060$.

Overall, the proportion of single vs. multiple experiencers was similar for male (42.5% vs. 57.5%) and female respondents (43% vs. 57%), $\chi^2 = 0.002$, $df = 1$, $p = .966$.

[2] Only 16 respondents reported having a UFO/Visitation experience (6 male vs. 10 female).

[3] Whilst the result for UFO/Sightings was significant, using the standard alpha level it falls short of the required value after correcting for multiple comparisons.

Table 4

Frequency of Paranormal Experience(s) (Single, 2-5 and more than 5) by Gender

	Male					Female					
		Experience Type		Breakdown of Multiple Experiences			Experience Type		Breakdown of Multiple Experiences		
Experience Type	N	Single	Multiple	Bewteen 2-5	More Than 5	N	Single	Multiple	Bewteen 2-5	More Than 5	Total
ESP	72	19 (26%)	53 (74%)	31 (43%)	22 (31%)	209	58 (28%)	151 (72%)	100 (48%)	51 (24%)	281
PK	18	6 (33%)	12 (67%)	8 (44%)	4 (22%)	28	15 (54%)	13 (46%)	5 (18%)	8 (29%)	46
Witchcraft	10	1 (10%)	9 (90%)	6 (60%)	3 (30%)	36	14 (39%)	22 (61%)	12 (33%)	10 (28%)	46
NDE/OBE	29	15 (52%)	14 (48%)	10 (34%)	4 (14%)	82	55 (67%)	27 (33%)	20 (24%)	7 (9%)	111
Haunting	39	14 (36%)	25 (64%)	19 (49%)	6 (15%)	128	38 (30%)	90 (70%)	64 (50%)	26 (20%)	167
Contact with the Dead	28	16 (57%)	12 (43%)	10 (36%)	2 (7%)	128	55 (43%)	73 (57%)	51 (41%)	22 (17%)	156
UFO Visitations	6	2 (33%)	4 (67%)	2 (33%)	2 (33%)	10	8 (80%)	2 (20%)	1 (10%)	1 (10%)	16
UFO Sightings	25	15 (60%)	10 (40%)	7 (28%)	3 (12%)	35	30 (86%	5 (14%)	3 (9%)	2 (6%)	60
Astrology	29	12 (41%)	17 (59%)	12 (41%)	5 (17%)	156	70 (45%)	86 (55%)	55 (35%)	31 (20%)	185
Other	14	10 (71%)	4 (29%)	1 (7)	3 (21%)	40	15 (38%)	25 (62%)	15 (38%)	10 (25%)	54

Finally, males (M = 3.14, SD = 1.15) and females (M = 3.29, SD = 1.16) endorsed the question "Do you believe in the paranormal because of your experience/s?" similarly, t (504) = -1.244, p = .214, d = .13.

Exploratory Factor Analysis

Exploration of the Adapted Paranormal Belief Measure Structure

Preliminary Analysis

Prior to conducting principal components analysis (PCA) the correctness of data on the adapted paranormal measure was established: the Kaiser-Mayer-Oklin value (.966) exceeded the recommended value of .6 (Kaiser, 1970, 1974); Bartlett's Test of Sphericity (Barlett, 1954) was significant (Chi-square, χ^2 = 45871.755, df = 2016, p < .001), and the correlation matrix contained numerous coefficients of .3 or above.

The subsequent principal components analysis (PCA) used oblique rotation. This method is preferred in circumstances where emergent factors are expected to correlate because oblique rotation methods (e.g., direct oblimin, quartimin & promax) render a more accurate, reproducible solution (Costello & Osborne, 2005); There is no widely preferred method of oblique rotation; all methods produce similar results (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

The initial PCA identified ten factors with eigenvalues greater than 1; accounting for 61.16% of the total variance. Inspection of the pattern matrix revealed that factors 9 and 10 lacked conceptual coherence and had several items loading above .3 on other factors.

Whilst, eigenvalues are a useful tool for identifying factors, researchers question their accuracy, arguing that eigenvalues are one of the least accurate methods for selecting the number of factors to retain (Velicer & Jackson, 1990). Hence, further analysis of the factorial structure was undertaken; examination of the scree slope was, and a Monte Carlo analysis. In conjunction, these methods indicated that an eight factor solution was apposite.

The eight factors were scrutinized: low-loading, cross-loading or freestanding items were removed. An item loading cut-off value of .45 was selected because it provides a good measure of a factor and produces a clean solution (Comrey & Lee, 1992).

Main Analysis

Responses to the remaining 47 items were analysed further by means of a second PCA (with oblique direct oblimin rotation): Kaiser-Mayer-Oklin value (.957) exceeded the recommended value of .6 (Kaiser, 1970, 1974); and Bartlett's Test of Sphericity (Barlett, 1954) was significant (Chi-square, $\chi^2 = 33050.227$, df = 1035, $p < .001$).

This PCA restricted the solution to 8 factors. The PCA accounted for 63.45% of the total variance. All emergent factors had eigenvalues exceeding 1 (see table 5):

Factor 1 (Haunting), eight items measuring belief in hauntings and communication with the dead; eigenvalue 15.55, accounted for 33.09% of the variance.

Factor 2 (Alien Visitation; ET), seven items assessing belief in extra-terrestrial visitations to earth including aliens landing on earth and abducting human beings (ET); eigenvalue of 3.58, accounted for 7.62% of the variance.

Factor 3 (Superstition), five items measuring superstitious beliefs; eigenvalue 3.09, accounted for 6.57% of the variance.

Factor 4 (PK), five items evaluating belief in psychokinesis; eigenvalue of 2.08, accounted for 4.43% of the variance.

Factor 5 (Religious Belief), seven items tapping into religious beliefs; eigenvalue of 1.79, accounting for 3.81% of the variance.

Factor 6 (Astrology), five items assessing belief in Astrology; eigenvalue of 1.54, accounted for 3.27% of the variance.

Factor 7 (ESP), five items measuring belief in extrasensory perception; eigenvalue of 1.15, accounted for 2.44% of the variance.

Factor 8 (Witchcraft) the final factor, was composed of five items evaluating belief in witchcraft; eigenvalue of 1.05, accounted for 2.23% of the variance.

Table 5

Principal Components and Factor Loadings for the MMU-N: New Paranormal Belief Measure (Factors 1- 4)

Q.	Factor item and number	Communalities	Component 1	2	3	4	5	6	7	8
No.	**Haunting (Factor 1) 8 Items**									
41	People have genuinely seen "ghosts" or "apparitions"	.704	.71							
49	Poltergeists exist	.729	.66							
33	Contrary to scientific belief, some people can make contact with the dead	.701	.64							
57	Ghosts/poltergeists can cause objects to move, appear (materialisation) or disappear (dematerialisation)	.714	.64							
17	Some places are haunted by the souls of people now dead	.727	.64							
9	Spirits of the dead can be seen by the living	.687	.64							
25 R	It is not possible to communicate with the spirit world	.584	.57							
1 R	Ghosts do not exist	.308	.51							
	Extra Terrestrial (Factor 2) 7 Items									
48	Alien crafts regularly visit earth	.774		-.83						
40 R	Alien spaceships have not crash landed on earth	.642		-.80						
16	Extra-terrestrials have visited earth throughout history	.671		-.78						
8	Unidentified Flying Objects (UFOs) suggest that some kind of extra-terrestrial life form has approached the surface of the Earth	.664		-.78						
56	People have been taken on board alien spaceships	.698		-.76						
24	Alien intelligence is responsible for some UFO sightings	.696		-.76						
64	Aliens are abducting human beings	.688		-.73						
	Superstition (Factor 3) 5 Items									
26	I do say 'touch wood' or actually touch wood to promote good luck	.647			.80					
34	I do say 'fingers crossed' or actually cross my fingers to promote good luck	.642			.78					
10	If you break a mirror, you will have bad luck	.681			.76					
2	I have avoided walking under a ladder because it is associated with bad luck	.589			.75					
18	The number "13" is unlucky	.546			.66					
	Pk (Factor 4) 5 Items									
45	A person's thoughts can influence the movement of a physical object	.711				.82				
13	People are able to bend metal objects simply by thinking about it (psychokinesis)	.588				.74				
61	In spite of the laws of science, some people can use their psychic powers to levitate objects	.722				.73				
53	I believe in the existence of psychokinesis, that is, the direct influence of mind on a physical system, without the mediation of any known physical energy	.630				.66				
21	The mind can be used to control the outcome of a random process (e.g., dice rolling or coin tossing)	.600				.62				

(Nb: Items represented by the letter **'R'** relate to reversed/negatively worded values)

Table 5

Principal Components and Factor Loadings for the MMU-N: New Paranormal Belief Measure (Factors 5 - 8)

Q.	Factor item and number	Communalities	Component 1	2	3	4	5	6	7	8
No.	**Religious Belief (Factor 5) 7 Items**									
11	There is a heaven and a hell	.806					.89			
3	I believe in God	.712					.85			
19	There is a devil	.741					.82			
35	There is no such thing as an afterlife	.653					.56			
43	The soul continues to exist after the death of the body	.658					.55			
51	We will never be reunited with deceased friends and relatives	.515					.52			
59	Earthly existence is the only existence we have.	.491					.47			
	Astrology (Factor 6) 5 Items									
30	A person's future has nothing to do with their zodiac sign	.648						.73		
54	Astrology can not be used to accurately predict the future	.523						.64		
38	It is not possible for planetary forces to control personality traits	.559						.64		
14	Astrological predictions, which come true are the result of coincidence	.573						.63		
62	Horoscopes prepared by qualified experts can accurately predict the future	.592						.42		
	ESP (Factor 7) 5 Items									
4	It is possible for people to know about the outcome of an event before it happens	.573							.63	
20	Some people have visions of the future which come true	.678							.60	
44	People have hunches that come true and are not just coincidences	.570							.53	
12	When dreams seem to foretell the future, it is just a coincidence	.509							.52	
28	Telepathy (mental communication) between two people is not possible	.461							.48	
	Witchcraft (Factor 8) 5 Items									
23	Witches/warlocks can actually curse/cast spells	.711								.75
47	There are actual cases of witchcraft	.695								.72
55	Black magic really exists and should be dealt with in a serious manner	.659								.67
39	Witches/warlocks who can perform genuine acts of magic exist outside the realm of imagination	.468								.64
63	Through the use of mysterious formulas and incantations it is possible to cast spells.	.682								.60

(Nb: Items represented by the letter **'R'** relate to reversed/negatively worded values)

Consideration of Emergent Factors

Each of the emergent factors was coherent, possessed conceptual clarity and demonstrated good to excellent internal reliability (see table 6).

Table 6

Descriptive Statistics Paranormal Belief (New Measure) Factors

Factor	Mean	SD	α
Haunting	3.95	1.51	0.91
ET	2.92	1.35	0.91
Superstition	3.93	1.58	0.83
PK	2.63	1.28	0.87
Religion	4.28	1.50	0.88
Astrology	3.11	1.33	0.81
ESP	4.27	1.29	0.79
Witchcraft	2.90	1.38	0.85
MMU-N	3.54	1.01	0.95

Pearson's Product Moment correlation revealed significant inter-factor correlations (see table 7). The majority of correlations were in the moderate to strong category, .30 to .69. Correlations between Superstition and ET (r = .20), Religious Belief & ET(r = .23), and PK & Superstition (r = .25) were in the weak range .20 to .29. Negligible correlations were observed between Witchcraft & Superstition (r = .17) and Religious Belief & Superstition (r = .18)

Table 7

Factor Descriptive Statistics

	1.	2.	3.	4.	5.	6.	7.	8.
1 . Haunting								
2 . ET	.51**							
3 . Superstition	.40**	.20**						
4 . PK	.58**	.50**	.25**					
5 . Religion	.53**	.23**	.18**	.39**				
6 . Astrology	.57**	.39**	.41**	.57**	.40**			
7 . ESP	.68**	.41**	.30**	.57**	.51**	.56**		
8 . Witchcraft	.58**	.48**	.17**	.64**	.48**	.47**	.52**	

** $p < .001$

Factors and Gender

Tests of Difference

One-way between-groups multivariate analysis of variance (MANOVA) was performed, examining gender differences across paranormal factors (Haunting, ET, Superstition, PK, Religious Belief, Astrology, ESP &Witchcraft).

A significant difference was observed for gender, $F(8, 1206) = 18.479$, $p < .001$; Wilks' Lambda =.891; $\eta p^2 = .1.09$. Females ($M = 3.63$, $SD = 0.98$) scored higher on the MMU-N than males ($M = 3.24$, $SD = 1.07$). Differences on each of the dependent variables were significant.

Females scored significantly higher than males on several subscales (see table 8):
Haunting ($M = 4.13$, $SD = 1.46$ vs. $M = 3.41$, $SD = 1.51$),
Superstition ($M = 4.12$, $SD = 1.59$ vs. $M = 3.33$, $SD = 1.42$),
PK ($M = 2.68$, $SD = 1.25$ vs. $M = 2.47$, $SD = 1.34$),
Religious Belief ($M = 4.40$, $SD = 1.45$ vs. $M = 3.89$, $SD = 1.60$),
Astrology ($M = 3.21$, $SD = 1.30$ vs. $M = 2.81$, $SD = 1.35$),
ESP ($M = 4.37$, $SD = 1.25$ vs. $M = 3.96$, $SD = 1.36$), and
Witchcraft ($M = 2.98$, $SD = 1.35$ vs. $M = 2.62$, $SD = 1.42$).

Males scored significantly higher on ET Belief than females ($M = 3.09$, $SD = 1.45$ vs. $M = 2.87$, $SD = 1.31$)[4].

[4] The established paranormal belief and anomalous beliefs measures also demonstrated gender difference; the MMU-N findings were consistent with these.

Table 8

Gender Differences on Paranormal Belief Subscales

	Gender							
	Male		Female					
	M	*SD*	*M*	*SD*				
Factor	(n = 295)		(n = 920)		*F*	df	*p*	*ηp2*
Haunting	3.41	1.51	4.13	1.46	53.18	1, 1213	<.001	.04
ET	3.09	1.45	2.87	1.31	6.27	1, 1213	=.012	.01
Superstition	3.33	1.42	4.12	1.59	58.26	1, 1213	<.001	.05
PK	2.47	1.34	2.68	1.25	6.11	1, 1213	=.014	.01
Religion	3.89	1.60	4.40	1.45	26.26	1, 1213	<.001	.02
Astrology	2.81	1.35	3.21	1.30	21.29	1, 1213	<.001	.02
ESP	3.96	1.36	4.37	1.25	22.87	1, 1213	<.001	.02
Witchcraft	2.62	1.42	2.98	1.35	15.56	1, 1213	<.001	.01

Cohen (1988) suggested that partial ηp^2 effects be interpreted using the following rule of thumb: values between .01-.06 reflect a small effect size, values within the .06–.13 range a medium effect size, and a value of .14 or higher indicates a large effect

Relationship between New Scale, Existing Scales, Anomalistic Beliefs and Paranormal Experience

Internal reliability of established paranormal belief measures (RPBS & ASGS) and anomalous belief scales (Conspiracies and Urban Legends) was assessed using Cronbach's alpha (α). All measures demonstrated good (approximately .8 to .9) to excellent (.9 and above) internal reliability (see table 9).

Table 9

Descriptives for Experience, Established Paranormal Belief Measures and Anomalous Beliefs (Conspiracies and Urban Legends)

Factor	Mean	SD	*a*
Experience	0.92	1.45	
MMU-N	166.22	47.65	.90
RPBS	55.15	28.48	.78
NAP	21.58	5.17	.87
TBP	22.49	5.15	.81
ASGS	9.07	7.08	.96
Urban Legends	20.94	6.30	.95
Conspiracies	18.69	5.52	.89

Pearson's Product Moment correlations explored relationships between variables (see table 10).

Table 10

Inter-correlations Experience, Established Paranormal Belief Measures and Anomalous Beliefs

		1.	2.	3.	4.	5.	6.	7.	8.
1.	Experience								
2.	MMU-N	.43**							
3.	RPBS	.39**	.88**						
4.	NAP	.34**	.80**	.87**					
5.	TBP	.31**	.75**	.83**	.72**				
6.	ASGS	.53**	.68**	.68**	.65**	.54**			
7.	Urban Legends	.21**	.43**	.43**	.38**	.37**	.35**		
8.	Conspiracies	.21**	.48**	.44**	.44**	.39**	.36**	.37**	

** $p < .001$

Number of experiences correlated with level of paranormal belief (MMU-N, RPBS & ASGS) and endorsement of anomalous beliefs (conspiracies and urban legends). Additionally, there was a positive correlation between the anomalous belief measures (Conspiracies and Urban Legends). Finally, MMU-N correlated with established measures of paranormal belief RPBS (NAP and TPB) & ASGS and anomalous beliefs (see table 11).

Table 11

Correlations MMU-N Subscales and Established Paranormal Belief Measures

	RPBS	NAP	TBP	ASGS
Haunting	.72**	.67**	.58**	.58**
ET	.52**	.46**	.38**	.44**
Superstition	.41**	.35**	.23**	.24**
PK	.71**	.68**	.56**	.64**
Religion	.67**	.52**	.74**	.37**
Astrology	.66**	.64**	.49**	.52**
ESP	.67**	.68**	.60**	.67**
Witchcraft	.73**	.62**	.72**	.53**

** $p < .001$

MMU-N Subscales and Anomalous Belief Measures (Conspiracies and Urban Legends)

For completeness, Pearson's Product Moment correlation examined relationships between MMU-N subscales and anomalous belief measures (conspiracies and urban legends) (see table 12).

Table 12

Correlations MMU-N Subscales and Anomalous Belief Measures (Conspiracies and Urban Legends)

	Conspiracies	Urban Legends
Haunting	.41**	.34**
ET	.37**	.26**
Superstition	.16**	.24**
PK	.32**	.33**
Religion	.33**	.29**
Astrology	.40**	.40**
ESP	.39**	.33**
Witchcraft	.38**	.34**

** $p < .001$

MMU-N subscales and anomalous belief measures correlated significantly. This finding demonstrated that MMU-N facets were associated with endorsement of conspiracy theories and urban legends.

An examination of individual item and subscale information appears in the appendices (Scale Development and Analysis, page 87).

Discussion

Within the present study, 42% of respondents reported a paranormal experience. The most frequently reported experience was ESP (23%) and the least commonly reported was UFO visitation 1%. Considering the experiences in more detail: Astrology (15%), Hauntings (14%), Contact with Dead (13%) and NDE/OBE (9%) were commonly reported experiences. In contrast, less commonly experienced were: UFO sighting (5%), PK (4%), Witchcraft (4%), and Other (4%). Whilst, percentages for less commonly reported experiences appear relatively low, it is worth noting a large sample was recruited (1215 respondents). Hence, the percentages represent a significant number of experiencers. For example, UFO visitations (1%), represents 16 respondents. This indicates that not only are paranormal experiences common, but that people perceive a range of paranormal phenomena.

Interestingly, a significant percentage of experiencers reported multiple experiences. In the case of ESP (73%), Hauntings (69%) and Witchcraft (67%) the majority of experiencers reported more than one experience. Approximately equal percentages of respondents reported single vs. multiple experiences for PK (46% vs. 54%), Contact with Dead (46% vs. 54%), and Astrology (44% vs. 56%). In the case of Other (96%), UFO sighting (75%), NDE/OBE (63%), and UFO visitation (62%) the majority of experiencers reported single instances. Considering multiple experiences, overall 94% reported 2-5 experiences and only 6% more than 5 experiences. The number of experiences reported correlated with degree to which respondents believed their experiences influenced their belief in the paranormal.

Similar percentages of males (41%) and females (42%) reported having paranormal experiences. Comparison with each paranormal experience type revealed differences on PK, UFO sightings and Astrology. A higher percentage of males reported PK (6% vs. 3%) and UFO sighting (8% vs. 4%) than females, a higher percentage of females reported Astrological experiences (17% vs. 10%) than males. There were no gender differences on ESP, Witchcraft, NDE/OBE, Hauntings, Contact with Dead, UFO Visitation and Other. With regard to single vs. multiple experiences, no gender differences were observed on experience type, or overall experiences.

It would be useful to evaluate the current findings in the context of those produced by Haraldsson and Houtkooper (1991) in their classic study. Haraldsson and Houtkooper (1991), interviewed participants from 13 European countries and from the United States, in total 18,607 participants took part. Respondents completed the European Value Systems Study Group (EVSSG) questionnaire, which consisted of 120 items measuring six domains: leisure, work, family life, meaning and purpose of life, contemporary social issues and demographic characteristics. Pertinently, the meaning of life component contained four items assessing paranormal experiences; these items originated from a survey, 'The ultimate Values of the American Population', undertaken by McCready and Greeley (1976). Haraldsson and Houtkooper (1991) analysed three items: communication with someone far away (telepathy), seeing distant events (clairvoyance), and closeness to someone who has died (contact with dead).

The results provided a number of interesting findings. The percentage of respondents reporting paranormal experiences was considerably higher in the United States than in Europe. Within the U.S. sample, 54% reported telepathy, 25% clairvoyance and 30% contact with the dead (compared to 34%, 25% and 21% respectively within the European sample). Interestingly, significant variations were noted across European countries: telepathy ranged between 41% (Italy) to 15% (Denmark); clairvoyance ranged from 39% (Italy) to 7% (Iceland, Norway & Sweden); and contact with dead ranged from 41% (Iceland) to 9% (Norway). Thus, nationality influenced the degree to which participants reported paranormal experiences. Within the present study 23%, reported ESP related experience and 13% contact with dead. In a recent study of 392 first year undergraduates in Argentina, Montanelli and Parra (2008) noted that a high percentage of respondents reported paranormal experiences (e.g., 66% ESP & 51% telepathy); the study noted a high percentage of multiple experiences.

A significant percentage of respondents in both Europe (46%) and the U.S. (60%) reported at least one type of paranormal experience. This corresponds with the figure of 42% obtained within this current study. Of those reporting paranormal experiences, a substantial percentage (49% Europe & 47% U.S.) claimed to experience just one type of experience; only 8% and 11% respectively reported having all three categories of experience. Our results found that 43% of experiencers reported only a single incident. This figure does not markedly differ from that obtained by Haraldsson and Houtkooper (1991). In both Europe and the U.S., more

women reported telepathic and contact with dead experiences than men; only a slight difference was observed for clairvoyance. In the present study, there were few gender differences; women reported more experiences related to Astrology, and fewer PK and UFO sighting experiences.

Whilst comparisons with previous research usefully serve to contextualise the results, they require cautious interpretation. Firstly, studies have used different questions to assess experience. For example, the Haraldsson and Houtkooper (1991) questions assessing telepathy and clairvoyance only touch on aspects of ESP; ESP is a broad term, which encompasses a range of other phenomena such as, precognition and remote viewing. Secondly, the type and wording of questions may influence reporting of paranormal experiences (Haraldsson & Houtkooper, 1991). Finally, perception and reporting of experiences will vary as a function of both culture and time period (Gergen, 1973). For example, Zangari and Machado (1996) reported that 90% of their sample (181 Brazilian university students) claimed to have had at least one parapsychological experience. Noting these concerns, the authors believe that figures produced in the current study provide an adequate estimation of interpretation of paranormal experience. The current work indicates that significant numbers of respondents claim paranormal experience and as such, that these experiences are an important feature of people's lives.

For this reason, future studies may wish to extend further the study of paranormal experiences. The present survey considered only the frequency of experiences; failed to account for the potential impact of experiences on the individual. This is an important area, which has been under researched (Montanelli & Parra, 2008). Previous related work produced mixed results (i.e., reports of negative and positive effects). Considering negative affects first, Montanelli and Parra (2008) noted that 13.8% of their sample perceived ESP dreams to be very disturbing. On occasion, experiences have produced uncomfortable negatives reactions, which have resulted in percipients seeking assistance/counselling (Hastings, 1983). Siegel (1986) identified common reaction patterns in such individuals: fear, sense of responsibility toward another, feeling divine, specially gifted, and the desire to develop abilities. Contrastingly, associations between paranormal experiences and an increased sense of well-being have been reported (Kennedy & Kanthamani, 1995). Particularly, near-death experiences (NDEs) have frequently induced positive changes in

people (Ring, 1984). Despite this research, there have been few studies examining the effects of psychic experiences on peoples' lives (McClenon, 1994).

Another advancement to consider is to recognise the distinction between proneness to anomalous experiences and a willingness to use paranormal interpretations; when a person reports a parapsychological experience they are in fact reporting two occurrences: that of an anomalous or seemingly inexplicable event, and their interpretation of this event in paranormal terms (H. Irwin, personal communication April 19, 2012). Future work could develop measures to recognise this.

Principal components analysis (PCA) reduced the original 64 items to 47. The remaining items produced eight coherent factors: Hauntings, eight items; Alien Visitation (ET), seven items; Superstition, five items; Psychokinesis (PK), five items; Religious Beliefs, seven items; Astrology, five items; ESP, five items; and Witchcraft, five items. Each factor was coherent, possessed conceptual clarity and demonstrated good to excellent internal reliability. The majority of inter-factor correlations were in the moderate to strong category (.30 to .69). Correlations between Superstition and ET, Religious Belief & ET and PK & Superstition were in the weak range (.20 to .29). There were negligible correlations between Witchcraft & Superstition and Religious Belief & Superstition. Overall, the scale possessed excellent internal reliability. The MMU-N overall and subscales correlated positively with established measures of paranormal belief (RPBS & ASGS) and anomalous beliefs (endorsement of urban legends & conspiratorial beliefs).

These findings provide support for Dagnall et al.'s (2010a) contention that important facets of paranormal belief not featured in the R-PBS and ASGS, such as (hauntings and alien visitation), should be assessed alongside traditional facets of paranormal belief (ESP, PK, *etc*.). This study also reproduced the factorial structure outlined by Dagnall et al. (2010a); the same coherent and internally reliable paranormal facets emerged. The MMU-N correlated highly with the existing measures of paranormal belief, but conveyed greater construct breadth. One of the objectives of the present study was to develop the MMU-N structure in such a way to create a measure composed of stable subscales. That is, subscales measuring a range of beliefs related to the individual facet, containing equal numbers of items and being composed of a balance of standard vs. reversed items. In this respect, the present study was

not wholly successful because the addition of items to achieve these goals did not produce the expected outcome.

The PCA resulted in the loss of 17 items; several reversed items alongside items sharing erroneous/spurious variance. Erroneous in this context, refers to items with unexpected commonality. For example, the ESP and Astrology factors lacked stability because both tapped into the notion of future events. Precognition involves perceiving forthcoming situations and circumstances, whilst astrology seeks to predict future events. Theoretically, ESP and astrology represent different aspects of paranormality, however, by virtue of shared terminology (such as predict and future) the constructs correlate highly. This is a problem with factor analytical solutions based on inter-item correlations; items producing high correlations group, and resemble a single factor. Solutions may be statistically sound, but theoretically illogical, thus caution is required when interpreting factor structures as substantive dimensions (Guildford, 1954). Of course, it is possible to write questions in a manner that merely uses the term precognition, however, items containing technical terms without definition/and or qualification will be difficult to for the uninitiated to comprehend; a problem especially likely to occur when a scale is used with large, general samples. A detailed discussion of the MMU-N's psychometric properties appears in the general discussion later.

Results obtained using the MMU-N was similar to those obtained with established paranormal measures (R-PBS & ASGS). Particularly, gender differences were consistent across paranormal measures. In the case of the MMU-N, gender analysis revealed that women overall scored higher than males. Females scored higher than males on Hauntings, Superstition, PK, Religious Belief, Astrology, ESP, and Witchcraft. Males scored higher on ET. Additionally, consideration of correlation patterns between the established paranormal measures, number of experiences and anomalous beliefs (conspiracies & urban legends) revealed similar results to those obtained with the MMU-N.

Overall, the MMU-N performed similarly to the established measures suggesting that it has some merit and potential. Certainly, the fact that the MMU-N contains discrete subscales is a major advantage, not inherent within the ASGS and R-PBS. The ASGS measures only the core facets of paranormal belief (ESP, PK & life after death), whilst the R-PBS contains

brief, narrow and restrictive subscales. For example, there is only vague reference to important areas, such as astrology and hauntings. Researchers wishing to measure these facets would be unable to do so using either the ASGS or R-PBS. Thus, the potential strength of the MMU-N is it provides a number of independent but related subscales.

Finally, Phase I supported previous research reporting correlations between paranormal and anomalous beliefs (i.e., urban legends, Dagnall et al., 2010d; & conspiracy theories, Drinkwater et al., 2012). Anomalous in this context, refers to subjective views generated and maintained without recourse to prevailing evidence. Such beliefs arise in part from the failure to appraise critically data (in terms of both source & content). The association between anomalous and paranormal beliefs is not surprising because they share important features. Particularly, referring to Irwin's (2009) definition of paranormality, anomalous beliefs by their very nature, are rarely subjected to scientific scrutiny, they are generated within the non-scientific community, and are extensively endorsed by people, who might normally be expected by their society to be capable of rational thought.

Similarly, this may also apply to other realms of belief, such as those related to pseudoscience (lenitive properties of alternative medicines, benefits of feng shui, effectiveness of neuro-linguist processing, etc.). Research into factors effecting the endorsement of publically available information is important because findings may provide insights into endorsement of socially important media (e.g., public information; i.e., health campaigns; government messages/briefings, i.e., global warming; and news stories). In the context of the present study, not only were paranormal and anomalous beliefs correlated, but so were anomalous beliefs (urban legends & conspiracies). This suggests a tendency, proneness to endorse unconventional/unorthodox beliefs generally. Clearly, more research in this area is required to determine the extent to which non-critical endorsement of information is a general feature of human reasoning.

Phase II

Introduction

Phase II had three principle aims: test and refine the MMU-N (presented in Phase I); assess the extent to which belief in the paranormal can be explained by reality testing deficits (Irwin, 2004); and examine the relationship between paranormal belief, reality testing and reasoning bias (Dagnall, Munley, & Parker, 2007; Rogers, Davis, & Fisk, 2009, Rogers, Fisk, & Wiltshire, 2011).

It is important to research paranormal beliefs because they are common and widely held within modern society (Diaz-Vilela & Alvarez-Gonzalez, 2004; Gallup & Newport, 1991; Musella, 2005; Newport & Strausberg, 2001). Critics have questioned the existence of ‘‘true’’ paranormal phenomena (Bressan, 2002; Stanovich, 2004), several pointing out that such happening/events are largely incompatible with current theories of physics (Musch & Ehrenberg, 2002). Consequently, researchers favour every day, orthodox explanation(s) (i.e., those based on misperception and misinterpretation (Houran & Lange, 1996; Lange & Houran, 1997). Indeed, myriad studies have focused upon probability misjudgement theory and reasoning bias (Blackmore & Troscianko, 1985; Bressan, 2002, Brugger, Landis, & Regard, 1990, Brugger & Taylor, 2003). The present study develops and expands works in this area.

Several studies have noted potential overlap between psychopathology correlates and anomalous/paranormal beliefs. Langdon and Coltheart (2000) contend that pathological beliefs/delusions arise (in part) from the failure to test adequately hypothetical explanations of sensory experience. This notion has been applied to the development and maintenance of paranormal beliefs; it has been argued that believers accept paranormal explanations as valid because they fail to subject them to rigorous, critical evaluation (Goode, 2000; Irwin, 2004, 2009; Zusne & Jones, 1982). Indeed, Irwin, Dagnall, & Drinkwater (2012a) found emotion-based reasoning predicted level of paranormal belief; respondents endorsed paranormal beliefs because of their emotional, rather than rational appeal (Sappington, 1990). Whilst, delusions and paranormal beliefs share common features (i.e., persistence & resistance to counterargument) it is important to note that they are not mutually exclusive (Irwin, Dagnall,

& Drinkwater, 2012b). For example, psychotic delusions are typically, considered false, whilst the falsity of paranormal beliefs remains unresolved (Irwin et al., 2012a).

Furthermore, it is not possible to endorse all paranormal beliefs with absolute certainty. Moreover, they differ at least qualitatively from psychotic delusions. Certainly, paranormal beliefs deviate significantly from the symptoms of psychotic delusions as represented by clinical measures (DSM-IV-TR; American Psychiatric Association, 2000). For these reasons, Irwin et al. (2012b) argue that paranormal beliefs should be reformulated/viewed as nonpsychotic delusions; delusions being viewed as beliefs endorsed without sufficient justificatory evidence (Coltheart, Langdon, & McKay, 2010). These beliefs may serve an adaptive function; act as a coping mechanism.

Pertinently, features associated with delusional thinking (i.e., the tendency to form conclusions from limited/restricted information, and the failure to assess critically hypotheses) are likely to foster the development of and adherence to unorthodox beliefs (e.g., alien abduction, belief in conspiracy theories). Thence, the information processing style of believers may predispose them to accept less credible (paranormal) explanations as plausible. Indeed, several studies have found belief in the paranormal to be associated with reality testing deficits (Irwin, 2004, 2009).

Reality testing refers to the inclination to test critically the logical plausibility of beliefs (Irwin, 2004). Reality-testing deficits bias individuals away from analytical/rational processing towards intuitive-experiential interpretations of anomalous events. Such subjective interpretations are likely to facilitate the generation of nonconventional (paranormal) explanations, and reinforce pre-existing paranormal beliefs. Once advanced the failure to subject subsequent evidence to scrutiny propagates personal hypotheses. In this context, paranormal beliefs are formed/maintained because individuals fail to test rigorously self-generated explanations of the world (Irwin, 2004, 2009). That is, consider them in the context of independent, objective, empirical evidence. The point is not that reasoning errors occur, but that in the case of ardent believers, intuitive-experiential processing is likely to be the predominant or preferred information processing style. This may explain why paranormal and pseudoscientific beliefs are frequently associated with a tendency to favour the intuitive experiential style (Lindeman, 1998). Such propensity may explain the reported finding that

believers (vs. non-believers) in the paranormal perform significantly less well on objective reasoning tasks.

Moreover, previous work notes that believers in the paranormal are more susceptible to cognitive and perceptual biases (French & Wilson, 2007). Such biases may inhibit performance on certain reasoning tasks and could play an important role in the development and maintenance of belief in the paranormal (French, 1992). Principally, poor comprehension of probability (Musch & Ehrenberg, 2002; Stuart-Hamilton, Nayak, & Priest, 2006), particularly misrepresentation of chance events (i.e., coincidence; misperception of randomness) (Bressan, 2002), has been found to be higher in believers than non-believers (Dagnall et al., 2007). Thus, percipients of paranormal events may incorrectly attribute chance happenings to paranormal causes (Blackmore & Troscianko, 1985). Other unrelated problem-solving tasks (e.g., base rate estimation) do not consistently appear to be subject to such bias. These findings suggest that belief in the paranormal may arise from specific reasoning deficits related to misrepresentation of chance rather than general cognitive ability.

Dagnall, Munley and Parker (2007)

Dagnall et al. (2007) noted that previous research investigating probabilistic reasoning errors and belief in the paranormal assessed only a limited number of types of probabilistic reasoning problem; those assessing judgements of randomness, or appreciation of the impact of sample size on distribution of cases to categories (e.g., Kahneman & Tversky, 1972: maternity ward problem).

Dagnall et al. (2007) examined whether misrepresentation of chance (perception of randomness), rather than a general weakness in probabilistic reasoning was linked to belief in the paranormal. Their study presented participants with a 17-item test composed of questions assessing a range of probabilistic reasoning tasks: perception of randomness (e.g., 'Imagine a coin was tossed six times. Which pattern of results do you think is most likely?'), 5 items; base rate, (e.g., 'You go to a party where there are 100 men, 70 of the men are Psychologists and 30 are Engineers. Before being introduced to each man you are given a short personality description of him – What is the probability that Dick is an Engineer?'), (4 items); conjunction fallacy, (e.g., 'Two football teams (Team A and Team B) are playing in a local derby. What is the most likely outcome of the game?'), (4 items); and derivation of expected

value, (e.g., Expected value problems presented participants with a choice to buy 1 of 2 lottery tickets with different odds and pay-outs or the opportunity to retain the stake), (4 items). Alongside the probabilistic reasoning tasks, participants completed the Revised Paranormal belief Scale (R-PBS) (Tobacyk, 2004). In total, ninety-six participants took part in the study; the sample being composed of first year freshman (full/part-time) undergraduate students enrolled on a Psychology programme.

Perception of randomness predicted paranormal belief. Similarly, participants scoring above the median (on belief in the paranormal) performed worse on the perception of randomness problems. Subsequently, the authors concluded that belief in the paranormal did not arise from a general weakness in probabilistic reasoning, but was associated with a specific deficit related to the misrepresentation of chance (misperception of randomness).

Rogers et. al. (2009) noted that previous research had typically reported believers in the paranormal to be poor at judging probability; a tendency towards misperceiving randomness (Blackmore & Troscianko, 1985; Bressan, 2002; Dagnall et al, 2007). Despite this wealth of research, Rogers et al. (2009) noted that no one had systematically examined whether believers were more susceptible to conjunction fallacy; the misperception that co-occurring events (simultaneously presented constituent events) are more likely to occur than single (constituent) events. Put more precisely, conjunction is a type of formal fallacy, an error in a deductive argument, which is evident via examination of an argument's overall structure. A formal fallacy may appear to be a valid logical argument because it contains at least one true premise; the defect in reasoning arises from the erroneously formed conclusion.

Rogers et al. (2009) examined paranormal believers' susceptibility to conjunction fallacy by constructing a Scenario Judgements Questionnaire (SJQ). The SJQ featured 16 conjunction vignettes, each approximately 40 words in length, equally divided into paranormal (e.g., alleged precognition, apparitional experience) vs. non-paranormal (e.g., getting food poisoning, queuing for airport coffee) events. For example, one paranormal scenario stated: 'Billy has a long lost friend who he hasn't seen in years. They were good friends in school but drifted apart when they went away to different colleges. Billy comes home from work one evening and sits down to eat his dinner'. Participants indicated the likelihood that, '(a) Billy thinks about his long lost friend, (b) Billy's long lost friend unexpectedly phones him, or (c)

Billy thinks about his long lost friend and (suddenly) his long lost friend unexpectedly phones him'. Event likelihood was assessed in terms of either probability (i.e. chance in 100'), or frequency (i.e. the number out of 100 occurrences) (Fisk, 2004). In total, two hundred participants from a university campus took part. The majority of respondents were full/part-time students, educated to at least A' Level or equivalent, and a significant proportion had obtained at least A Level qualifications or equivalent in maths, statistics and/or psychology.

In their analysis, Rogers et al. (2009) controlled for participants' level of qualification (knowledge) in maths, statistics and/or psychology. Paranormal believers made more conjunction errors than non-believers implying belief in the paranormal was associated with a greater susceptibility to conjunction fallacy, and thus to probabilistic reasoning biases (e.g., Blackmore & Troscianko, 1985; Brugger & Taylor, 2003). Contrary to prediction, both believers and non-believers made fewer conjunction errors for paranormal than for non-paranormal events. For response format, (probability vs. frequency) no difference was observed. Rogers et al. (2009) had hypothesised that believers would make more conjunction errors for paranormal events because of context/domain specificity (e.g., Alcock & Otis, 1980; Gray & Mill, 1990; Wierzbicki, 1985).

Rogers et al. (2009) acknowledged that their results required cautious interpretation, because the paranormal and non-paranormal scenarios differed markedly in terms of their content (e.g., a precognitive dream of a house fire versus food poisoning from a local restaurant). Based on these results, the authors concluded that paranormal believers were more susceptible to conjunction fallacy. Overall, the study provided support for the notion that belief in the paranormal is associated with a propensity for probabilistic reasoning biases related to conjunction fallacy.

Rogers et al. (2011) conducted a follow-up study again using the SJQ. In total, 167 participants, recruited via opportunity sampling, took part; 45.5% had obtained at least an undergraduate degree or equivalent, and 8.8% were qualified in mathematics, statistics and/or psychology. Participants (as per study 1) completed eight paranormal vs. eight non-paranormal scenarios. Each problem type incorporated two event types virtually co-occurring (e.g., Alan was told about the cause of his uncle's death and about his subsequent inheritance

at (virtually) the same time) vs. temporally disjointed (e.g., a woman was healed of her football injury six weeks after she started a course of treatment).

After controlling for several factors (i.e., gender and qualifications) the authors found that believers made more conjunction errors than non-believers; no effects were observed for event type (paranormal vs. non-paranormal), nor temporal relationship (co-occurring vs. disjointed). The authors concluded that believers' tendency to produce larger conjunctive estimates was unrelated to component probability estimates (surprise values), and perceived functional relationship between component and conjunctive events.

The findings of Rogers et al. (2009/2011) differed to those of Dagnall et al. (2007), who found that only scores on perception of randomness predicted level of paranormal belief; conjunction fallacy was not found to a be significant predictor of paranormal belief. Rogers et al. (2009, 2011) attributed this difference: to sampling bias, the use of the revised paranormal belief scale, and the fact that Dagnall et al. (2007), "presented just one conjunction problem relating to a football match and it may be that non-significant results were an artefact of this particular event type" (p 528-529).

Considering each of these criticisms in turn, the following responses are proffered. Regarding sampling, Rogers et al (2009) stated, "One problem with this study, as the authors note, is that the sample comprised psychology students who presumably had some basic understanding of probability theory" (p 528). This point is inaccurate; Dagnall et al. (2007) speculatively postulated that the use of Psychology undergraduates might explain differences between their findings and those of Bressan (2002). Bressan (2002) found an interaction between level of education, probabilistic reasoning and belief in the paranormal; errors in probabilistic reasoning being greater in believers than non-believers in a sample drawn from the general population, but not for a sample of university students. Dagnall et al. (2007) did not, use students "who presumably had some basic understanding of probability theory" as stated by as Rogers et al (2009). The Dagnall et al. (2007) sample was comprised exclusively of freshers/new first year students, who were unlikely to have a theoretical understanding of probability theory.

Secondly, considering criticism of the use of the R-PBS, Rogers et al. (2009) claimed the scale is a global measure, which has been criticised on both content and psychometric grounds (see Holden & French, 2000; Irwin, 2008). Whilst, there has been some debate regarding the factorial structure of the R-PBS, few critics would argue that it is not a valid measure of paranormal belief. Criticisms have tended to focus on the factorial structure of the scale as opposed to its validity; Tobacyk (1988) proposed seven-factors, other researchers two-factors (Houran, Irwin, & Lange, 2001; Lange et al., 2000), and Hartman, (1999) four factors. Such concerns are not unique to the R-PBS, and arise from ensuing debates about the appropriateness of definitions of paranormality. Despite psychometric debates, the R-PBS is a valid measure, and has general regard; the R-PBS is the most widely used instrument for measuring paranormal belief (Goulding & Parker, 2001). In this context, it is worth noting that the Holden & French (2000) reference quoted by Rogers et al. (2009) refers to an unpublished discussion paper as opposed to a peer reviewed, widely cited publication. Similarly, the Irwin (2008) paper is not in print; recent communication with the author suggests that no such criticism was implied.

Paradoxically, Rogers et al. (2009) used a visual analogue rather than the more normal trichotomous (true/do not know/false) scoring scale for the ASGS, and failed to score the measure using the rasch scaling procedure outlined by Lange and Thalbourne (2002). The point here is not that their measure of belief was necessarily invalid, but that there is no single accepted measure of paranormal belief. Hence, regardless of measure, there will be a trade-off between perceived benefits and potential theoretical and methodological limitations. For example, the R-PBS has construct breadth, but is based on an imprecise definition of paranormality (Lawrence, 1995a), whilst the ASGS assesses only a restrictive, core range of beliefs (ESP, PK and life after death), and is rarely corrected for differential item functioning. Thus, robust findings should generalise across measures of paranormal belief. Whilst different, the R-PBS and ASGS are assessing the same construct, and as such, do share considerable common content (variance). In short, the proposition that the findings were an artefact of the measure of paranormality employed is a criticism, which reciprocally applies to the Rogers et al. (2009) study. The key to this conundrum is to replicate the Dagnall et al.'s (2007) findings, and to determine whether they generalise across measures of paranormal belief. This approach would strengthen the original findings and serve to refute criticisms (legitimate or otherwise).

Finally, Rogers et al. (2009) stated that, "Dagnall et al. presented just one conjunction problem relating to a football match and it may be that non-significant results were an artefact of this particular event type" (p528-529). It appears that the authors misinterpreted the illustrative items in the appendices as the definitive set of stimulus materials. As outlined in the procedure of their study (p1410), the Dagnall et al. (2007) article featured 17 problems, four questions assessing conjunction fallacy, each framed in a different context. These problems were either derived (e.g., the Linda problem) or adapted (e.g., Borg tennis problem) from Tversky and Kahneman (1983).

Based on this body of work it would appear that believers in the paranormal are susceptible to representativeness biases (Kahneman & Tversky, 1972; Tversky & Kahneman, 1982; 1983) and thus prone to flawed reasoning (i.e., misperceptions of randomness, pseudoscientific beliefs Hardman, 2009; and probability of co-occurring (conjunct) events (Rogers et al., 2009; 2011). This notion is not without support. Particularly, Marks (2000) argued that believers in the paranormal are inclined to seek relatedness amongst random events because they possess a priori, presumptive expectations, which predispose them to seek subjective rather than objective validations. Bressan (2002) contended that believers have a lower threshold of subjective chance and consequently, frequently incorrectly perceive casual relationships between unrelated events; believers require less subjective evidence of relatedness than non-believers do prior to misattribution. These findings may explain why a number of published studies have reported that believers are more likely to view coincidences (coinciding random events) as meaningful (casual and related) (Brugger & Taylor, 2003). Thus, it may be that believers define randomness less rigorously, and that their perception of chance is unduly influenced by factors, such as salience of potential causes.

Based on this body of work it appears that believers in the paranormal are susceptible to specific biases in reasoning. Particularly, representativeness biases (Kahneman & Tversky, 1972; Tversky & Kahneman, 1982; 1983), which predispose believers to faulty reasoning (i.e., misperceptions of randomness, Hardman, 2009; pseudoscientific beliefs, Gilovich & Savitsky, 1996; and probability of co-occurring (conjunct) events, Rogers et al., 2009; 2011). To date, only a limited number of previous studies have examined paranormal believer's susceptibility to the conjunction fallacy (Dagnall et al., 2007; Rogers et al., 2009, 2011).

The current study extends work on paranormal belief and reasoning bias (i.e., perception of randomness & conjunction fallacy). Rogers et al. (2009, 2011) criticised Dagnall et al. (2007) for their use of the R-PBS (Holden & French, 2000; Irwin, 2008). Whilst, this point derives from a selective interpretation of literature and has questionable veracity, it is a fact that paranormal belief can be measured using different scales. Each scale has perceived advantages and disadvantages, for this reason in the present study assessed the effects of paranormal belief on reasoning performance using multiple measures of paranormal belief: R-PBS, ASGS and MMU-N scale. Performing a substantial replication also addressed Rogers et al., (2009, 2011) comment regarding potential sampling bias; the study used a larger and more diverse (heterogeneous) sample, which embraced a breath of abilities and academic disciplines. The researchers anticipated, in line with Dagnall et al.'s, (2007) findings, that perception of randomness would be the best predictor of level of paranormal belief.

Using multiple measures of paranormal belief enabled the present study to test the generality of Rogers et al. (2009, 2011) findings. In their studies, Rogers et al. (2009, 2011) used the ASGS (Thalbourne, 1995a, 1995b; Thalbourne & Delin, 1993; Thalbourne, Dunbar & Delin, 1995). The ASGS is restricted to the core aspects of paranormality (PK, ESP and life after death) and typically, researchers use the scale as a measure of belief in psychic ability (Wiseman & Watt, 2006). Although, the ASGS is a valid, reliable and accepted measure, it has less construct breadth than the R-PBS. Thus, the Rogers et al findings may be an artefact of this scale.

If believers in the paranormal show pronounced susceptibility to conjunction bias, as stated by Rogers et al., (2009, 2011), then a relationship between conjunction error and belief in the paranormal should be found across all measures of paranormal belief. Based on previous work (Dagnall et al, 2007; Rogers et al., 2009, 2011), it was hypothesized that perception of randomness and conjunction fallacy scores would be positively correlated. Furthermore, if the present study replicated the findings of Dagnall et al.'s (2007), belief in the paranormal will correlate with perception of randomness and conjunction error. However, a stronger correlation between level of paranormal belief and perception of randomness was expected.

A commendable aspect of Rogers at al.'s, (2009, 2011) work was their comparison of standard vs. paranormal event types. This manipulation involved presenting conjunction

problems as either standard (everyday) (e.g., queuing for airport coffee) or paranormal (e.g., precognition) events. It is hypothesized that Rogers et al.'s (2009, 2011) conjunction bias findings will be replicated. Specifically, believers are expected to make more conjunction errors than non-believers for both event types, and fewer errors will be made for paranormal than standard event types.

Finally, the present study presented the Inventory of Personality Organization (IPO-RT Lenzenweger et al., 2001), a measure of reality testing, alongside the other measures. Several previous studies have reported that proneness to reality testing deficits is positively associated with belief in the paranormal. Reality-testing deficits bias individuals away from analytical/rational processing towards intuitive-experiential interpretations of anomalous events (Irwin, 2004). Such subjective interpretations are likely to facilitate the generation of nonconventional (paranormal) explanations, and possibly influence reasoning performance. Similarly, Irwin et al. (2012a) found emotion-based reasoning to predict level of paranormal belief; respondents endorsed paranormal beliefs because of their emotional, rather than rational appeal (Sappington, 1990). Collectively, these findings suggest that believers in the paranormal are more prone to subjective, less critical/analytical appraisals of events and therefore may demonstrate reasoning bias. Hence, proneness to reality testing deficits will positively correlate with paranormality, and perception of randomness. The relationship between reality testing and other problem solving tasks is less certain. If Rogers et al. (2009, 2011) are correct proneness to reality testing deficits will correlate with conjunction error.

METHOD

Participants

An opportunity sample of 305 participants (64 male, 21%; and 241 female, 79%) completed the study. Mean participant age was 22.97, *SD* = 8.19; ages ranged from 18-65. Male mean was 24.44, *SD* = 9.88; range 18-65. Female mean was 22.58, *SD* = 7.65; range 18-60. Participants were recruited via: undergraduate and postgraduate health care programs at Manchester Metropolitan University, emails to all university staff and students, local vocational/sports and leisure classes, and through small businesses in the North West (Manchester, Salford, Chester, Trafford, Rochdale & Bolton). Participation was voluntary and participants could terminate their involvement at any point.

Materials

Measures used in Phase II:

Paranormal Belief Factors

MMU-N

Phase I suggested a factorial structure similar to that identified by Dagnall et al. (2010): Hauntings, Alien Visitation, Superstitions, PK, Religious Beliefs, Astrology, ESP, and Witchcraft. Phase II used the 47 item measure constructed in Phase I (see Phase I results). To improve subscale breadth a single item was added to each of the Astrology, Alien Visitation and ESP subscales. Thus, the Phase II measure comprised 50 items.

Alongside the MMU-N, the R-PBS and ASGS were also used to measure paranormal belief (see Phase I method for details).

Reality Testing

Inventory of Personality Organization

Reality testing was assessed using the Inventory of Personality Organization (IPO-RT) (Lenzenweger et al., 2001), a unidimensional self-report measure designed to measure "the capacity to differentiate self from non-self, intrapsychic from external stimuli, and to maintain empathy with ordinary social criteria of reality" (Kernberg, 1996, p.120). It is consistent with Langdon and Coltheart's (2000) account of belief generation, placing an emphasis upon information processing style rather than psychotic symptomology (e.g., 'I have heard or seen things when there is no apparent reason for it').

The IPO-RT contains 20 items, with responses being recorded on a 5-point Likert scale (1 'never true' to 5 'always true'); scores range from 20 to 100, with low scores indicating high reality-testing ability. The IPO-RT has demonstrated good psychometric integrity: it is internally consistent, temporally stable with nonclinical populations, and possesses construct validity and good retest reliability (r = .73; Lenzenweger et al., 2001).

Probabilistic Reasoning Tasks

The reasoning section was comprised of 20 problems divided into four sections each containing one of five types of problem: perception of randomness, base rate, conjunction fallacy, paranormal conjunction fallacy, and probability.

Perception of Randomness

Perception of randomness problems required participants to make judgements about the likelihood of obtaining strings (e.g., 'Imagine a coin was tossed six times. Which pattern of results do you think is most likely?' '(a) HHHHHH, (b) HHHTTT, (c) HTHHTT, (d) All equally likely').

Base Rate

Base rate problems required participants to evaluate the likelihood of an outcome using both evidence in relation to the outcome and base rate evidence (e.g., 'You go to a party where there are 100 men, 70 of the men are Psychologists and 30 are Engineers. Before being introduced to each man you are given a short personality description of him – What is the probability that Dick is an Engineer?' (a) 70%, (b) 30%, (c) 50%).

Conjunction Fallacy

Conjunction fallacy problems presented participants with a number of alternatives and asked participants to select the alternative with the highest likelihood of being true (e.g.,'Two football teams (Team A and Team B) are playing in a local derby. What is the most likely outcome of the game?' (a) Team A score first, (b) Team A score first and win, (c) Team A score first and lose, (d) Team A score first and the game is drawn).

Paranormal Conjunction Fallacy

Paranormal conjunction fallacy problems also presented participants with a number of alternatives and asked participants to select the alternative with the highest likelihood of being true (e.g., 'Andrew often sits by the telephone at work. Just as he is thinking about his friend, she rings. Which of the following is most likely? (a) Elaine rang because Andrew was thinking about her, (b) Andrew was thinking about Elaine because she was about to ring, (c) Elaine rang). Rogers et al. (2009) hypothesized that believers in the paranormal may be prone

to conjunction fallacy when problems are couched/framed in a paranormal context, hence paranormal conjunctions were included in the present study.

Probability

In their 2007 study, Dagnall et al. used expected value problems. Performance on these items across conditions was low; respondents found the problems difficult to comprehend. For the purpose of this project, these items were replaced with probability questions These provided participants with a scenario containing information and asked them to select the correct probability of success from four alternatives (e.g., 'Melissa shuffled a deck of number cards containing 5 each of the numbers 2, 4, 6, 7. If Rona selects a 4 from the deck and does not return it, what is the probability that she will select a 4 on her next draw? (a) 3/20 (.15), (b) 4/5 (.80), (c) 4/19 (.21), (d) 1/4 (.25)'.

To control for potential order effects problem type order was counter-balanced.

Procedure

Questionnaire booklets were distributed and respondents read the instructions. These informed respondents that they must complete all questions, and that there was no time limit. The tester collected the completed questionnaires and debriefed each participant. All aspects of the study adhered to British Psychological Society (BPS) ethical guidelines.

Results

Scale Reliability

The paranormal belief measures: Australian Sheep Goat Scale, ASGS (α = .86); Revised Paranormal Belief Scale, R-PBS (α = .92), and MMU New scale (MMU-N) (α = .95) demonstrated good/excellent internal reliability (George & Malley, 2003). Similarly, the RPBS subscales: TPB (α = .81) and NAP (α = .87) possessed good internal reliability. The, Reality Testing (RT) also displayed excellent internal reliability, RT (α = .90). Table 1 contains the rasch scaled scores for ASGS and the R-PBS subscales (NAP and TPB); MMU-N, R-PBS and RT scores represent overall mean totals.

Table 1

Scale Descriptive Statistics

	α	*Mean*	*SD*	*Min*	*Max*
ASGS	.86	18.89	5.95	8.13	43.39
MMU-N	.95	165.04	50.75	50.00	339.00
R-PBS	.92	77.76	27.51	26.00	167.00
NAP	.87	21.42	5.11	6.85	47.72
TPB	.81	22.19	5.38	11.16	43.27
RT	.90	41.40	12.46	20.00	79.00

Inter-Measure Correlations

Relationships between measures were examined using Pearson Product Moment correlations (see table 2).

Table 2

Inter-Measure Correlations

	1	2	3	4	5	6
1. ASGS						
2. MMU-N	.81**					
3. R-PBS	.78**	.90**				
4. TPB	.65**	.77**	.86**			
5. NAP	.74**	.82**	.86**	.75**		
6. RT	.48**	.47**	.47**	.38**	.46**	

** $p < .001$

Significant positive correlations were observed between paranormal belief measures: ASGS; R-PBS; MMU-N; R-PBS subscales, TPB & NAP; and between each paranormal measure and reality testing (RT). Correlations between paranormal measures were in the high range (above .5), and RT correlations with paranormal measures were within the mid-range (between .3 - .5) (Cohen, 1988, 1992).

Probabilistic Reasoning Errors

Mean score for each problem type (base rate, conjunction fallacy, probability and perception of randomness) was calculated. Table 3 contains; problem type scores, overall reasoning performance and number of paranormal conjunctions.

Table 3
Problem Type Descriptive Statistics

	Total		Proportion					
Problem type	*M*	*SD*	*M*	*SD*	1	2	3	4
1. Base Rate	1.12	0.84	.28	.21				
2. Conjunction Fallacy	1.17	0.98	.29	.25	.09			
3. Probability	2.01	1.17	.50	.29	.17**	.15**		
4. Percep of Randomness	2.52	0.96	.63	.25	.05	.27**	.10*	
5. Overall	1.70	0.60						
6. Paranormal Conjunction	3.20	0.99	.81	.25	.13*	.18**	.18**	.27**

* $p < .05$; ** $p < .001$

Pearson Product Moment correlations were conducted exploring relationships between problem types (see table 3) and between problem types and measures (see table 4).

Within problem type, significant positive correlations were found between:
Base Rate and Probability, $r = .17$, df = 303, $p = .002$;
Conjunction Fallacy and Probability, $r = .15$, df = 303, $p = .005$;
Perception of Randomness and Conjunction Fallacy, $r = .27$, df = 303, $p < .001$; and,
Perception of Randomness and Probability, $r = .10$, df = 303, $p = .035$,
Paranormal measures and overall reasoning scores correlated negatively. There was no significant relationship between overall reasoning and RT (see table 4).

Table 4

Correlations between problem type and overall problem solving

Paranormal Belief Measure	Overall Correct Responses
ASGS	-.19**
MMU-N	-.23**
R-PBS	-.17**
NAP	-.21**
TPB	-.20**
RT	-.08

Further analysis of reasoning and belief in the paranormal

The relationship between reasoning and belief in the paranormal was examined further using multiple regression. Problem types (base rate information, conjunction fallacy, probability and perception of randomness, use) were entered as predictors of paranormal belief and reality testing. Separate multiple regressions were conducted for ASGS, MMU-N, R-PBS, and RT (see table 5).

Using the enter method; significant models emerged for paranormal belief. A similar pattern of results emerged for each of the paranormal measures:

ASGS, $F(4, 300) = 4.471$, $p = .002$, $R^2 = .06$, adjusted $R^2 = .04$. Perception of randomness was found to predict paranormal belief as measured by the ASGS ($b = -.17$, $p = .004$); MMU-N, $F(4, 300) = 4.77$, $p = .001$, $R^2 = .06$, adjusted $R^2 = .05$. Perception of randomness was found to predict paranormal belief as measured by the MMU-N ($b = -.16$, $p = .005$); and R-PBS, $F(4, 300) = 2.91$, $p = .022$, $R^2 = .04$, adjusted $R^2 = .03$. Perception of randomness was found to predict paranormal belief as measured by the MMU-N ($b = -.16$, $p = .008$).

The RT model was not found to be significant, $F(4, 300) = 1.433$, $p > .05$, $R^2 = .02$, adjusted $R^2 = .01$. However, perception of randomness was found to predict reality testing deficits ($b = -.14$, $p = .03$). Performance on base rate, conjunctive fallacy and probability did not predict RT scores.

Table 5. Multiple regression problem type and paranormal belief and reality testing

	UNSTANDISED COEFFICENTS		STANDISED COEFFICENTS						
Variable	B	SE	Beta (b)	*t*	*p*	*F*	*R*	R^2	*Adj.* R^2
ASGS									
(Constant)	23.09	1.09		21.13	>.001	4.47	.24	.06	.04
Base Rate	-0.72	0.40	-.10	-1.78	.076				
Conjunction Fallacy	0.28	0.37	.05	0.79	.430				
Probability	-0.56	0.29	-.11	-1.90	.058				
Perception of Randomness	-1.04	0.35	-.17	-2.93	.004* *sig*				
MMU-N									
(Constant)	203.46	9.30		21.89	>.001	4.77	.25	.06	.05
Base Rate	-6.01	3.43	-.10	-1.75	.081				
Conjunction Fallacy	-1.13	3.03	-.02	-0.37	.710				
Probability	-4.49	2.49	-.10	-1.81	.072				
Perception of Randomness	-8.48	3.01	-.16	-2.82	.005* *sig*				
R-PBS									
(Constant)	94.22	5.10		18.48	>.001	2.91	.19	.04	.03
Base Rate	-1.78	1.88	-.06	-0.95	.343				
Conjunction Fallacy	-0.02	1.66	.00	-0.10	.992				
Probability	-1.65	1.36	-.07	-1.21	.229				
Perception of Randomness	-4.42	1.65	-.16	-2.68	.008* *sig*				
RT									
(Constant)	45.81	2.33		19.64	.010	1.43	.14	.02	.01
Base Rate	-0.24	0.86	-.02	-0.28	.783				
Conjunction Fallacy	0.36	0.76	.03	-0.48	.634				
Probability	-0.05	0.62	-.01	-0.08	.934				
Perception of Randomness	-1.77	0.76	-.14	-2.35	.030* *sig*				

For completeness, correlations between each problem type, paranormal belief and reality testing appear in table 6. Of the problem types, only perception of randomness correlates with all measures.

Table 6

Correlations between each Problem Type, Paranormal Belief and Reality Testing

Measure	Base Rate	Conjunction Fallacy	Probability	Perception of Randomness
ASGS	-.12*	-.03	-.14**	-.18**
MMU-N	-.13*	-.09	-.14**	-.19**
R-PBS	-.07*	-.06	-.10*	-.17**
TPB	-.12*	-.11*	-.09	-.21**
NAP	-.08	-.08	-.10*	-.22**
RT	-.02	-.01	-.02	-.13**

High vs. low level of paranormal belief/reality testing and problem solving

Median splits on each paranormal measure and RT produced low vs. high belief conditions. Next, t-tests comparing low vs. high believers on each problem type were undertaken (see table 7).

Table 7

Low vs. High paranormal belief, reality testing and problem solving

	Level of Score							
	Below Median		Above Median					
Problem type	*M*	*SD*	*M*	*SD*	*t*	df	p	*d*
ASGS								
Base Rate	1.18	0.84	1.05	0.85	1.289	303	.198	.15
Conjunction Fallacy	1.15	0.97	1.18	1.00	-0.262	303	.794	.03
Probability	2.11	1.22	1.91	1.11	1.515	303	.131	.17
Percep of Randomness	2.64	0.90	2.39	1.05	2.296	289.539	.022*	.27
MMU-N								
Base Rate	1.20	0.82	1.03	0.87	1.717	303	.087	.20
Conjunction Fallacy	1.15	0.95	1.18	1.02	-0.242	303	.809	.03
Probability	2.13	1.17	1.88	1.16	1.912	303	.057	.22
Percep of Randomness	2.63	0.92	2.40	1.03	2.011	303	.045*	.23
R-PBS								
Base Rate	1.18	0.82	1.05	0.86	1.379	303	.169	.16
Conjunction Fallacy	1.15	0.96	1.19	1.01	-0.320	303	.749	.04
Probability	2.10	1.15	1.91	1.19	1.415	303	.158	.16
Percep of Randomness	2.63	0.93	2.93	1.03	2.124	303	.035*	.24
RT								
Base Rate	1.13	0.81	1.11	0.87	0.176	303	.861	.02
Conjunction Fallacy	1.23	0.94	1.11	1.02	1.038	303	.300	.12
Probability	2.01	1.16	2.01	1.19	0.051	303	.959	.01
Percep of Randomness	2.67	0.92	2.37	1.02	2.741	303	.006*	.32

Participants scoring below the median solved more perception of randomness problems than those above the median (similar small effect sizes were noted on each paranormal measure):

ASGS, $M = 2.64$, $SD = 0.90$ vs. $M = 2.39$, $SD = 1.05$, $t_{(289.539)} = 2.296$, $p = .022$, $d = .27$.

MMU-N, $M = 2.63$, $SD = 0.92$ vs. $M = 2.40$, $SD = 1.03$, $t_{(303)} = 2.011$, $p = .045$, $d = .23$.

R-PBS, $M = 2.63$, $SD = 0.93$ vs. $M = 2.93$, $SD = 1.03$, $t_{(303)} = 2.124$, $p = .035$, $d = .24$.

RT, $M = 2.67$, $SD = 0.92$ vs. $M = 2.37$, $SD = 1.02$, $t_{(303)} = 2.741$, $p = .006$, $d = .32$.

Paranormal vs. Conventional Conjunction Fallacy

A series of 2 (Conjunction type: conventional vs. paranormal: within subjects) x 2 (Level: low vs. high: between subjects) mixed ANOVAs were conducted (see tables 8 & 9).

Table 8

Paranormal vs. Conventional Conjunction Fallacy

	Level					
	Below Median		Above Median		Overall	
Problem type	*M*	*SD*	*M*	*SD*	*M*	*SD*
ASGS						
Conjunction	1.15	0.97	1.18	1.00	1.17	0.98
Paranormal Conjunction	3.44	0.81	2.95	1.10	3.20	0.99
Overall	2.30	0.68	2.07	0.82		
MMU-N						
Conjunction	1.15	0.95	1.18	1.02	1.17	0.98
Paranormal Conjunction	3.45	0.79	2.95	1.11	3.20	0.99
Overall	2.26	0.65	2.10	0.86		
R-PBS						
Conjunction	1.15	0.96	1.19	1.01	1.17	0.98
Paranormal Conjunction	3.38	0.91	3.01	1.05	3.20	0.99
Overall	2.30	0.64	2.06	0.85		
RT						
Conjunction	1.23	0.94	1.11	1.02	1.17	0.98
Paranormal Conjunction	3.43	0.79	2.99	1.12	3.20	0.99
Overall	2.33	0.68	2.05	0.81		

Table 9

Summary ANOVA statistics[5]

Scale	Problem type				Level				Problem type x level			
	F	df	*p*	*Partial η²*	*F*	df	*p*	*Partial η²*	*F*	df	*p*	*Partial η²*
ASGS	811.29	(1, 303)	<.001	.73	7.06	(1, 303)	.004	.02	13.14	(1, 303)	<.001	.04
MMU-N	814.67	(1, 303)	<.001	.73	7.64	(1, 303)	.003	.03	13.87	(1, 303)	<.001	.04
R-PBS	794.24	(1, 303)	<.001	.72	3.52	(1, 303)	.036	.01	7.64	(1, 303)	.003	.03
RT	798.89	(1, 303)	<.001	.73	7.59	(1, 303)	.001	.03	5.00	(1, 303)	.013	.02

[5] Cohen (1988) suggested that partial ηp^2 effects be interpreted using the following rule of thumb: values between .01-.06 reflect a small effect size, values within the .06–.13 range a medium effect size, and a value of .14 or higher indicates a large effect.

ASGS

A significant main effect was found for problem type, $F(1, 303) = 811.29$, $p < .001$, $\eta p^2 = .73$. Fewer errors were made for paranormal conjunction ($M = 3.20$, $SD = 0.99$) than for conventional conjunction ($M = 1.17$, $SD = 0.98$).

A significant main effect was also found for Level, $F(1, 303) = 7.06$, $p = .004$, $\eta p^2 = .02$. Participants above the median produced fewer correct answers than those below the median. ($M = 2.07$, $SD = 0.82$).

The main effects were qualified by the significant interaction between problem type vs. level, $F(1, 303) = 13.14$, $p < .001$, $\eta p^2 = .04$. Simple main effects analysis was undertaken; independent t- tests, comparing participants below vs. above the median, on each type of conjunction. Participants above the median ($M = 2.95$, $SD = 1.10$) produced fewer correct responses on the paranormal conjunction problems than those scoring below the median ($M = 3.44$, $SD = 0.81$), $t(269.266) = 4.371$, $p < .001$, $d = .51$. However, there was no difference on conventional conjunctions, $t(303) = -0.262$, $p > .05$.

MMU-N

A significant main effect was found for problem type, $F(1, 303) = 814.67$, $p < .001$, $\eta p^2 = .73$. Fewer errors were made for paranormal conjunction ($M = 3.20$, $SD = 0.99$) than for conventional conjunction ($M = 1.17$, $SD = 0.98$).

A significant main effect was also found for Level, $F(1, 303) = 7.64$, $p < .001$, $\eta p^2 = .03$. Participants above the median produced fewer correct answers than those below the median. ($M = 2.06$, $SD = 0.85$).

The main effects were qualified by the significant interaction between problem type vs. level. Simple main effects analysis was undertaken; independent t- tests, comparing participants below vs. above the median, on each type of conjunction. Participants above the median ($M = 2.95$, $SD = 1.11$) produced fewer correct responses on the paranormal conjunction problems than those scoring below the median ($M = 3.45$, $SD = 0.79$), $t(265.7) = 4.527$, $p < .001$, $d = .52$. However, there was no difference on conventional conjunctions, $t(303) = -0.242$, $p > .05$.

R-PBS

A significant main effect was found for problem type, $F(1, 303) = 794.24$, $p < .001$, $\eta p^2 = .72$ Fewer errors were made for paranormal conjunction (M = 3.20, SD = 0.99) than for conventional conjunction (M = 1.17, SD = 0.98).

A significant main effect was also found for Level, $F(1, 303) = 3.52$, $p < .036$, $\eta p^2 = .01$. Participants above the median produced fewer correct answers than those below the median. (M = 2.10, SD = 0.86).

The main effects were qualified by the significant interaction between problem type vs. level. Simple main effects analysis was undertaken; independent t- tests, comparing participants below vs. above the median, on each type of conjunction. Participants above the median (M = 3.01, SD = 1.05) produced fewer correct responses on the paranormal conjunction problems than those scoring below the median (M = 3.38, SD = 0.91), $t(303) = 3.223$, $p = .001$, d = .38. However, there was no difference on conventional conjunctions, $t(303) = -0.320$, $p >$ .05.

RT

A significant main effect was found for problem type, $F(1, 303) = 798.89$, $p < .001$, ηp^2 = .73 Fewer errors were made for paranormal conjunction (M = 3.20, SD = 0.99) than for conventional conjunction (M = 1.17, SD = 0.98).

A significant main effect was also found for Level, $F(1, 303) = 7.59$, p $< .001$, $\eta p^2 = .03$. Participants above the median produced fewer correct answers than those below the median. (M = 2.05, SD = 0.81).

Simple main effects analysis was undertaken; independent t- tests, comparing participants below vs. above the median, on each type of conjunction. Participants above the median (M = 2.99, SD = 1.12) produced fewer correct responses on the paranormal conjunction problems than those scoring below the median (M = 3.43, SD = 0.79), $t(277.509) = 3.981$, $p < .001$, d = .45. However, there was no difference on conventional conjunctions, $t(303) = -1.038$, $p >$ .05.

The relationship between study measures and paranormal conjunction problems was assessed further using Pearson's Product Moment correlation. Scores on paranormal conjunction problems negatively correlated with the measures of paranormal belief and RT; as level of paranormal belief and proneness to reality testing deficits increased performance on the paranormal conjunction problems decreased (see table 10).

Table 10

Study Measures and Mean Number of Paranormal Conjunction Errors

Measure	Paranormal Conjunction Fallacy
ASGS	-.32**
MMU-N	-.31**
R-PBS	-.30**
TPB	-.26**
NAP	-.29**
RT	-.19**

Evaluation of new paranormal measure

The MMU-N has established face validity, measuring the construct of paranormal belief. The MMU-N also has content validity; items drawn from questions encompassing a broad range of paranormal constructs (i.e., Astrology; Psi, ESP & PK; ET/Alien; Hauntings; Religion; Superstition; & Witchcraft). It was clear that the new measure of belief in the paranormal (MMU-N) performed similarly to the established measures (ASGS and R-PBS). Indeed, the MMU-N shared considerable variance with the ASGS (65%) and R-PBS (81%). The MMU-N also shared significant variance with the two factors of the R-PBS (TPB 60% & NAP 68%). Thus, the MMU-N has good concurrent validity: it correlated positively with criterion measures. In addition to this, the MMU-N demonstrated convergent validity, the MMU-N correlated positively with other variables (i.e., reasoning measures and RT) in a pattern comparable to the ASGS and R-PBS.

MMU-N subscales scores were calculated and internal reliability assessed (see table 11). All subscales were in the good (.8) to excellent (.9) range; consideration of individual items revealed subscale coherence.

Table 11

MMU-N Subscale Descriptive Statistics

MMU Subscales	α	Mean	SD
Astrology	.81	2.91	1.27
ESP	.81	3.79	1.32
ET/Alien	.92	2.76	1.31
Hauntings	.92	3.69	1.56
PK	.88	2.41	1.28
Religion	.87	4.17	1.50
Superstition	.85	3.65	1.63
Witchcraft	.90	2.68	1.51

Correlations examining relationships between MMU-N subscales and established paranormal measures were also performed (ASGS & R-PBS) (see table 12).

Table 12

Correlations for Paranormal Measures and Subscales

MMU Subscales	ASGS	RPBS	TPB	NAP
Astrology	.54**	.58**	.42**	.62**
ESP	.74**	.73**	.62**	.71**
ET/Alien	.45**	.53**	.41**	.50**
Hauntings	.68**	.74**	.59**	.67**
PK	.68**	.71**	.58**	.67**
Religion	.49**	.71**	.81**	.58**
Superstition	.35**	.37**	.22**	.35**
Witchcraft	.59**	.76**	.74**	.61**

MMU-N subscales positively correlated with established measures of paranormal belief.

In conclusion, findings indicated that the MMU-N possesses similar psychometric properties to existing, established measures of paranormal belief (ASGS & R-PBS). The MMU-N has, however, notable advantages. Firstly, the MMU-N contains reversed items and therefore is less prone to response bias. Secondly, the MMU-N is composed of several component subscales, which stand as discreet, standalone measures. These subscales will be of tremendous value to researchers wishing to concentrate on particular facets of paranormal belief, as opposed to the general construct.

For the sake of completeness, table 13 contains inter-subscale correlations. All subscales with, the exception of the relationship between Superstition and Religion, were significantly positively correlated.

Table 13

Inter-Subscale Correlations

MMU Subscales	1	2	3	4	5	6	7	8
1. Astrology								
2. ESP	.64**							
3. ET/Alien	.34**	.38**						
4. Hauntings	.58**	.70**	.53**					
5. PK	.53**	.62**	.53**	.57**				
6. Religion	.27**	.49**	.26**	.51**	.43**			
7. Superstition	.43**	.39**	.13*	.42**	.25**	.08		
8. Witchcraft	.35**	.52**	.42**	.52**	.60**	.54**	.11*	

Discussion

Overall reasoning performance correlated negatively with belief in the paranormal; high paranormal belief was associated with fewer correct responses on reasoning tasks. Across paranormal belief measures a small but consistent effect was noted; ASGS, r = -.19; MMU-N, r = -.23; and R-PBS, r = -.17. However, there was no significant correlation between reasoning performance and reality testing.

Multiple regression analysis revealed the best predictor of paranormal belief was perception of randomness. Whilst, each reasoning task (base rate, conjunction fallacy, & probability) correlated with one or more paranormal measure, only perception of randomness correlated with all belief measures (MMU-N; R-PBS overall; R-PBS subscales, NAP & TPB; and ASGS). These findings replicate those of Dagnall et al. (2007), who concluded that belief in the paranormal arose from a specific deficit associated with perception of randomness (misrepresentation of chance). It is worth noting that correct responses across the two studies were similar (approximately 63%), this suggests that the original findings were not an artefact of the sample used; the results has been replicated with a larger, more diverse sample.

In the present study, only the TPB dimension of the R-PBS correlated negatively with conjunction fallacy. Overall, there was no evidence to support Rogers et al. (2009, 2011) ascertain, that proneness to general conjunction fallacy is predicted by level of paranormal belief.

Previous research in this area has utilised median splits to differentiate between non-believers (sceptics) and believers (Dagnall et al., 2007; Rogers et al., 2009). Thus, median splits are a valid and often used analytical strategy (Wiseman & Morris, 1995). Comparisons between non-believers (sceptics) and believers supported the regressional analysis. Participants below the median solved more perception of randomness problems than those above the median. Similar small effect sizes were evident across paranormal measures (ASGS, MMU-N, & R-PBS) and reality testing. Median splits revealed no differences for conjunction fallacy, base rate and probability. This finding, countered that of Rogers et al. (2009, 2011), who reported that believers made more conjunction errors than non-believers did. In conclusion, within the current study there was no consistent relationship between level of paranormal belief and conjunction fallacy.

In line with Rogers et al. (2009, 2011), two types of conjunction fallacy were used (conventional vs. paranormal) in the present study. Rogers (2009) reported that both believers and non-believers made fewer errors for paranormal conjunctions than for non-paranormal conjunctions. However, Rogers (2011) believers vs. non-believers were not found to differ on event type (paranormal vs. non-paranormal). Based on this observation Rogers et al. (2011) dismissed their 2009 findings, concluding that susceptibility to conjunction fallacy was robust, and therefore not influenced by context, and that probability reasoning biases were not domain specific. Clearly, conclusions based on limited empirical evidence and null findings require further scrutiny and cautious interpretation.

Within the present study, a marked difference between conjunction types occurred; participants produced more correct responses when problems were framed in a paranormal (vs. conventional) context. Additionally, differences between believers and non-believers were evident only on paranormal conjunctions; believers solved fewer paranormal conjunctions than non-believers did. Non-believers found paranormal conjunctions easier to solve. This suggests that the presentation of conjunction fallacies in a paranormal context makes them easier to solve, but that the framing effect is less dramatic for non-believers.

Paranormal conjunction negatively correlated with all measures of paranormal belief: as level of paranormal belief and proneness to reality testing deficits increased, performance on paranormal conjunction problems decreased. Similarly, regarding reality testing, participants scoring above the median (indicating higher proneness to reality testing deficits) performed less well on paranormal conjunctions. These results emphasise that a strong framing effect occurred in the present study.

Rogers et al. (2009/2011) suggested that the findings of Dagnall et al. (2007) were an artefact produced by methodological issues. The results of the present study countered Roger's criticisms by replicating and extending the findings of Dagnall et al. (2007). Firstly, Rogers et al. (2009, 2011) criticised Dagnall et al. (2007) for using a sample comprised of psychology students, claiming they presumably possessed basic understanding of probability theory. Whilst, Dagnall et al. (2007) contend the use of freshers/new first year students, circumvented this concern, the sample used in the present study was larger and more diverse.

Secondly, the use of the R-PBS was questioned (Rogers et al., 2009, 2011). Rogers et al. claimed that the R-PBS was a global measure that has been criticised on both content and psychometric grounds. The authors refute this claim for a number of reasons. Principally, because the R-PBS is an established, widely used and accepted measure of paranormal belief (Goulding & Parker, 2001). Additionally, Rogers at al. (2009, 2011) used speculative unpublished sources to support their point. To counter this, the current study employed three measures of paranormal belief (MMU-N, ASGS & R-PBS). Findings were consistent across the three belief measures suggesting that the results of the Dagnall et al. (2007) study were not a consequence of the measure used.

Finally, Rogers et al. (2009, 2011) incorrectly stated that Dagnall et al. (2007), "presented just one conjunction problem relating to a football match and it may be that non-significant results were an artefact of this particular event type" (p528-529). The current study, in line with the 2007 study employed four distinct conjunction problems. These problems were similar to ones commonly cited within the literature (Tversky & Kahneman, 1982, 1983).

In both the Dagnall et al. (2007) and present study, proneness to conjunction error was not found to be a significant predictor of belief in the paranormal[6], nor did participants scoring below vs. above the median differ with regards to number of conventional conjunction problems solved. These results contrasted with those of Rogers et al. (2009, 2011), who reported believers to be more prone to general conjunction error.

Why this difference arises is not clear. Certainly, there are methodological issues that merit consideration. The Rogers studies used 16 scenarios (8 paranormal and 8 non-paranormal), Dagnall et al. (2007) employed 4 standard conjunctions, and the present study 8 problems (4 paranormal and 4 non-paranormal). Rogers et al. (2009) asked respondents to judge the likelihood of three related statements, two singular constituent options and a conjunction. A conjunction was noted when the conjunction was rated more likely than the singular constituent options. Two response formats were used; either probability (i.e., chance in 100) or frequency estimate (i.e., number of occurrences out of 100). Response format had little impact. Hence, in their 2011 follow-up study, Rogers et al. restricted ratings to likelihood and

[6] Only the Traditional Paranormal Belief (TPB) dimension of the R-PBS correlated with level of belief in the paranormal.

introduced an unsuccessful temporal condition (co-occurring vs. disjointed). Dagnall et al. (2007) and present study merely asked participants to indicate which of the presented alternatives was most likely to occur. In the case of three of the four problems there were three incorrect conjunctions and a singular correct option, the fourth question contained two conjunctions and a singular (correct) option.

Another important difference was that Rogers et al. (2009, 2011) presented conjunction questions as a block within the SJQ. Dagnall et al. (2007) and the current study presented problem types in four counter-balanced, sections. Thus, within each section there was one of example of each problem type. Counter-balancing prevented the formation of response sets, and made it more difficult for participants to identify common problem types. Blocking problem types emphasizes problem commonality and thence, may encourage the adoption of general problem-solving strategies. In the case of conjunction fallacy this would be the simple rule/heuristic that singular events are always more likely to occur than multiple events. If detected, similarities in underlying structure are likely to make problems easier to solve.

On balance, the authors consider both approaches (rating likelihood vs. forced choice) to be valid ways of assessing proneness to conjunction fallacy. That acknowledged, if proneness to conjunction fallacy was robustly associated with belief in the paranormal then consistent effects, similar to those observed with perception of randomness, would be observed across studies. Currently, there are few studies in this area and their findings are contradictory. These differences are evident not only between researchers (Dagnall et al., 2007; Rogers et al., 2009, 2011) but within the work of Rogers. This lack of consensus raises questions about soundness of assumptions made, and indicates that additional research is required to establish the conditions under which conjunction fallacy is likely to influence belief in the paranormal.

Looking at the conventional conjunction findings in toto it is noticeable that the number of conjunctions solved is consistent across the two Dagnall studies (2007 compared with the present study), however, within the Rogers studies (2007, 2009) there are significant variations. These differences may be attributable to the fact that the Rogers' papers manipulated different independent variables (format type vs. with temporal relationship), however, it is noticeable that conventional conjunction performance error rate differs across

the two studies (error rate $M = 3.81$ vs. $M = 5.29$). Similarly, paranormal conjunction also varies ($M = 1.40$ vs. $M = 4.88$). Within the present study, levels of paranormal conjunction were similar to those in Rogers et al. (2009).

Clearly, conjunction fallacy may contribute to the development and maintenance of anomalous/paranormal related beliefs. For instance, conspiratorial beliefs often arise from the endorsement of conjunctions (Drinkwater et al., 2012). In this context, reasoning problems arise not when official explanations are questioned/rejected, but when alternatives theories are accepted/endorsed without adequate evidence. An example of this is the 1947 Roswell incident, where the perceived inadequacy of the official/government account wrongly provides evidence for the existence/visitation of alien life forms (Nickell, 2009; Thomas, 1995). It is worth noting that cognitive-perceptual such as jumping to conclusions and proneness to reality testing deficits have been found to be associated with belief in the paranormal. Such measures tap directly into the tendency to make inferences based on limited, subjectively appraised information; they oppose the notion of reasoned, rational and objective consideration of information. These characteristics, at least superficially, appear to be conducive to the production of conjunction errors.

Within the present study, level of belief influenced the degree to which participants estimated the likelihood of multiple vs. single events only when reasoning problems were presented within paranormal contexts. The development of problems framed in paranormal contexts is a potentially useful research tool, however, there may also be limitations. Particularly, belief may influence response regardless of problem content. That is believers may endorse the paranormal options not because they are poor at reasoning, but because they believe that the given phenomenon exists and is valid. For example, if a respondent believes in the existence of ESP then they may accept that it is possible to influence whether a friend telephones. In this context, participants are not treating items as reasoning tasks, but as assessments of paranormal belief. Thus, the items may produce a conflated measure; it is not merely reasoning ability that produces any observed bias, but the degree to which the person endorses the anomalous/paranormal occurrence. In addition to this, Rogers et al. (2009, 2011) used mundane (everyday events) (e.g., queuing for airport coffee) compared with more unusual ostensibly paranormal events (e.g., near death experience). Clearly, the frequency and commonality of such events differs markedly. This too may inadvertently influence

likelihood estimates. Indeed, in the current study, participants made fewer errors on paranormal conjunction problems than conventional conjunctions; believers vs. non-believers did not differ on conventional problems. This suggests that the performance of believers is similar to that of non-believers generally, but that believers are more susceptibility to contextual interference.

One potential criticism of the present study is that we did not control for participants' level of statistical qualification, or gender. There are two main reasons for this. Firstly, as Rogers et al. (2009) note previous work has found conjunction fallacy to be largely unaffected by level of statistical awareness (Fisk, 2004; Tversky & Kahneman, 1983). Further to this point, Rogers et al. (2011) failed to replicate the Rogers et al. (2009) finding that participants less qualified in mathematics, statistics and/or psychology made more conjunction errors. The body of evidence suggests that conjunction fallacy is a robust phenomenon. Considering this, it is paradoxical, that Rogers et al. (2009, 2011) criticised Dagnall et al. (2007) for not controlling level of qualification, only to conclude that their failure to replicate suggests that such factors are relatively unimportant. Additionally, we considered that level of qualification at best provides only a crude, indirect measure of general cognitive ability (McClelland, 1973).

The present findings support the notion that paranormal believers demonstrate a greater misappreciation of probability (Blackmore & Troscianko, 1985; Tobacyk & Wilkinson, 1991). This seems to be associated with perception of randomness. There was no evidence to suggest that conjunction fallacy is a major factor associated with the development and maintenance of paranormal beliefs. This report supports and adds to the corpus of evidence, which indicated that paranormal belief is not associated with a general weakness in probabilistic reasoning but arises from a specific deficit associated with perception of randomness (misrepresentation of chance). Deficit in this context refers an insufficiency rather than a defect. This semantic difference requires qualification because performance differences may arise not from reasoning deficiencies per se but instead stem from the adoption of a preferential mode of cognition; one based on intuition and subjective interpretation rather than rational, analytical, objective thought. Our results merely serve to demonstrate that paranormal believers in comparison to non-believers perform less well on a narrow range of reasoning tasks; the reasons for this require further investigation and

elucidation. The authors would be reluctant to go as far as to endorse Rogers et al.'s (2011) notion that believers have a more pronounced cognitive 'deficits' (French, 1992; French & Wilson, 2007; Irwin, 1993, 2009; Irwin &Watt, 2007).

Evaluation the MMU-N and issues pertaining to the measurement of paranormal belief appear in the general discussion.

General Discussion

This general discussion concentrates on the development and performance of the MMU-N. The main aim of Phase I was to extend the research of Dagnall et al. (2010a, 2010b). Principally, to refine the authors' extracted paranormal factors, with the intention of producing a number of independent, but related subscales measuring a broad and coherent set of paranormal beliefs.

Consideration of the original extracted factors revealed imbalanced item numbers across subscales. To address this issue, a further literature review was undertaken and supplementary items generated. The addition of new items increased subscale breadth and equalised item numbers across subscales. The item target figure per subscale was set at eight because the aim was to retain a sufficiency of items after subsequent factor analysis; typically, only 50% of created items appear within the final scale (Hinkin, 1998). In addition, the Alien Visitation subscale, which has been the subject of previous academic consideration, contained eight items (Dagnall et al., 2010b; Dagnall, Drinkwater, & Parker, 2011).

Prior to scale construction, items were scrutinised, clarity checked and repetitions (overlaps) removed. To ensure subscales sampled the breadth of construct domain a further literature review was undertaken and additional items added. Within subscales, there was reversing of selected items to counter potential response bias; the authors took care to ensure that reversed/negative worded items possessed semantic clarity. The final scale comprised 64 items measuring eight paranormal facets/dimensions. The dimension labels were largely consistent with Irwin's (2009) delineation of paranormal belief, "A paranormal belief is defined on a working basis as a proposition that has not been empirically attested to the satisfaction of the scientific establishment but is generated within the nonscientific community and extensively endorsed by people who might normally be expected by their society to be capable of rational thought and reality testing." (Irwin, 2009, p 16-17). This designation effectively reflects the variety of beliefs that fall into the paranormal category. According to Furr (2011), selected questionnaire items must adhere to an explicit and precise construct definition. Hence, the MMU-N conforms closely to the classification of paranormality advanced by Irwin (2009).

In Phase One, principal components analysis (PCA) reduced the item set to 47 items, retaining the original eight factors (Hauntings, eight items; ET, seven items; Superstition, five items; PK, five items; Religion, seven items, Astrology, five items; ESP, five items and Witchcraft, five items). Subscales were conceptually coherent and possessed good to excellent internal reliability. The MMU-N measured the construct of paranormal belief, possessed face validity, and demonstrated content validity, being composed of subscales assessing a range of paranormal phenomena (i.e., Astrology; Psi, ESP & PK; ET; Hauntings; Religion; Superstition; & Witchcraft). Performance wise, the scale demonstrated good concurrent validity; there were high positive correlates between the MMU-N and established paranormal measures (ASGS & R-PBS). Convergent validity was also evident; positive correlations between the MMU-N and other study variables (i.e., reasoning measures & RT) were comparable to those obtained with the ASGS and R-PBS.

The exploratory factor analysis raised several questions of interest. Issues of concern were item loss and performance of reversed items. As discussed previously, items sharing unexpected commonality were problematic and disrupted factorial structure. For instance, references to prediction and foreseeing the future (notions related to different factors ESP & Astrology) frequently cross–loaded, and hence failed to feature in the final factorial solution. The net effect was a reduction in construct breadth. Clearly, item disambiguation is a complex process requiring consideration and deliberation throughout the developmental process. It is advisable that included items explain specialist terms in plain language, and that there is a clear linkage between the exposition/elucidation and the phenomenon of interest. For example, specifying that precognition is a form of ESP, which involves seeing future events. Similarly, horoscopes are a form of natal astrology, predicated upon the assumption that predictions based on the date of a person's birth are valid.

Considering the inherit difficulties involved in precisely defining paranormality and paranormal concepts, the radical notion arose that a general global measure could best be produced by first developing a set of subscales. In the case of the current project, this would entail operationalizing the contents of each subscale prior to testing the subscales in tandem. This approach would hopefully avoid concept confusion and generate a set of discrete, but related scales. These subscales would assess independent facets of paranormality, or be combined to form a global measure of paranormal belief. This bottom-up approach runs

contrary to the normal convention, where item pools are generated then reduced. The advocated strategy has the advantage of being theory rather than statistically driven.

Debates surrounding the development of the R-PBS illustrate difficulties associated with scale development. Particularly, the original R-PBS seven factors lacked breadth and coherence, and the factorial structure was criticised. Whilst, the prevailing two-factor solution served only to produce two general, global belief dimensions. The two factors measure New Age Philosophy (NAP; e.g., psi, reincarnation, & astrology) and Traditional Paranormal Beliefs (TPB; e.g., the devil, heaven and hell, & witchcraft). NAP related beliefs, instil a sense of control over external events on an individual level and may be reinforced by personal experience (Irwin, 1992; Lawrence et al., 1995). Whereas, TPB associated beliefs maintain control over external events on a social level, these beliefs are culturally reinforced (Ember & Ember, 1988, Goode, 2000). Collectively, the two-factor solution emphasizes the different functions of paranormal beliefs. Consequently, the factors are inclusive aspects of belief and offer few insights into particular phenomena. For example, the scales would be of limited use to researchers studying specific beliefs (hauntings, ESP, etc.).

The present study noted issues with the use of reversed items. Often, respondents struggled to comprehend fully negative statements. For example, what does an item such as, 'When dreams seem to foretell the future, it is just a coincidence' actually measure. Not believing in a specific instance/situation (dreams foretelling the future) does not invalidate belief in other contexts (e.g., visions predicting the future). For example, the fact that a respondent indicates that they do not believe in precognition via dreams does not mean that they do not believe in precognition per se, or other aspects of ESP. The question tells the researcher little about general belief in ESP; it is possible that respondents could believe that people have visions of the future, that people can communicate telepathically, see things remotely, but that they do not believe that information is transmitted via dreams.

Problems with reversed items are not unique to the present study (Wong, Rindfleisch, & Burroughs, 2003). Researchers frequently report that reversed items display lower reliability and weaker item-to-total correlations than positive-worded counterparts (Cronbach, 1942; Benson & Hocevar 1985; Peabody, 1966). In addition, reversed items have often proved difficult to accommodate within factorial models; reversed items frequently load on a

separate factor (Benson & Hocevar, 1985; Herche & Engelland, 1996; Pilotte & Gable, 1990). This occurred in the present study where, within the preliminary PCA, negative items clustered together. Thus, whilst reverse items may reduce potential response bias, the inclusion of such items may reduce a measure's internal consistency and obscure its dimensionality (Benson & Hocevar, 1985; Goldsmith & Desborde, 1991; Schriesheim & Hill, 1981). For these reasons, some psychometricians have proposed that scales should only include positively worded items (or at least items in the same direction) (Iwata, Saito, & Roberts, 1994; Schriesheim & Eisenbach, 1995).

The problem with this proposition is that the use of consistently worded questions may introduce issues, such as straight-line responding or other forms of acquiescence (Wong et al., 2003). Thus, a sensible compromise position is to suggest that reversed items should be included liberally and when used their wording should be carefully checked to ensure clarity. In addition, the effect of reversed items on factor loadings and communalties should be carefully scrutinized (Schriesheim, Eisenbach, & Hill, 1989). In the present study regardless of item content negative items performed poorly in comparison to positively worded items. Subsequent work needs to examine how best to integrate and utilise negative items when applied to the assessment of paranormal belief.

Phase II, employed a 50-item version of the MMU-N. This was composed of the 47 items extracted from Phase I plus three supplementary items designed to increase subscale coherence and breadth; an item was added to each of the astrology, extra-terrestrial visitations and ESP subscales. Within the second study phase, the MMU-N performed well, demonstrating excellent internal reliability, concurrent validity and convergent validity. High positive correlations were observed between the MMU-N and established paranormal measures (ASGS & R-PBS). There were also, positive correlations between the MMU-N and other study variables (i.e., reasoning measures & RT), which were comparable to those obtained with the ASGS and R-PBS. Similarly, when used in multiple regression and median split analysis findings aligned closely with those produced using established paranormal measures. Subscales demonstrated good to excellent internal reliability. Finally, MMU-N subscales correlated with the ASGS and R-PBS (TPB & NAP) in a similar pattern to that observed in Phase I.

In conclusion, the results of Phase II indicated that the MMU-N possesses similar psychometric properties to existing, established measures of paranormal belief (ASGS & R-PBS). The MMU-N has, however, important advantages. Firstly, the MMU-N contains reversed items and therefore is less prone to response bias; although, as noted previously the use of reversed/negative worded items can be problematic. Secondly, the MMU-N is composed of several component subscales, which can stand as discreet/independent measures. These subscales may be of value to researchers wishing to concentrate on individual facets of paranormal belief, as opposed to the general/global construct.

This is an important development since psychometric validation typical reduces items to broad common elements derived via statistical conventions and parameters. In the case of the R-PBS, seven subscales (26 items) were reducible to two general factors (NAP, 11 items; & TPB, 5 items). These factors are inclusive and as such, provide few insights into particular phenomena. For example, the factors would be of limited utility to researchers studying specific beliefs (i.e., hauntings or alien abductions). Whilst, it is important to ensure that scales are psychometrically sound, this can best be achieved at the subscale (rather than the general scale level). Consideration of items following factor analysis often reveals question sets lacking in subscale breadth, balance and coherence. In the case of the R-PBS psi subscale, levitating/moving objects and the impossibility of mind reading are the only phenomena assessed. Collectively, these items provide no more than a blurry, partial snapshot of belief in PK and ESP.

Another potential advancement is to approach item generation in a more sophisticated and theory driven manner. The traditional method involves collating large item pools then reducing them to a set of related, but idiosyncratic statements. Each of the retained items provides an indirect measure of the construct of interest. For instance, ‘Ghosts do exist’ assesses belief in the existence of ghosts, which incidentally relates to general belief in the paranormal. An alternative and potentially more productive approach would be to assess belief in the paranormal via a series of global statements (e.g., I believe in the paranormal, that is forces/powers beyond current understanding). Such statements, link explicitly to working definitions of paranormality, and avoid obfuscations arising from the perceived veracity/validity of specific phenomena. Particularly, considering the factors identified in the present study, a failure to endorse items supporting the existence of ghosts would affect the

religious dimension and overall belief in the paranormal. Thus, someone with high general belief would by virtue of not endorsing one particular type of paranormal phenomenon be under represented on the global construct.

Another, even more radical approach would be to assess belief in the paranormal via endorsement of a single-item measure. This would be a prudent approach, if the intention were simply to assess general belief in the paranormal. Such an approach has generality without specificity, and avoids the problem of sampling precise construct content; the pitfalls of either failing to exclude core phenomena, or including phenomena that is peripheral or debatable.

Single-item instruments have been successfully used to measure psychological constructs, such as well-being (Diener, 1984); job satisfaction (Wanous, Reichers, & Hudy, 1997), personality (e.g., self-esteem scale) (Robins, Hendin & Trzesniewski, 2001), ability (Rammstedt & Rammsayer, 2002), and have been found useful screening instruments in medical settings (Konstabel, Lönnqvist, Walkowitz, Konstabel, & Verkasalo, 2012). Shorter instruments are easier for respondents to complete because they are less time demanding. This has a number of benefits. Respondents will be more likely to volunteer, making it easier to recruit large sample numbers.

Furthermore, single-item measures avoid difficulties associated with long scales, where item redundancy (repetition) may frustrate, fatigue, and bore participants (Robins et al., 2001). The authors are mindful of the criticisms levelled at single item measures. Common concerns being difficulty of estimating their reliability, low reliability and perceived inadequacy in comparison to longer measures. Considering reliability, longer scales will generally be more reliable because the addition of items negates measurement error. Thus, each item provides an estimate of construct endorsement. The advantage of single-item measures is that respondents may comprehend their purpose and meaning more easily, and therefore produce more accurate and precise responses. In addition, because of the brevity of single-item measures respondents will be more able retain motivation and concentrate more fully (Burisch, 1984a, 1984b).

The ‘most obvious limitation’ (Abdel-Khalek, 2006) of single-item measures is that they fail to generate internal consistency reliability coefficients (Abdel-Khalek, 2006). Herzberg and Bra¨hler (2006) argue that at least three (probably more) items are required in order to construct a psychometric measurement model. This is a complex issue without an easy solution clearly; alternative psychometric models to assess their reliability are required.

The principal concern with single-item measures centres on the degree to which they can adequately assess construct breadth, or the extent to which single items are capable of assessing construct breadth in comparison to longer scale measures (Smith, McCarthy, & Anderson, 2000). To alleviate this concern, single-items should contain detailed and comprehensive content. Additionally, item(s) presentation should be at an understandable level of abstraction (cf.. John, Hampson, & Goldberg, 1991). This has the benefit of ensuring that items require less cognitive effort to comprehend. Additionally, lower level constructs possess a predictive advantage over broad factors (Paunonen, 1998; Paunonen & Ashton, 2001).

These issues and debates are worth considering when developing a coherent and robust measure of belief in the paranormal. Certainly, it is vital that researchers begin with a clear conceptualisation of the target construct (Clark & Watson, 1995). In this case, it would be one unsullied by definitional debates about the legitimacy and veracity of particular paranormal phenomena. No delineation will ever prove sufficient, nor will it receive universal acclaim. Currently we have a board agreement that paranormal beliefs share a set of important characteristics; lack general scientific verification and endorsement, generated within the nonscientific community, and extensively endorsed by people who might normally be expected by their society to be capable of rational thought and reality testing (Irwin, 2009). Certainly, the measurement item(s) should conform to this definition (Burisch, 1984b). Whilst some authors have argued primary item pools should be boarder than a narrow, specific theoretical view of the target construct, our experience suggests that greater focus and consideration is required. Consistent with this, we would support the method recommended by Konstabel et al. (2012), who propose closely matching items to construct definitions. This approach avoids common problems surrounding statistical selection, may result in a set of items whose content is biased or narrower (‘bloated specific’) than intended.

Konstabel et al. (2012) also usefully recommend that items should not be from different levels of abstraction. Particularly, one item should not logically assume another. For example, having a specific statement regarding belief in PK (the ability to move objects by the power of mental processes) and asking whether respondents have themselves experienced the process of PK, whereby they have moved objects by the power of their mental processes. In addition, items referring to different perspectives should be excluded (e.g., I consider myself to be psychic and friends and family believe I am psychic) because one can vary the point of view systematically based on the perceptions of others' views.

Finally, the use of items with complex embedded clauses and qualifiers should be avoided because respondents may find compound items difficult to comprehend. Similarly, there are potential problems with the use of double-barrelled items. For example, the R-PBS contains the statement 'There is a heaven and a hell'. Respondents who only endorse one of these notions (heaven or hell) may not know how to respond to this item. Moreover, respondents may endorse the item (or reject it) based on belief in either. Alternatively, the item may produce mid-range, scores indicating uncertainty.

Hinkin (1998) points out, that the process would be the same, although less complex for developing a single item scale. Namely, establishing construct validation via three steps: specifying the construct domain, empirically exploring the degree to which an item/items measure that domain, and investigating the extent to which the measure generates coherent findings (those consistent with theory) (Nunnally, 1978). Construct validity is vitally important because it links theory to psychometric measurement (Kerlinger, 1986). Thus, feature measures need to be theory driven and must address the issues and concerns addressed within this section.

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Appendices

Table 1: Correlations between individual items and overall measure

Table 2: Observed Average Measures For Person (Unscored)

Table 3: Item Statistics: Misfit Order (Recode 1-5)

Table 4: Correlations and Infit/Outfit statistics

Scale Development and Analysis

Table 1 Correlations between individual items and overall measure

Items	Factor	Wording	Total/Item Correlation	M	SD	SEM	Median	Mode	ENTRY NUMBER	TOTAL SCORE	MEASURE	MODEL S.E.	INFIT		OUTFIT		PT-MEASURE		EXACT	MATCH
													MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%
Item 2 **	Superstition	Positive	0.35	4.02	2.26	0.06	5.00	1.00	2	4885	-0.19	0.02	1.58	9.9	2.69	9.9	0.33	0.56	15.7	21.6
Item 26 **	Superstition	Positive	0.34	4.90	2.09	0.06	5.00	7.00	21	5950	-0.49	0.02	1.69	9.9	2.25	9.9	0.35	0.59	18.7	23.6
Item 34 *	Superstition	Positive	0.36	4.89	2.02	0.06	5.00	7.00	25	5943	-0.49	0.02	1.62	9.9	1.93	9.9	0.37	0.59	21.5	25
Item 3 *	Religion	Positive	0.39	4.09	2.18	0.06	4.00	4.00	3	4975	-0.28	0.02	1.46	9.9	1.6	9.9	0.38	0.56	15.5	20.3
Item 18	Superstition	Positive	0.45	2.77	1.85	0.05	2.00	1.00	14	3364	0.3	0.02	1.17	4.5	1.19	3.5	0.41	0.48	24.6	23.6
Item 40	ET	Negative	0.45	3.20	1.83	0.05	4.00	4.00	29	3886	0.1	0.02	1.17	4.5	1.49	9.9	0.41	0.5	25.6	24.6
Item 1	Haunting	Negative	0.43	3.97	1.83	0.05	4.00	4.00	1	4827	-0.19	0.02	1.25	6.3	1.41	9.5	0.42	0.54	25.9	25.2
Item 10	Superstition	Positive	0.47	3.07	1.98	0.06	3.00	1.00	7	3724	0.16	0.02	1.19	5	1.29	5.4	0.43	0.5	22.9	22.6
Item 19	Religion	Positive	0.46	3.58	2.10	0.06	4.00	1.00	15	4346	-0.1	0.02	1.26	6.8	1.32	6.7	0.44	0.53	24	21.9
Item 39	Witchcraft	Positive	0.48	3.01	1.75	0.05	3.00	1.00	28	3659	0.21	0.02	1.11	2.9	1.28	5.7	0.44	0.49	28.1	24.4
Item 11	Religion	Positive	0.45	3.94	2.04	0.06	4.00	4.00	8	4785	-0.22	0.02	1.27	7.1	1.29	6.6	0.44	0.55	21.3	22.8
Item 56	ET	Positive	0.52	2.37	1.56	0.04	2.00	1.00	41	2878	0.51	0.02	0.96	-1.1	1.15	2.7	0.46	0.43	28.5	25.6
Item 64	ET	Positive	0.53	2.20	1.50	0.04	1.00	1.00	47	2678	0.58	0.02	0.94	-1.5	0.91	-15	0.46	0.42	29.4	27.2
Item 54	Astrology	Negative	0.51	3.21	1.83	0.05	3.00	1.00	39	3905	0.11	0.02	1.09	2.4	1.22	5	0.47	0.5	27.5	24.5
Item 28	ESP	Negative	0.49	4.01	1.88	0.05	4.00	4.00	22	4877	-0.22	0.02	1.17	4.4	1.22	5.1	0.47	0.54	24.8	25.3
Item 30	Astrology	Negative	0.53	3.03	1.88	0.05	3.00	1.00	23	3684	0.18	0.02	1.06	1.5	1.24	4.8	0.47	0.49	27	23.1
Item 13	PK	Positive	0.54	2.33	1.52	0.04	2.00	1.00	10	2835	0.57	0.02	0.93	-1.7	0.88	-25	0.48	0.43	30.8	27.2
Item 16	ET	Positive	0.54	3.52	1.72	0.05	4.00	4.00	12	4277	0.04	0.02	1.03	0.8	1.06	1.4	0.5	0.51	28.4	29
Item 8	ET	Positive	0.54	3.50	1.77	0.05	4.00	4.00	5	4257	0.04	0.02	1.03	0.8	1.05	1.2	0.5	0.52	25.7	26.6
Item 48	ET	Positive	0.57	2.58	1.60	0.05	2.00	1.00	35	3129	0.42	0.02	0.91	-2.5	0.94	-13	0.5	0.45	25.3	23.7
Item 38	Astrology	Negative	0.55	3.13	1.73	0.05	3.00	4.00	27	3808	0.17	0.02	0.99	-0.2	1	0.1	0.51	0.49	30.3	25.6
Item 45	PK	Positive	0.58	2.52	1.56	0.04	2.00	1.00	33	3058	0.46	0.02	0.89	-3	0.93	-15	0.51	0.44	31	25.5
Item 14	Astrology	Negative	0.56	3.50	1.73	0.05	4.00	4.00	11	4250	0	0.02	1	-0.1	1.02	0.4	0.52	0.51	30.6	27.6
Item 51	Religion	Negative	0.54	4.44	1.90	0.05	4.00	4.00	37	5398	-0.41	0.02	1.1	2.6	1.13	3.1	0.52	0.56	24	23
Item 12	ESP	Negative	0.54	3.97	1.75	0.05	4.00	4.00	9	4829	-0.22	0.02	1.03	0.7	1.03	0.9	0.52	0.53	25.1	25.8
Item 55	Witchcraft	Positive	0.59	3.20	1.84	0.05	3.00	1.00	40	3883	0.08	0.02	0.95	-1.2	1.07	1.7	0.53	0.5	29.1	24.2
Item 23	Witchcraft	Positive	0.62	2.53	1.65	0.05	2.00	1.00	18	3076	0.37	0.02	0.85	-4	1.1	1.9	0.54	0.45	32.1	25.2
Item 59	Religion	Negative	0.56	4.44	1.86	0.05	4.00	4.00	43	5391	-0.45	0.02	1.04	1.2	1.1	2.6	0.54	0.56	23.6	23.6
Item 4	ESP	Positive	0.56	4.11	1.69	0.05	4.00	5.00	4	4988	-0.2	0.02	1.01	0.2	1.02	0.5	0.54	0.54	28.5	28.6
Item 24	ET	Positive	0.60	3.08	1.65	0.05	4.00	4.00	19	3743	0.24	0.02	0.9	-2.9	0.93	-1.7	0.54	0.49	29.4	25.7
Item 63	Witchcraft	Positive	0.64	2.54	1.62	0.05	2.00	1.00	46	3087	0.39	0.02	0.82	-4.9	0.78	-4.9	0.55	0.45	30.4	24.7
Item 21	PK	Positive	0.63	2.77	1.67	0.05	3.00	1.00	17	3361	0.38	0.02	0.83	-4.9	0.85	-3.5	0.55	0.47	26.2	23.9
Item 53	PK	Positive	0.64	2.91	1.57	0.05	3.00	4.00	38	3533	0.32	0.02	0.83	-4.8	0.95	-1.1	0.56	0.47	29.4	24.9
Item 47	Witchcraft	Positive	0.64	3.20	1.79	0.05	4.00	4.00	34	3889	0.15	0.02	0.87	-3.9	0.92	-2	0.57	0.5	30.3	24.9
Item 61	PK	Positive	0.65	2.63	1.56	0.04	2.00	1.00	44	3193	0.42	0.02	0.8	-5.8	0.76	-6	0.57	0.45	28.5	24.4
Item 62	Astrology	Positive	0.65	2.69	1.62	0.05	2.00	1.00	45	3266	0.42	0.02	0.8	-5.9	0.77	-5.6	0.57	0.46	29.6	24.5
Item 35	Religion	Negative	0.61	4.75	1.87	0.05	5.00	4.00	26	5768	-0.54	0.02	0.96	-1	0.96	-1	0.59	0.57	23.3	21.9
Item 44	ESP	Positive	0.61	4.76	1.69	0.05	5.00	5.00	32	5779	-0.54	0.02	0.96	-1.1	0.93	-1.7	0.6	0.56	30.9	28.9
Item 43	Religion	Positive	0.62	4.71	1.89	0.05	5.00	4.00	31	5724	-0.5	0.02	0.96	-1	0.93	-1.8	0.6	0.57	24.3	23.2
Item 25	Haunting	Negative	0.64	4.26	1.95	0.06	4.00	4.00	20	5178	-0.31	0.02	0.92	-2.1	0.92	-2	0.6	0.56	26.9	23.7
Item 20	ESP	Positive	0.67	4.51	1.76	0.05	5.00	5.00	16	5478	-0.39	0.02	0.86	-3.7	0.82	-4.3	0.64	0.56	30.9	28.9
Item 57	Haunting	Positive	0.74	3.37	1.97	0.06	4.00	1.00	42	4094	0.04	0.02	0.71	-9	0.68	-8.1	0.65	0.52	28.7	23.3
Item 41	Haunting	Positive	0.69	4.59	1.89	0.05	5.00	4.00	30	5575	-0.43	0.02	0.83	-4.6	0.82	-4.5	0.65	0.57	28.8	24.5
Item 49	Haunting	Positive	0.74	3.42	1.86	0.05	4.00	4.00	36	4155	0.05	0.02	0.71	-9	0.68	-8.4	0.65	0.52	30.5	25.6
Item 33	Haunting	Positive	0.74	3.91	2.34	0.07	4.00	4.00	24	4708	-0.14	0.02	0.74	-8	0.73	-7.1	0.66	0.54	27.2	24.2
Item 9	Haunting	Positive	0.74	3.94	1.91	0.05	4.00	4.00	6	4783	-0.14	0.02	0.73	-8.2	0.73	-7.3	0.67	0.54	27.6	25.2
Item 17	Haunting	Positive	0.75	4.20	1.94	0.06	4.00	5.00	13	5097	-0.24	0.02	0.71	-8.7	0.71	-7.5	0.69	0.56	29.4	25.3

(NB: ** Items above 2 are deemd distruptive and are ouside the recommended infit and outfit values - * These items are withn the 1.5-2 band and whilst not disruptive, are not useful for the construction of a suitable measure).

Table 2 Observed Average Measures For Person (Unscored) (By Observed Category)

-4 -3 -2 -1 0 1 2		
| 1 2345 67 |	47	BELIEF64
| 1 234567 |	10	BELIEF13
| 1 234756 |	**41**	**BELIEF56**
| 1 2 3 4567 |	33	BELIEF45
| 1 2 3456 7 |	45	BELIEF62
| 1 2 34 567 |	35	BELIEF48
| 1 2 34 567 |	44	BELIEF61
| 1 23456 7 |	46	BELIEF63
| 1 23 456 7 |	17	BELIEF21
| 1 2 3 4567 |	18	BELIEF23
| 1 23 4567 |	38	BELIEF53
| 1 234567 |	14	BELIEF18
| 1 2 34 567 |	19	BELIEF24
| 1 273456 |	**28**	**BELIEF39**
| 1 237456 |	**23**	**BELIEF30**
| 1 23 4567 |	27	BELIEF38
| 1 234567 |	7	BELIEF10
| 1 2 34657 |	**34**	**BELIEF47**
| 1 273456 |	**39**	**BELIEF54**
| 1 234567 |	29	BELIEF40
| 1 2 34567 |	40	BELIEF55
| 1 23 456 7 |	36	BELIEF49
| 1 2 3456 7 |	42	BELIEF57
| 1 2 3456 7 |	5	BELIEF8
| 1 234 567 |	12	BELIEF16
| 1 2 34567 |	11	BELIEF14
| 1 234567 |	15	BELIEF19
| 1 2 345 6 7 |	6	BELIEF9
| 1 2 345 67 |	24	BELIEF33
| 1234567 |	2	BELIEF2
| 1 2 34567 |	1	BELIEF1
| 1 2 34567 |	4	BELIEF4
| 1 2 34567 |	22	BELIEF28
| 1 234567 |	8	BELIEF11
| 1 2 34567 |	9	BELIEF12
| 1 2 3 456 7 |	13	BELIEF17
| 1 234567 |	3	BELIEF3
| 1 2 34567 |	20	BELIEF25
| 1 2 3 45 6 7 |	16	BELIEF20
| 1 2 34567 |	37	BELIEF51
| 1 23 45 67 |	30	BELIEF41
| 1 234 567 |	43	BELIEF59
| 1 2 34567 |	25	BELIEF34
| 1 234567 |	21	BELIEF26
| 1 2 3456 7 |	31	BELIEF43
| 1 2 3456 7 |	32	BELIEF44
| 1 2 345 67 |	26	BELIEF35
|---------+---------+---------+---------+---------+---------|	NUM	ITEM
-4 -3 -2 -1 0 1 2		

(NB: Bold Items represent disorganised response catagories)

Table 3 Item Statistics: Misfit Order (Recode 1-5)

NUMBER	SCORE	COUNT	MEASURE	S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD		CORR.	EXP.	OBS%	EXP%	ITEM
2	3534	1215	-0.28	0.03	1.93	9.9	2.1	9.9	A	0.35	0.56	27.9	45.6	Belief2
21	4179	1215	-0.87	0.03	1.81	9.9	1.88	9.9	B	0.36	0.58	25.2	34.7	Belief26
3	3703	1215	-0.43	0.03	1.81	9.9	1.79	9.9	C	0.39	0.57	31.7	43.7	Belief3
25	4141	1215	-0.83	0.03	1.66	9.9	1.7	9.9	D	0.38	0.58	26.6	35.5	Belief34
15	3314	1215	-0.07	0.03	1.55	9.9	1.51	9.9	E	0.46	0.55	39.5	46.2	Belief19

Table 4 Correlations and Infit/Outfit statistics for Factors of Paranormal Belief

	Items	Factor	Wording	Total/Item Correlation	M	SD	SEM	Median	Mode	ENTRY NUMBER	TOTAL SCORE	MEASURE	MODEL S.E.	INFIT		OUTFIT		PT-MEASURE		EXACT	MATCH	ITEM
														MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	
	ASTROLOGY .81																					
1	Item 54	Astrology	Negative	0.51	3.21	1.83	0.05	3.00	1.00	4	3905	-0.08	0.02	1.12	2.70	1.07	1.5	0.71	0.72	41	32.7	54
2	Item 14	Astrology	Negative	0.56	3.50	1.73	0.05	4.00	4.00	1	4250	-0.29	0.02	1.02	0.60	1.04	0.8	0.73	0.75	37.5	31.7	14
3	Item 38	Astrology	Negative	0.55	3.13	1.73	0.05	3.00	4.00	3	3808	-0.02	0.02	1.03	0.60	1.03	0.8	0.71	0.71	38.4	32.5	38
4	Item 30	Astrology	Negative	0.53	3.03	1.88	0.05	3.00	1.00	2	3684	0.06	0.03	1.01	0.30	0.98	-0.5	0.71	0.7	38.4	32.7	30
5	Item 62	Astrology	Positive	0.65	2.69	1.62	0.05	2.00	1.00	5	3266	0.33	0.03	0.88	-3.00	0.86	-3.1	0.69	0.66	35.4	32.6	62
	ESP .79																					
1	Item 28	ESP	Negative	0.49	4.01	1.88	0.05	4.00	4.00	4	4877	0.19	0.02	1.36	8.1	1.37	7.9	0.64	0.7	32.1	31.7	28
2	Item 12	ESP	Negative	0.54	3.97	1.75	0.05	4.00	4.00	2	4829	0.21	0.02	1	0.1	1	0.1	0.7	0.7	36.3	31.7	12
3	Item 44	ESP	Positive	0.61	4.76	1.69	0.05	5.00	5.00	5	5779	-0.36	0.03	0.98	-0.4	0.98	-0.5	0.72	0.71	40.5	33.9	44
4	Item 4	ESP	Positive	0.56	4.11	1.69	0.05	4.00	5.00	1	4988	0.12	0.02	0.88	-3	0.92	-1.8	0.71	0.7	37.2	32.3	4
5	Item 20	ESP	Positive	0.67	4.51	1.76	0.05	5.00	5.00	3	5478	-0.17	0.02	0.83	-4.4	0.79	-5.3	0.76	0.71	42	33.8	20
	ET .91																					
1	Item 40	ET	Negative	0.45	3.20	1.83	0.05	4.00	4.00	1	3886	-0.31	0.03	1.38	7.7	1.28	5.1	0.75	0.8	44	39.8	40
2	Item 8	ET	Positive	0.54	3.50	1.77	0.05	4.00	4.00	5	4257	-0.63	0.03	1.1	2.2	1.11	2.2	0.8	0.81	37	39.6	8
3	Item 16	ET	Positive	0.54	3.52	1.72	0.05	4.00	4.00	4	4277	-0.64	0.03	1	-0.1	1.03	0.6	0.81	0.81	40	36.9	16
4	Item 64	ET	Positive	0.53	2.20	1.50	0.04	1.00	1.00	3	2678	0.8	0.03	0.93	-1.6	0.93	-1	0.72	0.7	49	45.2	64
5	Item 56	ET	Positive	0.52	2.37	1.56	0.04	2.00	1.00	2	2878	0.6	0.03	0.9	-2.2	0.92	-1.4	0.74	0.72	48	44.7	56
6	Item 24	ET	Positive	0.60	3.08	1.65	0.05	4.00	4.00	7	3743	-0.19	0.03	0.91	-2.1	0.88	-2.4	0.8	0.79	47	41.2	24
7	Item 48	ET	Positive	0.57	2.58	1.60	0.05	2.00	1.00	6	3129	0.37	0.03	0.68	-8.1	0.64	-7.1	0.8	0.75	55	43.6	48
	HAUNTING .91																					
1	Item 1*	Haunting	Negative	0.43	3.97	1.83	0.05	4.00	4.00	1	4827	-0.01	0.02	1.91	9.9	2.21	9.9	0.58	0.75	35.1	33.7	1
2	Item 25	Haunting	Negative	0.64	4.26	1.95	0.06	4.00	4.00	2	5178	-0.22	0.02	1.28	6.1	1.22	4.4	0.72	0.75	41	34	25
3	Item 41	Haunting	Positive	0.69	4.59	1.89	0.05	5.00	4.00	4	5575	-0.48	0.03	0.92	-1.8	0.88	-2.6	0.78	0.76	39	34.4	41
4	Item 57	Haunting	Positive	0.74	3.37	1.97	0.06	4.00	1.00	3	4094	0.42	0.02	0.88	-3.1	0.86	-3.1	0.75	0.73	36.3	32	57
5	Item 33	Haunting	Positive	0.74	3.91	2.34	0.07	4.00	4.00	6	4708	0.06	0.02	0.86	-3.5	0.83	-3.9	0.77	0.74	43.1	33.3	33
6	Item 9	Haunting	Positive	0.74	3.94	1.91	0.05	4.00	4.00	7	4783	0.02	0.02	0.79	-5.4	0.82	-4.1	0.77	0.74	42	33.3	9
7	Item 17	Haunting	Positive	0.75	4.20	1.94	0.06	4.00	5.00	8	5097	-0.17	0.02	0.76	-6.2	0.75	-6	0.79	0.75	45	34.1	17
8	Item 49	Haunting	Positive	0.74	3.42	1.86	0.05	4.00	4.00	5	4155	0.38	0.02	0.73	-7.5	0.76	-5.5	0.77	0.73	39	32	49
	PK .87																					
1	Item 21	PK	Positive	0.63	2.77	1.67	0.05	3.00	1.00	3	3361	-0.16	0.03	1.18	3.8	1.15	2.9	0.76	0.78	40.6	38.7	21
2	Item 13	PK	Positive	0.54	2.33	1.52	0.04	2.00	1.00	1	2835	0.35	0.03	1.15	3.1	1.15	2.7	0.71	0.73	43.6	40.2	13
3	Item 53	PK	Positive	0.64	2.91	1.57	0.05	3.00	4.00	4	3533	-0.32	0.03	0.93	-1.5	0.91	-1.8	0.8	0.8	43.3	36.5	53
4	Item 45	PK	Positive	0.58	2.52	1.56	0.04	2.00	1.00	2	3058	0.13	0.03	0.86	-3.3	0.84	-3.2	0.77	0.75	47.5	38.3	45
5	Item 61	PK	Positive	0.65	2.63	1.56	0.04	2.00	1.00	5	3193	0	0.03	0.84	-3.8	0.83	-3.6	0.79	0.77	49.2	38.3	61
	RELIGION .88																					
1	Item 59	Religion	Negative	0.56	4.44	1.86	0.05	4.00	4.00	2	5391	-0.09	0.02	1.21	4.7	1.44	8.5	0.66	0.71	30.2	30.2	59
2	Item 51	Religion	Negative	0.54	4.44	1.90	0.05	4.00	4.00	1	5398	-0.1	0.02	1.16	3.8	1.38	7.4	0.67	0.71	34.2	30.2	51
3	Item 3	Religion	Positive	0.39	4.09	2.18	0.06	4.00	4.00	4	4975	0.11	0.02	1.14	3.3	1.14	3	0.7	0.71	28.6	29.3	3
4	Item 43	Religion	Positive	0.62	4.71	1.89	0.05	5.00	4.00	7	5724	-0.27	0.02	0.91	-2.2	1.02	0.4	0.72	0.71	34.9	30.1	43
5	Item 19	Religion	Positive	0.46	3.58	2.10	0.06	4.00	1.00	5	4346	0.42	0.02	0.98	-0.5	0.95	-1	0.72	0.71	30.8	29.1	19
6	Item 35	Religion	Negative	0.61	4.75	1.87	0.05	5.00	4.00	3	5768	-0.29	0.02	0.86	-3.6	0.88	-2.7	0.74	0.71	35.6	30.1	35
7	Item 11	Religion	Positive	0.45	3.94	2.04	0.06	4.00	4.00	6	4785	0.21	0.02	0.76	-6.6	0.74	-6.4	0.76	0.71	35.7	28.9	11
	SUPERSTITION .83																					
1	Item 18	Superstition	Positive	0.45	2.77	1.85	0.05	2.00	1.00	4	3364	0.74	0.02	1.06	1.4	1.27	3.9	0.69	0.71	38.1	36.2	18
2	Item 2	Superstition	Positive	0.35	4.02	2.26	0.06	5.00	1.00	1	4885	-0.04	0.02	1.21	4.6	1.19	3.7	0.73	0.75	27.2	29.4	2
3	Item 26	Superstition	Positive	0.34	4.90	2.09	0.06	5.00	7.00	2	5950	-0.63	0.02	1.09	2	1	-0.1	0.76	0.77	32.5	33.1	26
4	Item 34	Superstition	Positive	0.36	4.89	2.02	0.06	5.00	7.00	3	5943	-0.62	0.02	1.05	1.2	1	0.1	0.76	0.77	32.6	33.3	34
5	Item 10	Superstition	Positive	0.47	3.07	1.98	0.06	3.00	1.00	5	3724	0.55	0.02	0.76	-6	0.79	-3.8	0.76	0.72	38.4	32.2	10
	WITCHCRAFT .85																					
1	Item 39	Witchcraft	Positive	0.48	3.01	1.75	0.05	3.00	1.00	1	3659	-0.11	0.03	1.44	9	1.42	7.7	0.7	0.76	39.5	35	39
2	Item 55	Witchcraft	Positive	0.59	3.20	1.84	0.05	3.00	1.00	2	3883	-0.28	0.03	1.12	2.7	1.1	2	0.77	0.78	38.9	33.5	55
3	Item 47	Witchcraft	Positive	0.64	3.20	1.79	0.05	4.00	4.00	5	3889	-0.28	0.03	0.86	-3.4	0.85	-3.3	0.8	0.78	43.5	33.5	47
4	Item 63	Witchcraft	Positive	0.64	2.54	1.62	0.05	2.00	1.00	4	3087	0.33	0.03	0.85	-3.5	0.82	-3.6	0.74	0.71	47.4	36.8	63
5	Item 23	Witchcraft	Positive	0.62	2.53	1.65	0.05	2.00	1.00	3	3076	0.34	0.03	0.77	-5.8	0.74	-5.6	0.75	0.71	47.9	38	23

Scale Development and Analysis

Following principal components analysis (PCA) item analysis was undertaken using WINSTEPS software (Linacre, 2012). Item evaluation followed the recommendations of (Bond & Fox, 2007; Linacre, 2004, 2005); consideration of dimensionality and item fit. Firstly, with regard to item polarity no MMU-N items negatively correlated with the overall scale measure or fellow subscale items (see table 1).

Category response was generally good, the seven classes (*strongly disagree* to *strongly agree*) were typically ordered correctly and functioned to produce an interpretable measure. Considering empirical item category measures, (observed average measures for person) only five items deviated from the expected response pattern (see table 2):

Item 56: People have been taken on board alien spaceships,

Item 39: Witches/warlocks who can perform genuine acts of magic exist outside the realm of imagination,

Item 30: A person's future has nothing to do with their zodiac sign (R[7]),

Item 47: There are actual cases of witchcraft, and

Item 54: Astrology cannot be used to accurately predict the future (R).

In the case of Items 56, 39, 30 and 54 the response extreme (strongly agree) was erroneously located in the mid-range of category responses. All other responses increase in the expected monotonic pattern. Item 47 had an inversion of categories 5 & 6.

Next, an exploration of category function was undertaken. Category function refers to the degree to which categories increase monotonically; the extent to which the seven response categories *(strongly disagree to strongly agree)* produced an interpretable measure (Bond & Fox, 2001; Briggs & Wilson, 2003; Linacre, 1999). Analysis revealed some disordering of categories, particularly in the scale mid-range (neither agree nor disagree; categories 3, 4 & 5), indicating insufficient discrimination between mid-scale scores. In order to address this issue, categories 3, 4 and 5 were recoded to produce a 5-point scale. Re analysis found the recoded scale possessed a monotonic ordering of steps.

[7] R denotes a reversed, negatively worded item.

In order to assess item performance, infit and outfit mean squared values (for both 7-point and 5-point scales) were scrutinised. Mean-square fit statistics illustrate the size of the randomness (i.e., the amount of distortion of the measurement system); 1.0 is the expected value. Values less than 1.0 indicate observations that items are too predictable and redundant; overfit the model. Values greater than 1.0 indicate unpredictability (i.e., unmodeled noise); underfit the model. The infit mean square value is relatively affected by unexpected responses closer to item and person measures. Thus, infit mean square residuals are weighted by individual variance to minimise the impact of unexpected responses far from the measure. For example, infit reports overfit for Guttman patterns, underfit for alternative curricula, or idiosyncratic clinical groups. Outfit mean square is the average of the standardised residual variance across items and persons, and is unweighted. Hence, the estimate produced is relatively more affected by unexpected responses distant to item or person measures. For example, outfit reports for lucky guesses and careless mistakes.

In general, mean square values near 1.0 indicate little distortion of the measurement system; scores in the range 0.5 - 1.5 being considered productive for measurement. Items outside of this range are problematic:

- < 0.5 less productive for measurement, but not degrading. May produce misleadingly good reliabilities and separations;
- 1.5 - 2.0 unproductive for construction of measurement, but not degrading; and
- > 2.0 distorts or degrades the measurement system.

For the 7-point scale, four items demonstrated errant fit statistics[8] (see table 1):

Item 2: I have avoided walking under a ladder because it is associated with bad luck (INFIT MNSQ = 1.58; OUTFIT MNSQ = 2.69);

Item 26: I do say 'touch wood' or actually touch wood to promote good luck (INFIT MNSQ = 1.69; OUTFIT MNSQ = 2.25);

Item 34: I do say 'fingers crosses' or actually cross my fingers to promote good luck (INFIT MNSQ = 1.62; OUTFIT MNSQ = 1.93); and

Item 3: I believe in God (INFIT MNSQ = 1.46; OUTFIT MNSQ = 1.60).

[8] Items are presented in order of WINSTEPS misfit output.

A similar pattern of results emerged following recoding. For the 5-point scale, five items demonstrated errant fit, the four previously identified items plus item 19 (see table 3):

Item 2: I have avoided walking under a ladder because it is associated with bad luck (INFIT MNSQ = 1.93; OUTFIT MNSQ = 2.1);

Item 26: I do say 'touch wood' or actually touch wood to promote good luck (INFIT MNSQ = 1.81; OUTFIT MNSQ = 1.88);

Item 3: I believe in God (INFIT MNSQ = 1.81; OUTFIT MNSQ = 1.79).

Item 34: I do say 'fingers crosses' or actually cross my fingers to promote good luck (INFIT MNSQ = 1.66; OUTFIT MNSQ = 1.70); and

Item 19: There is a devil (INFIT MNSQ = 1.55; OUTFIT MNSQ = 1.51).

In terms of the production of an overall measure of paranormal belief, these items need reappraisal. This could take the form of either removal or rephrasing, however, the purpose of scale development (in this report) was to create a series of independent, but inter-related measures. In this context, removing items is not a prudent option. Looking at the subscales (see table 4) only one item produced fit statistics outside of the accepted range (0.5 -1.5). This was item 1: Ghosts do not exist (INFIT MNSQ = 1.91; OUTFIT MNSQ = 2.21) on the Haunting subscale. It is difficult to understand why this item performed atypically. Speculatively, problems may have arisen from the item's negative wording. Some respondents may have misread the item when completing the questionnaire booklet. Thus, responses on the item may not be indicative of level of paranormal belief. This demonstrates the importance of developing subscales prior to amalgamating them into a general scale. Clearly, further research is required to refine, extend and develop the existing item pool, to first validate the subscales and then finally produce a global measure of paranormal belief (see general discussion).