Development and validation of the Multi-dimensional Questionnaire of Scientifically Unsubstantiated Beliefs

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Abstract

Objective: There are several existing questionnaires measuring paranormal or scientifically unsubstantiated beliefs but none cover a broad spectrum of cognitions while also being up-to-date and unconstrained by theoretical limitations. There is also a debate about the number of separate types of belief. Thereby, reported here is the development and validation of a new multidimensional questionnaire measure of scientifically unsubstantiated beliefs in the general UK population.

Method & Results. In Study 1, participants (N=393) completed a questionnaire containing a pool of 82 items covering nine facets of belief discernible conceptually within the existing research literature. Scree analysis followed by exploratory factor analysis indicated the existence of four empirically observable factors: belief in supernatural forces; belief in God and destiny; belief in alien visitation, monsters and conspiracies; and belief in consciousness beyond the body. Twenty-four items were selected as measures of these factors. Studies 2, 3 and 4 demonstrated the convergent and divergent validity of the four empirically-derived questionnaire subscales and their internal reliability.

Conclusion. The resultant new Multi-dimensional Questionnaire of Scientifically Unsubstantiated Beliefs (MQSUB) is a psychometrically robust measure and comprises a comprehensive framework which can be used to systematically investigate the psychological and social concomitants of such beliefs.

Introduction

Belief in scientifically unsubstantiated phenomena is widespread throughout the world. For example, Moore (2005) observed that around three-quarters of the adult American population accept at least one paranormal belief (for example, ghosts, telepathy, precognition, astrology) while Austin (2015) reported that 68% of adult British society reported having experienced some kind of supernatural event, including 31% who claimed to have experienced the presence of a ghost. Brotherton, French & Pickering (2013) reported moderate levels of conspiracist ideation in their series of studies. Despite the prevalence of belief in scientifically unsubstantiated phenomena there is currently no comprehensive and up-to-date measure available for researchers. The studies reported here document the development and validation of a comprehensive and multi-dimensional measure of scientifically unsubstantiated belief to assist research examining the causes and consequences of such belief.

The term *paranormal* is defined as 'a proposition that has not been empirically attested to the standards of the scientific establishment but is generated within the non-scientific 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, p16). This definition emphasises the lack of empirical evidence for a belief and so might include beliefs in conspiracy theories and religious belief, though these are not typically regarded as facets of the paranormal. The present series of studies use the term `scientifically unsubstantiated phenomena' as a generic one to encompass a wider field than is commonly understood by the word `paranormal'.

Belief in scientifically unsubstantiated phenomena may seem harmless but can have damaging impacts on personal outcomes and on wider society. For example, a tendency to conspiracist thinking is associated with non-compliance with

vital health care for HIV/AIDS (Bogart et al, 2010), and a withdrawal from cooperation with security measures (Bartlett & Miller, 2010). Belief in alternative medicine can lead to inappropriate health behaviours (Perry & Dowrick, 2000; White, Resch & Ernst, 1997), while belief in demonic possession can result in violence against individuals perceived to be afflicted (http://www.livescience.com/37274-toddler-exorcism-death.html). Generally, belief in scientifically unsubstantiated phenomena discourages appreciation of the value of reliable and replicable evidence and so damages the ability of individuals to assess current threats and concerns, such as climate change, or to evaluate the importance of health initiatives, for example testing for cancer in at-risk groups (French & Stone, 2014, p171; Sherriff, 2010). This may be a particular concern for politicians who may be taking decisions with far-reaching consequences. It is desirable that their decisions should be based on sound evidence when, for example, deciding whether to fund investment in renewable energy sources or homeopathy delivered through a national health service.

There are several questionnaire measures of paranormal belief, of which the two most commonly used are the Revised Paranormal Belief Scale (RPBS) originally developed by Tobacyk (1988), and the Australian Sheep and Goat Scale (ASGS) of Thalbourne and Delin (1993). Both of these have substantial limitations.

The RPBS is probably the most frequently-used measure of paranormal belief according to Irwin (2009, p45) and it aims to measure belief in seven facets of the paranormal: traditional religious belief, psi, witchcraft, superstition, spiritualism, extraordinary life forms, and precognition. This measure has been valuable in establishing the multi-dimensional character of paranormal belief and has given rise to a substantial body of research. Its major drawback is that its 26 items may be insufficient to measure the seven facets reliably. There have also been frequent

failures to replicate the factor structure: some researchers consider there are five factors (Lawrence, Roe, & Williams, 1997, 1998) while Lange, Irwin, and Houran (2000) preferred two clusters of items which they termed New-Age Philosophy (psi and psychic powers, future prediction, astral projection) and Traditional Paranormal Belief (witchcraft and the devil). Some of the items are outdated, for example, the statement `witches do exist' could be argued to be true since there are people who follow the practice of Wicca and call themselves witches. The item `There is life on other planets' is now scientifically supported and generally accepted as almost certainly true. The items in the traditional religious belief scale are Judeo-Christian in nature and do not address the full spectrum of traditional religious beliefs which are commonplace in many countries today.

The ASGS is so-named to refer to those who believe in the paranormal as `sheep' and those who are sceptical as `goats'. The ASGS contains eighteen items measuring belief in, and self-rated abilities in, telepathy, psychokinesis (movement of objects by the power of the mind), precognition, and post-mortem survival. Its scope, however, does not cover the full range of popular paranormal belief.

Other measures are focused on a narrow range of belief: for example, the Generic Conspiracist Belief Scale (Brotherton, French & Pickering, 2013) measures generic conspiracist ideation, the tendency to endorse conspiracy theories across a range of domains. Its scope is thus limited to one specific facet of scientifically unsubstantiated belief.

None of these existing measures cover the whole range of common beliefs in scientifically unsubstantiated phenomena. The present study aimed to discover the structure of scientifically unsubstantiated belief and to create a multi-dimensional questionnaire measuring belief in a wide range of topics of current concern and using

items that are well-understood by the general population. In Study 1, participants were presented with 82 questions covering a wide range of beliefs including the seven facets of the RPBS and additionally belief in conspiracy theories, religion, destiny / fate / karma, and alternative medicine.

Subsequent studies reported here investigated the convergent and divergent validity of the relevant subscales of the new questionnaire compared to existing measures. Convergent validity was measured relative to the RPBS (Study 2), the Generic Conspiracist Belief Scale (Study 2), and the Australian Sheep-Goat Scale (Study 3 and 4). Divergent validity was measured by comparison with the Creative Experiences Questionnaire measure of fantasy proneness (Study 2), the Rational Experiential Inventory measure of thinking styles (Study 3), and locus of control (Study 4). In addition, Study 4 examined how mortality awareness, rebelliousness, and self-perceived marginalisation, relate to scientifically unsubstantiated beliefs.

Study 1

Participants

There were 393 participants recruited via social media, comprising 280 women (71%), 112 men (28.5%), and 1 respondent who gave their gender as androgyne. Their ages ranged from 18 to 86 (with 80% being aged 18 to 48), mean age = 34.9 years, SD = 14.71. Of these participants, 131 (33%) were married, 29 (7.4%) were cohabiting, 190 (48%) were single, 18 (4.6%) were divorced, 6 (1.5%) were widowed and 19 (4.8%) were separated. Educationally, 73 (18.6%) had been educated to age 16 (UK General Certificate of Secondary Education), 85 (21.6%) to age 18 (`Advanced' secondary school level), and 234 (59.5%) had university or professional qualifications. There were 122 (31%) students (only 4 of whom self-designated as part-time), 20 (5%) were unemployed, 11 (2.8%) self-designated as home-makers,

210 (53%) were employed (153 full-time, 57 part-time), and 30 (7.6%) described themselves as retired. Household income was less than £5,000 per year for 109 (28%) of the participants, over £45,000 for 30 (7.6%) of the participants, with the majority (50%) reporting between £11,000 and £30,000. A majority of respondents (N=310, 79%) gave their ethnicity as `white European', with the remainder spread among other ethnicities (for example, 6% as `black african' and 6.6% as `south asian / indian / pakistani'). Religious affiliation was varied: 175 (44.5%) specified having no religion, 136 (34.6%) self-designated as Christian, 37 (9.4%) were Muslim, and 6 (1.5%) were Buddhist, while 35 (8.9%) gave their religion as `other'.

Measures

The initial pool of 82 items was created following an examination of existing questionnaire measures of paranormal and conspiracist belief (ASGS, Thalbourne & Delin, 1993; RPBS, Tobacyk, 1988; GCBS, Brotherton et al, 2013) and the a-priori consideration of other areas of belief, specifically belief in the influence of destiny / fate / karma and belief in the efficacy of alternative medicine. Nine conceptual domains of belief were identified: *anomalous mental powers* including clairvoyance, telepathy, precognition, and psychokinesis, an example of an item being `some people can see events before they happen'; *traditional supernatural belief* including good and bad luck, dowsing, and casting spells, an exemplar item being `touching wood can bring good luck'; *fate / destiny / karma*, e.g., `some events are fated to occur'; *extraordinary life forms* including aliens, the Loch Ness monster, and Bigfoot, e.g., `Aliens from other planets have visited Earth'; *the survival hypothesis* including reincarnation, ghosts, and astral travel, e.g., `Some part of a person’s consciousness can survive their death'; *future prediction*, e.g., `Study of the stars can be used to predict the future for individuals'; *Energy-based therapies*, e.g., 'homeopathy is an

effective form of medicine'; *religious beliefs*, e.g. 'The world was created by a God'; and *conspiracist beliefs*, e.g., 'National governments routinely lie to the general public in order to retain power'. For each of these nine conceptual domains of belief items were generated so that collectively the item pool comprised of 82 in all.

Results & Discussion

All 82 items were entered into an initial principal components analysis in which the minimum eigen value for each extracted factor was supressed from 1.0 to 0.25, thereby treating each item as if it were a factor and producing an associated eigen value. These values were then graphically illustrated in the form of a scree plot, as after Cattell (1966). Visual analysis of this scree plot indicates four `jumps' down to the scree line, which, from previous data sets in which the number of underlying dimensions is known, indicates the number of principal components which can be extracted. Therefore, a further principal components analysis was conducted in which the eigen value for the extraction of the factor reverted to 1.0, with the number of factors to be extracted being specified as four. Varimax rotation was also specified to maximise the amount of unique variance accounted for by each factor. The resulting four factors collectively accounted for 48% of the variance in the item correlation matrix. Loadings of each item onto the factors are displayed in Table 1, Appendix 1.

Only items with a loading greater than 0.4 are considered substantive. Items with loadings on more than one factor at above 0.4 were discounted since they would indicate the presence of a general factor. We excluded an item if it was very strongly correlated with another item and addressed the same concept, which enabled us to select items with a greater conceptual spread and diversity of content that still reflected a theoretically coherent factor. By rank ordering the items within each factor

in terms of the magnitude of the item loading, an inspection of the content of the items for each factor led to the following names for each of the four factors being specified: belief in supernatural forces (BSF) - the lead item being `*hanging a mirror in a special place can bring good fortune to a house'* (eight items, 3, 5, 17, 21, 22, 29, 58r & 72, wherein `r' denotes reverse scoring); belief in the influence of God and destiny (BIGD), the lead item being `*God has created rules for correct moral behaviour'* (six items, 18, 32, 39, 43r, 48, 80); belief in aliens, monsters and conspiracies (BAMC) - the lead item being `*There is no physical evidence on earth of alien visitors from other planets'* (reverse scored) (six items, 25, 33, 46, 53r, 63, 67r)*;* and, belief in consciousness beyond the body (BCB), the lead item being `*Individual existence ends with death'* (reverse scored) (four items, 15r, 37, 50r 64r). Collectively these four empirically derived subscales constitute the twenty-four item *Multidimensional Questionnaire of Scientifically Unsubstantiated Beliefs* (MQSUB).

Given the four-factor structure of the MQSUB has been derived from principal components analysis wherein the ratio of participants to items is 4.79:1 (N=393:82), this structure is likely to be stable and replicable. Further, the four-factor structure of the MQSUB bears some resemblance to the two-cluster solution of the RPBS found by Lange, Irwin, and Houran, (2000). Their first cluster, new-age philosophy, consisted of psi, future prediction, astrology, and astral travel, and so resembles the BSF scale, which includes items measuring belief in future prediction, spiritualism, and Psi (e.g., telepathy). Their second cluster, traditional paranormal beliefs (witchcraft and the devil), resembles BIGD which include items measuring traditional religious belief. Differences are likely to be due to the small number of items in the RPBS wherein it is not possible to discover some clusters of beliefs given no items addressed all of the relevant areas of belief. For example, Lange et al (2000) could

not have discovered a cluster resembling the BAMC since there were no items accessing conspiracist beliefs in the RPBS. Lange et al (2000) did not find a distinct cluster of items relating to belief in consciousness existing beyond the body. This may be because the RPBS did not examine this belief directly; the items in the RPBS spirituality facet relate to astral travel, reincarnation, and communication with the dead, which may imply, but do not specifically state, the possibility of consciousness existing outside the body.

The Australian Sheep-Goat Scale maps conceptually onto both the BSF and BCB scales, though the ASGS has only a single scale. This is possibly because the ASGS contains only two items pertinent to the belief in consciousness beyond the body (addressing life after death) and this may be too narrow in scope to be apparent as a distinct factor.

Study 2

The aim of Study 2 was to investigate the convergent and discriminant validity of the new MQSUB. Convergent validity would be supported by the observation of substantive correlations between the subscales of the MQSUB and existing questionnaires with equivalent or overlapping conceptual content, while divergent validity would be supported by the observation of smaller correlations elsewhere.

The following correlations were predicted on the basis of conceptual overlap and similarity of content between the MQSUB and other measures:

(1) belief in supernatural forces (BSF) should correlate substantively with almost all facets of the RPBS, since the facets all suppose the existence of forces beyond the natural world; the exception is Traditional Religious belief, which is often

characterised somewhat differently to other forms of scientifically unsubstantiated belief;

(2) belief in the influence of God and destiny (BIGD) should correlate substantively with the Traditional Religion facet of the RPBS; BIGD should also correlate strongly with the Precognition facet, which presupposes the existence of a force, conceptually similar to destiny, controlling future events;

(3) belief in aliens, monsters and conspiracies (BAMC) should correlate substantively with the Extraordinary Life Forms facet of the RPBS and with the GCBS since these purpose to measure the same concepts; and,

(4) belief in consciousness beyond the body (BCB) should correlate substantively with the Traditional Religion and Spiritualism facets of the RPBS, which depend on some form of soul, or mind that is not tied to the body.

Several other predictions for moderately sized correlations were based on previous studies. Correlations among the facets of the RPBS (Tobacyk, 1988) suggest that small to moderate correlations should be expected among all of the scales of the MQSUB. The observation by Darwin, Neave & Holmes (2013) of moderate correlations between conspiracy beliefs and the Psi, Witchcraft, Spiritualism and Precognition facets of the RPBS suggests that BAMC should correlate moderately with these facets of the RPBS. The CEQ should be moderately correlated with all the subscales of the MQSUB, following observations of correlations between fantasy-proneness and paranormal belief and experience (see French & Stone, 2014, for a review). Finally, the relationship of MQSUB scores to demographic variables and individual traits should resemble findings in the literature (e.g., French & Stone, 2014).

Method

Participants

There were 123 participants recruited via social media, comprising 73 women, 49 men, and one individual who gave their gender as androgyne. Their ages ranged from 18 to 86, mean age = 41.9 years, SD = 14.9. Of these, 56 were married, 10 were cohabiting, 43 were single, 10 were divorced, 2 were widowed and 2 were separated. Educationally, 19 were educated to age 16, 28 to age 18, and 76 had university or professional qualifications. There were 15 full-time students, 12 unemployed, 6 home-makers, 69 employed, and 21 retired. Household income was less than £5,000 per year for 25 of the participants, over £45,000 for 16 of the participants, and the majority were between £11,000 and £25,000. Nearly all gave their ethnicity as white European with the rest spread among other ethnicities. Religious affiliation was varied: 48 had no religion, 50 were Christian, 4 were Buddhist, and 21 gave their religion as `other'.

Design

Participants completed a series of questionnaires online: the new Multi-Dimensional Questionnaire of Scientifically Unsubstantiated Beliefs; the RPBS; the GCBS; the Creative Experiences Questionnaire (CEQ; Merckelbach, Horselenberg, & Muris, 2001); and the demographic questions.

Measures

The RPBS consists of 26 items designed to measure 7 facets of paranormal belief. These are (with example items in parentheses): Traditional Religious Belief (`*there is a devil*'); Psi (`*some individuals are able to levitate (lift) objects through mental forces*'); Witchcraft (`*black magic really exists*'); Superstition (`*black cats can bring bad luck*'); Spiritualism (`*your mind or soul can leave your body and travel*' i.e.

astral projection); Extraordinary Life Forms (`*the Loch Ness monster of Scotland exists*'); and, Precognition (`*astrology is a way to accurately predict the future*'). Participants report their agreement with each item on a 7-point scale of 1 (*strongly disagree*) to 7(*strongly agree*). The test-retest reliability of the facets of the RPBS ranged from 0.71 to 0.95 over a four week period (Tobacyk, 2004).

The GCBS is designed to measure the extent to which an individual believes that the public is not told the truth about important issues. It includes 15 questions in a single scale, for example `*the government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret*` and `*the spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organisation*'. The internal reliability of the GCBS was very high at 0.93 and the five week test-retest reliability was also high at 0.89 (Brotherton et al, 2013, Study 2).

The Creative Experiences Questionnaire (CEQ; Merckelbach et al, 2001) contains 25 items measuring fantasy-proneness, example items being `*as a child I had my own make believe friend or animal*` and `*many of my fantasies have a realistic intensity*'. Test-retest reliability over six weeks was reported as 0.95 and internal consistency was satisfactory with Cronbach's alpha = 0.72 (Merckelbach et al, 2001, Study 2).

Procedure

Participants were recruited via social media and completed the set of questionnaires online. The only inclusion criteria were that the participant should be over 18 years old with a good command of written English. The following questionnaires were completed, always in this sequence: the new Multi-Dimensional Questionnaire of Scientifically Unsubstantiated Beliefs, the Revised Paranormal Belief Scale, the Generic Conspiracist Belief Scale, the Creative Experiences

Questionnaire, and the demographic questions. The set of questionnaires took around thirty minutes to complete and participants were able to pause the questionnaires and return within seven days. After completion, participants were given debriefing information and invited to contact the researcher if they had any further questions about the study.

Results and Discussion

There were no missing data. No outliers were detected and so all of the participants were included in the analysis. Total scores for each of the four subscales of the new MQSUB were calculated as the mean of the items on each subscale, with some item scores reversed as indicated in Study 1. Internal reliability of the subscales was good: Cronbach's alpha = 0.91 for BSF, 0.74 for BIGD, 0.81 for BAMC, and 0.91 for BCB. The score on each facet of the RPBS was calculated as the sum of the items on the facet, with items reverse scored as necessary. The total score was calculated for the CEQ and the GCBS as the sum of all items.

Means and standard deviations for the subscales and facets are shown in Table 2.1, together with bivariate correlations among the variables.

Each scale of the MQSUB correlated more strongly with those measures with which it was predicted to have a substantive correlation than with the other measures (the exception being the correlation of BSF with RPBS-superstition, which had a coefficient of 0.52). This pattern of results provides support for the convergent and divergent validity of the new questionnaire.

Table 2.1: Means and SD of the scales, and correlations among the scales, in Study 2.

			Correlations among the scales			
	Mean	SD	BSF	BIGD	BAMC	BCB
Belief in supernatural forces	2.78	0.94	-	0.50 ***	0.56 ***	0.57 ***
Belief in the influence of God or Destiny	2.85	0.76		-	0.36 ***	0.56 ***
Belief in extra. life forms and conspiracies	3.23	0.85			-	0.44 ***
Belief in consciousness beyond the body	3.46	1.15				-
RPBS Traditional Religious Belief	4.0	1.8	0.39 ***	**0.77** ***	0.32 ***	**0.65** ***
RPBS Psi	3.6	1.7	**0.78** ***	0.41 ***	0.58 ***	0.59 ***
RPBS Witchcraft	4.1	2.0	**0.83** ***	0.44 ***	0.54 ***	0.49 ***
RPBS Superstition	2.2	1.3	**0.52** ***	0.32 ***	0.27 **	0.20 *
RPBS Spiritualism	4.4	1.9	**0.83** ***	0.51 ***	0.57 ***	**0.71** ***
RPBS Extraordinary Life Forms	4.2	1.4	**0.60** ***	0.31 **	**0.75** ***	0.31 **
RPBS Precognition	3.6	1.6	**0.87** ***	**0.56** ***	0.52 ***	0.57 ***
GCBS	3.21	1.05	0.49 ***	0.34 ***	**0.77** ***	0.30 **
CEQ	9.39	4.95	0.54 ***	0.27 **	0.34 ***	0.35 ***
Age	41.9	14.9	0.06	0.05	0.02	0.06
Gender			0.21 *	0.12	- 0.11	0.11
Education level			0.10	0.03	0.02	0.15
Household income			- 0.03	- 0.02	- 0.10	0.09
Religious affiliation			0.25 **	0.27 **	0.19 *	0.36 ***

Notes: * p<0.05; ** p<0.01; *** p<0.001. Correlations predicted to be substantial are indicated in bold.

Relationships with demographic variables and the trait of fantasy-proneness were investigated in a series of multiple regressions, one for each subscale of the MQSUB. This approach takes account of potential relationships among the variables to discover the extent to which they uniquely predict scores on the MQSUB. Only those variables with a significant (or near significant) bivariate correlation with the MQSUB subscale were included in the multiple regression. Age, ethnicity, employment status, and income, had no relationship with any of the subscales of the MQSUB.

With BSF as the target variable, the predictors entered in the multiple regression were gender, relationship status coded as single or not, religious affiliation coded as religious or not, and fantasy-proneness. In the first step, gender and relationship status predicted 9% of the variance (adjusted R^2). In the second step, the addition of religious affiliation and fantasy-proneness improved the predictive utility of the model, with the four predictors together accounting for 29% of the variance in BSF. Only fantasy-proneness, however, was a significant independent predictor, $t(118)=4.79$, $p<0.001$, beta = 0.41.

With BIGD as the target variable, the predictors were religious affiliation and fantasy-proneness, entered in a single step. Together these variables predicted 10% of the variance in the target variable. Religious affiliation was a significant independent predictor, $t(120)=2.48$, $p<0.05$, beta = 0.22, and fantasy-proneness was a marginally significant predictor, $t(120)=1.90$, $p<0.07$, beta = 0.17.

With BAMC as the target variable, the predictors were fantasy-proneness, relationship status, and religious affiliation, entered in a single step. Together these variables predicted 13% of the variance, though only fantasy-proneness was a significant independent predictor, $t(119)=3.16$, $p<0.005$, beta = 0.29.

With BCB as the target variable, the predictors entered into the multiple regression were relationship status, religious affiliation, and fantasy-proneness. Together these variables accounted for 22% of the variance. Religious affiliation (yes or no) was a significant independent predictor, $t(119)=3.18$, $p<0.005$, beta = 0.27, and so was fantasy-proneness, $t(119)=3.38$, $p<0.005$, beta = 0.29.

The relationship of all subscales of the questionnaire with fantasy-proneness is consistent with the literature, showing that fantasy-proneness is related to many types of paranormal belief and experience (as after: Auton, Pope & Seeger, 2003; Gow, Lang & Chant, 2004; Irwin, 1994; Rogers, Qualter & Phelps, 2007; and, French & Stone, 2014). The relationship of religious affiliation with BIGD and BCB is readily understood by the conceptual overlap between these subscales and common elements of religious belief.

It is perhaps surprising that there were no observed gender differences as the literature shows a consistent though weak effect of gender on many aspects of belief. Nevertheless, it should be noted that females scored higher on BSF in the simple bivariate comparison. The absence of gender effects may be due to a general decrease in gender differences in paranormal belief (Blackmore, 1997; Vitulli & Luper, 1998; McLenon, 1994). Alternatively, the frequently observed gender differences in levels of belief may be due to the underlying trait of fantasy proneness, rather than gender per se; fantasy proneness was higher in females (mean = 10.2, S.D. = 5.1) than in males (mean = 8.2, S.D. = 4.6) in the present study, $t(120) = 2.18$, $p<0.05$. Other studies reporting gender differences may not have measured fantasy proneness or entered both variables into a multiple regression to predict level of belief.

Another potentially surprising result is that belief in the influence of God and destiny does not appear to increase with age, apparently contradicting the generally accepted knowledge that older generations are more religious than younger generations. It is possible that though belief in God may increase with age, belief in concepts associated with destiny deceases (Rice, 2003; Torgler, 2007), so that there is no overall relationship.

The Social Marginality Hypothesis (Irwin, 2009) proposed that disadvantaged groups in society might turn to belief in the paranormal as an emotional compensation for feelings of powerlessness or alienation in their lives. This predicts that belief would be higher in the elderly, those not in relationships, the unemployed, those with lower income, those with poorer education, and among minority ethnic groups. The absence of any relationship between the subscales of the MQSUB and demographic factors including age, marital status, ethnicity, employment status, and income, argues against the Social Marginality Hypothesis as operationalised by simple demographics measures. A more nuanced view of social marginality therefore was examined in Study 4.

In summary, the convergent validity of the MQSUB is attested to by the strong correlations between the subscales of the MQSUB and the scores on existing questionnaires with conceptually similar or overlapping content. Divergent validity is supported by less substantive correlations where there is less conceptual similarity between the scales examined.

Study 3

The aim of Study 3 was to continue the investigation of the convergent and discriminant validity of the new MQSUB. Convergent validity would be supported by a substantive correlation between the Australian Sheep-Goat Scale and the BSF

subscale which has overlapping conceptual content, and a moderate correlation with the BCB subscale which has some overlapping content in so far as it assumes the existence of some aspect of soul or mind that can exist outside the body.

Divergent validity would be supported by the observation of weaker correlations with the subscales of the Rational-Experiential Inventory (REI; Paccini & Epstein, 1999). There is a substantial body of research linking paranormal belief with an experiential/intuitive thinking style (Aarnio & Lindeman, 2005; Hollinger & Smith, 2002; Epstein et al, 1996; Genovese, 2005; Irwin & Young, 2002; Marks et al, 2008). A smaller body of research links paranormal belief with lower levels of rational thinking (Aarnio & Lindeman, 2005; Irwin & Young, 2002).

Correlations were predicted as follows:

(1) BSF should correlate substantively with the ASGS;

(2) BCB should correlate moderately with the ASGS;

(3) MQSUBs subscales correlate moderately with REI Experiential thinking;

(4) small correlations of MQSUBs subscales with REI Rational thinking.

As in Study 2, small to moderate correlations were predicted among all the scales of the MQSUB. Moderation of MQSUB scores by demographic variables and individual traits should resemble consistent findings in previous research (e.g., French & Stone, 2014).

Method

Participants

There were 168 participants recruited via social media, comprising 129 women and 39 men. Their ages ranged from 18 to 77, mean age = 32.1 years, SD = 14.0. Of these, 52 were married, 19 were cohabiting, 85 were single, 7 were divorced, 3 were

widowed and 2 were separated. Educationally, 41 were educated to age 16, 44 to age 18, and 83 had university or professional qualifications. There were 60 students, 4 unemployed, 2 home-makers, 96 employed, and 6 retired. Household income was less than £5,000 per year for 48 of the participants, over £45,000 for 7 of the participants, and the rest were evenly spread between these extremes. The majority, 132, gave their ethnicity as white European, 18 gave their ethnicity as south Asian (Indian / Pakistani) with the rest spread among other ethnicities. Religious affiliation was varied: 83 had no religion, 55 were Christian, 20 were Muslim, and 10 gave their religion as Hindu, Sikh or “other”.

Design

Participants completed a series of questionnaires online: the new MQSUBs; the Australian Sheep-Goat Scale (ASGS); the Rational-Experiential Inventory (REI); and the demographic questions. The questionnaires were always completed in this order and the procedure took around thirty minutes.

Measures

The Australian Sheep-Goat Scale (ASGS; Thalbourne & Delin,1993) consists of 18 items designed to measure belief in telepathy, psychokinesis, precognition, and life after death. Items include: `*I believe in life after death*' and `*I believe I am psychic*'. Items are scored 0 = false, 1 = uncertain, or 2 = true. The internal consistency was good in the present study, Cronbach’s alpha = 0.92.

The Rational-Experiential Inventory (Paccini & Epstein, 1999) consists of 40 questions designed to reveal individual preference for rational thinking (e.g., `*I enjoy intellectual challenges*' and reverse-scored `*I’m not that good at figuring out complicated problems*') and intuitive or experiential thinking (e.g., `*I like to rely on my*

intuitive impressions' and reverse scored `*I don't have a very good sense of intuition*'). Internal consistency was good in the present study; Cronbach's alpha was 0.9 for the Rationality scale and 0.92 for the Experientiality scale.

Procedure

Participants were recruited via social media and completed the set of questionnaires online. The only inclusion criteria were that the participant should be over 18 years old with a good command of written English. The following questionnaires were completed, always in this sequence: the new Multi-Dimensional Questionnaire of Scientifically Unsubstantiated Beliefs; the ASGS; the REI; and, the demographic questions. The set of questionnaires took around thirty minutes to complete and participants could pause the questionnaires and return within seven days. After completion, participants were given debriefing information and invited to contact the researcher if they had any further questions about the study.

Results and Discussion

All questions were compulsory so there were no missing data. The responses were examined and no outliers were detected, hence all of the participants were included in the analysis. The total scores on each of the four subscales of the new MQSUB were calculated as the mean of the items on the scale, with some items reverse scored as indicated in Study 1. Internal reliability of the subscales was good: Cronbach's alpha = 0.88 for BSF, 0.83 for BIGD, 0.71 for BAMC, and 0.86 for BCB. The score on the ASGS was calculated as the sum of the items. The score on each subscale of the REI was calculated as the sum of the items on the corresponding subscale, with items reverse scored as appropriate. Means and standard deviations of the scales and facets, and bivariate correlations among the variables, are shown in Table 3.1.

Table 3.1: Means and SD of the scales, and correlations among the scales, in Study 3.

			Correlations among the scales			
	Mean	SD	BSF	BIGD	BAMC	BCB
Belief in supernatural forces	2.39	0.79	-	0.28 ***	0.31 ***	0.47 ***
Belief in the influence of God or Destiny	2.89	0.89		-	0.06	0.48 ***
Belief in extra. life forms and conspiracies	2.77	0.62			-	0.20 *
Belief in consciousness beyond the body	2.81	0.97				-
Australian Sheep-Goat Scale	11.7	8.80	**0.74** ***	0.36 ***	0.31 ***	0.49 ***
REI – Rational thinking	72.9	13.2	-0.15 *	-0.22 **	-0.03	-0.02
REI – Intuitive / Experiential thinking	67.1	13.7	0.32 ***	0.25 **	0.18 *	0.26 ***
Age	32.1	14.0	0.14	- 0.09	- 0.01	- 0.09
Gender			0.09	0.08	- 0.11	- 0.11
Education level			- 0.03	- 0.14	- 0.13	- 0.11
Household income			0.15	- 0.19 *	0.03	- 0.05
Religious affiliation (yes or no)			0.04	0.53 ***	0.03	0.31 ***
Ethnicity (white European or not)			0.13	-0.57 ***	0.04	-0.16 *

Notes: * p<0.05; ** p<0.01; *** p<0.001. Correlations predicted to be strong are indicated in bold.

Scores on the ASGS were correlated substantively with BSF, and moderately with BCB, as predicted. There were also small correlations with BIGD and BAMC, which were not specifically predicted but unsurprising given the tendency for correlations among subscales of belief. As predicted, there was a positive correlation between the intuitive scale of the REI and all subscales of the MQSUB, and a smaller negative correlation that reached statistical significance only for BSF and BIGD with the rational scale of the REI.

The correlations among the subscales of the MQSUB were smaller in Study 3, ranging from 0.01 to 0.49, than in Study 2 where they ranged from 0.35 to 0.62. It is interesting to note that despite the difference in the magnitude of the correlations they still followed the same pattern: the largest correlation was BCB with BIGD; followed by the correlation of BSF with BAMC and BSF with BCB; and the smallest correlation was BAMC with BIGD.

Relationships with demographic factors and individual traits were investigated in a series of multiple regressions, one for each subscale of the MQSUB. This approach takes account of potential relationships among the demographic factors and traits to discover those which uniquely predict the MQSUB. Only those variables with a significant (or near significant) bivariate correlation with the MQSUB subscale were included in the multiple regression. Age, gender, and educational status had no relationship with any of the subscales of the MQSUB.

BSF scores were significantly correlated bivariately with relationship status (coded as single or not), employment status (coded as working or not), income, rational thinking, and experiential thinking. Employment status and income were highly correlated [r(166)=0.71] so only employment status, which had the stronger relationship with BSF, was entered into the multiple regression. In the first step,

relationship status and employment status predicted 6% of the variance in BSF. In the second step, the addition of rational thinking and experiential thinking improved the predictive utility of the model to explain 18% of the variance in BSF. The three variables employment status, rational thinking, and experiential thinking were all significant independent predictors of BSF. Participants in employment had higher scores on BSF than those not in employment, $t(163)=2.37$, $p<0.05$, beta = 0.18. Rational thinking was negatively associated with BSF, $t(163)=2.79$, $p<0.01$, beta = -0.20, and experiential thinking was positively associated with BSF, $t(163)=4.41$, $p<0.001$, beta = 0.32.

With BIGD as the target variable, the predictors entered in the regression were employment status, ethnicity (coded as white European or other), religious affiliation (coded as yes or no), rational thinking and experiential thinking. In the first step, employment status, ethnicity, and religious affiliation accounted for 43% of the variance in BIGD. The addition of rational and experiential thinking improved the power of the model and 52% of the variance in BIGD was accounted for. The variables religious affiliation, ethnicity, rational thinking and experiential thinking were all significant independent predictors of BIGD. Higher scores on BIGD were associated with religious affiliation, $t(162)=5.37$, $p<0.001$, beta = 0.32, non-white European ethnicity, $t(162)=6.59$, $p<0.001$, beta = 0.43, lower scores on rational thinking, $t(162)=4.09$, $p<0.001$, beta = -0.32, and higher scores on experiential thinking, $t(162)=3.98$, $p<0.001$, beta = 0.22.

Scores on BAMC were significantly correlation bivariately only with experiential thinking, $r(166) = 2.37$, $p<0.05$, beta = 0.18, which accounted for only 3% of the variance in BAMC.

Scores on the BCB subscale were significant correlated bivariately with ethnicity, religious affiliation, and experiential thinking. In the first step, ethnicity and religious affiliation accounted for 10% of the variance in BCB. In the second step, the addition of experiential thinking improved the power of the model and accounted for 15% of the variance in BCB. Participants with religious affiliation had higher scores on BCB than those with no religion, $t(164)=3.49$, $p<0.005$, beta = 0.27, and BCB was related to experiential thinking, $t(164) = 3.25$, $p<0.005$, beta = 0.24.

The correlations between the subscales of the MQSUBs, intuitive thinking (positive correlation), and rational thinking (negative correlation), were consistent with previous research (French & Stone, 2014). It is unsurprising that having a religious affiliation (compared to no religion) was associated with higher scores on BIGD and BCB given the conceptual overlap between these subscales and traditional religious beliefs. The observation of lower levels of BIGD in white Europeans compared to other ethnicities is perhaps not to be expected given increasing secularisation in the countries of the European Union.

The observation of higher scores on the BSF subscale for those participants in employment (or with higher income as these two variables were strongly correlated) compared to those not in employment might seem counterintuitive, given the marginalisation hypothesis of Irwin (Chapter 4), but it is not without precedent. For example, Rice (2003) reported that higher income was associated with greater belief in psychic healing, and Emmons & Sobal (1981) noted that the employed generally showed higher levels of paranormal belief than the unemployed (see French & Stone, 2014, p31, for a review).

The absence of gender differences is unexpected in light of the substantial body of research showing consistent, though small, gender differences (see French &

Stone, 2014, for a review) but it is noted here that other researchers have failed to find gender differences (Blackmore, 1997; Vitulli & Luper, 1998; McLenon, 1994).

In conclusion, Study 3 offers further support for the convergent and divergent validity of the MQSUB.

Study 4

Study 4 continued the exploration of the convergent and discriminant validity of the new twenty-four item MQSUB. As in Study 3, it is predicted here that scores on the Australian Sheep Goat scale will be related substantively to scores on the Supernatural Forces subscale and moderately to those on other subscales. Additionally, the locus of control subscale `belief in powerful others' was predicted to relate to belief in supernatural forces, belief in the influence of God and destiny, and belief in aliens, monsters and conspiracies. The legacy subscale of the mortality awareness questionnaire (Levasseur, McDermott & Lafreniere, 2015) was predicted to relate to belief in supernatural forces; the mortality acceptance subscale was predicted to relate to a belief in God and destiny; the mortality disengagement subscale was predicted to relate negatively to a belief in God and destiny; scores on the mortality disempowerment subscale were predicted to be associated with belief in aliens, monsters and conspiracies via the link between belief in conspiracies and social anomie. As per Irwin (2009), self-perceived marginalisation was predicted to be related to scientifically unsubstantiated beliefs, though only weakly. A larger correlation should be observed between self-perceived marginalisation and belief in aliens, monsters and conspiracies, following consistent observations that social anomie predicts conspiracist thinking. Reactive rebelliousness was predicted to relate to belief in scientifically unsubstantiated beliefs in general, and in particular to a belief in aliens, monsters and conspiracies via the link with a sense of alienation.

As in Study 2 and 3, small to moderately sized correlations were predicted among all the subscales of the MQSUB. Relationships of MQSUB scores with demographic variables and individual traits should resemble those found in the literature (e.g., Stone & French, 2014).

Method

Participants

There were 100 participants contributing complete data, all recruited via social media, comprising 76 women and 22 men and two who declined to respond. Their ages ranged from 18 to 68, mean age = 31.24 years, SD = 12.71. Of these, 23 were married, 15 were cohabiting, and 60 were single. Educationally, 11 were educated to age 16, 13 to age 18, and 75 had university or professional qualifications. There were 45 students, 4 unemployed, 3 self-designated as home-makers, 45 as employed, and 3 as retired. Household income was less than £5,000 per year for 35 of the participants, £6-25,000 for 40 respondents, and £25- £46,000+ for 20 of the participants, with five participants not providing data. The majority, 63, gave their ethnicity as white European, 14 as black African, 7 gave their ethnicity as south Asian (Indian / Pakistani) with the rest spread among other ethnicities. Religious affiliation was varied: 43 self-designated as having no religion, 30 as Christian, 17 as Muslim, and 7 gave their religion as `other'.

Design

A cross-sectional correlational self-report design was used in which participants responded to a series of questionnaires online in the order as specified below, completion taking approximately around thirty minutes.

Measures

Seven questionnaires were administered to respondents, as follows: the new twenty-four item Multi-Dimensional Questionnaire of Scientifically Unsubstantiated Beliefs; the Australian Sheep-Goat Scale (Thalbourne & Delin, 1993), as described in Study 3; the multi-dimensional Locus of Control scale (Levenson, 1981) which has three subscales measuring internality (the belief that there is a contingent relationship between actions and outcomes, an example item being `*I can pretty much determine what will happen in my life*'), belief in the influence of powerful others as determinants of outcomes (an example item being `*I feel like what happens in my life is mostly determined by powerful people*'), and belief in the role of chance as a determinant of outcomes (an example item being `t*o a great extent my life is controlled by accidental happenings*'); a twelve-item measure of self-perceived marginalisation as devised by the second author, with responses given on a five point scale from `strongly disagree' (1) to ` strongly agree' (5), an exemplar item being `*I think that I am someone who exists on the margins of society*'; the Multi-dimensional Mortality Awareness Measure (Levasseur, McDermott, & Lafreniere, 2015) which measures five forms of such awareness (fearfulness, acceptance, disempowerment, disengagement, and mortality legacy awareness), an exemplar item being `*I am aware that death is part of life*'; the Social Reactivity Scale (McDermott & Apter, 1985) which measures proactive and reactive rebelliousness, an exemplar item being `*How often do you do something you shouldn't just to get some excitement?*'; and a questionnaire containing demographic questions.

Procedure

The procedure was similar to Studies 2 and 3, with identical inclusion criteria.

Results and Discussion

There were no missing data. No outliers were detected, hence all the participants were included in the analysis. Given an additional new measure was included in this study, a brief, twelve item, self-report questionnaire measure of *Self-Perceived Marginalisation* as devised by the second author, the results of a one-factor principal components analysis of these items is shown in Table 4.1.

Table 4.1 Items for the Self-Perceived Marginalisation Questionnaire and loadings from a one-factor principal components analysis (`r' denoting reverse scoring).

Item	loading
1. In my day to day life others treat me as a person of significance (r).....	0.52
2. The world in which I live treats people like me with respect (r).....	0.72
3. People like me are often given positions of high status in society (r).....	0.72
4. I have access to opportunities for occupational development (r).....	0.66
5. There are many barriers for me to achieving success.....	0.67
6. People like me are often victimised.....	0.69
7. People like me tend to have no power to change things that they do not like	0.56
8. I think that I am someone who exists on the margins of society.....	0.75
9. I think that I am someone who is part of mainstream society (r).....	0.71
10. People like me are not often given fair access to suitable employment.....	0.73
11. People like me are not often included in decisions about how society runs things	0.61
12. I often feel that I am excluded from making decisions about things that affect me	0.53

An initial scree analysis indicated a single factor solution, with 43% variance explained and Cronbach's Alpha=0.88 indicating good internal reliability. Notably all twelve items load substantively onto the factor at above 0.5, with the lead item being item 8: *I think that I am someone who exists on the margins of society.*

Total scores for each of the four subscales of the new MQSUB were calculated as in Study 1. Internal reliability for each of the subscales was good: Cronbach's alpha = 0.89 for BSF, 0.88 for BIGD, 0.75 for BAMC, and 0.91 for BCB (thereby replicating findings in Studies 2 & 3). The score on the ASGS was calculated as the sum of the items. Means and standard deviations of the scales and facets are shown in Table 4.2. These are all similar to published norms. Bivariate correlations among the variables are also shown in Table 4.2.

Statistically significant bivariate correlates (with the exception of ASGS scores) of the four MQSUB subscales were entered into four separate regression analyses wherein in turn each MQSUB subscale was designated as the dependent variable. For the belief in supernatural forces subscale, three variables were found to independently predict scores on this component (with adj. R2=.29): mortality legacy awareness (beta=0.27, t=2.55, p=.01), mortality acceptance (beta = =-.25, t= -2.33, p=.02), and gender (beta=0.36, t=3.72, p=.001). For belief in the influence of God and destiny, one bivariate correlate in the regression analysis emerged as an independent predictor (adj. R2=0.24), namely mortality disengagement (beta=-0.34, t=-3.37, p<.001), while proactive rebelliousness approached significance (beta=0.20, t=1.94, p<.056). For the belief in aliens, monsters and conspiracies factor, no one variable emerged as an independent predictor (adj r2=0.11). For scores on the belief in consciousness beyond the body subscale of the MSQUB, three bivariate correlates emerged as independent predictors (adj. R2=0.26); self-perceived marginalisation (beta=0.32, t=3.28, p<.002), mortality disempowerment awareness (beta=-0.37, t=-3.41, p<.001) and mortality legacy awareness (beta=0.23, t=2.26, p<.03).

Table 4.2: Means and SD of scale scores, and bivariate correlations among the subscales, in Study 4.

			Correlations among the scales			
	Mean	SD	BSF 1	BIGD 2	BAMC 3	BCB 4
Belief in supernatural forces	1.99	0.83	--	.38 ***	.55 ***	.58 ***
Belief in the influence of God or destiny	2.77	1.09	--	--	.37 ***	.38 ***
Belief in extraord. life forms & conspiracies	2.53	0.73	--	--	--	.40 ***
Belief in consciousness beyond the body	2.83	1.16	--	--	--	--
Australian Sheep-Goat Scale (ESP & PK)	10.10	8.80	**.80** ***	.47 ***	.58 ***	.67 ***
Internality-externality locus of control	33.47	5.54	-.04	-.27 **	-.21 *	-.09
Belief in powerful others	23.64	7.40	.05	-.16	.03	.01
Belief in chance as determining outcomes	23.97	6.37	.15	.15	.09	.15
Mortality legacy awareness	4.2	1.14	.19 *	.13	.01	.21 *
Mortality fearfulness	3.5	1.25	.23 *	.17 *	.03	.19 *
Mortality acceptance	6.38	0.66	-.25 *	-.11	-.14	-.12
Mortality disempowerment	2.79	1.19	.12	.17 *	.14	-.19 *
Mortality disengagement	3.57	1.10	-.08	-.46 ***	-.23 *	-.13
Reactive rebelliousness	3.45	3.34	.14	.11	.18 *	.07
Proactive rebelliousness	3.09	3.51	.17 *	.25 **	.17 *	.02
Self-perceived marginalisation	2.76	0.71	.21 *	.25 **	.29 **	.21 **
Age	31.24	12.71	-.25 **	-.27 **	-.18 *	-.20 *
Gender			.38 ***	.15	.13	.20 *
Education			-.20 *	-.22 *	-.21 *	-.18 *
Household income			-.25 **	-.24 **	-.22 *	-.16

Note: * p<0.05; ** p<0.01; *** p<0.001 (one tail test). Correlations predicted to be strong are indicated in bold.

The pattern of the relative magnitude of correlations among the four factors of the MQSUBs is similar to that in Study 2 and 3, thereby providing replication. ASGS was substantively correlated with BSF, replicating the findings of Study 3, as predicted from the overlap in terms of the conceptual content of the items.

Consistently it can be seen that various forms of mortality awareness are independently related in regression with three of the MSQUB subscales, with scores on the BAMC subscale, beliefs in aliens, monsters and conspiracies, being the exception. Notably, mortality disengagement is inversely related to beliefs in God and destiny, with higher scores on BIGD covarying with lower mortality disengagement, thereby suggesting that beliefs in deities and fate is associated with an enhanced ability to not avoid (or engage with) the fact of one's eventual demise. In addition, mortality disempowerment was seen to be independently and negatively related to beliefs in consciousness beyond the body. Consistent with this was the finding that self-perceived marginalisation (also about a sense of disempowerment) likewise predicted scores on this form of scientifically unsubstantiated belief, albeit that bivariately such self-perceptions were correlated with all four MSQUB subscale scores. However, mortality disempowerment was negatively related to BCB and marginalisation was positively related to BCB. It is possible that self-perceived marginalisation promotes a need for belief, and then the chosen area of belief satisfies a more specific and focused area of need.

Further, mortality acceptance (inversely) and mortality legacy (positively) were both found to be independently related to BSF (belief in supernatural forces), though in different directions: people who do not have a sense of mortality acceptance are more likely to believe in supernatural forces; whilst those who have a heightened

sense of mortality legacy, of wanting to leave something behind after death, are more likely to believe in supernatural forces, Arguably, however, both of these forms of mortality awareness (high legacy and low acceptance) are about a non-acceptance of death; covariance with belief in supernatural forces that likewise transcend death is consistent thereby with such an orientation.

General Discussion

The new Multi-Dimensional Questionnaire of Scientifically Unsubstantiated Beliefs (MQSUB) consists of four subscales measuring belief in a broad range of phenomena. Beliefs in this area have been generally assumed to be organised into several factors, but with disagreement about the number of components. This study clarifies the nature and number of the factors by starting from a broader range of conceptual possibilities.

The first subscale measures belief in supernatural forces (BSF), including traditional superstitions, future prediction, energy healing, ghosts, and telepathy. The second subscale measures belief in the influence of God and destiny (BIGD) including traditional religious concepts (creation, rules for moral behaviour, and life after death) and the inescapable influence of fate or destiny. The third subscale measures belief in aliens, monsters and conspiracies (BAMC) with items addressing alien visitation and the Loch Ness monster, and popular conspiracies, for example national governments routinely lying to the general public and pharmaceutical companies withholding cures. The fourth and final subscale measures belief that a conscious existence can continue independent of the body (BCB; belief in consciousness beyond the body). The four subscales correlate with each other at small to moderate levels of association, confirming their relative independence and

yet at the same time consistent with observations from previous research that belief in distinct types of scientifically unsubstantiated phenomena tend to co-occur.

Strong support for the convergent and divergent validity of the MQSUB was observed in Studies 2, 3 and 4. There were moderate to large correlations between the dimensions of the MQSUB and other existing measures, and their individual facets, with overlapping conceptual content (Revised Paranormal Belief Scale, Australian Sheep-Goat Scale, and Generic Conspiracist Belief Scale). Smaller correlations with existing measures were observed where a dimension of the MQSUB did not have explicitly overlapping content, in line with previous observations of a general tendency to entertain scientifically unsubstantiated belief. There were also small to moderate correlations with other psychological variables to which the dimensions of the MQSUB were predicted to be related (fantasy proneness in Study 2; intuitive and rational thinking in Study 3; mortality awareness, marginalisation, and rebelliousness in Study 4).

The new MQSUB represents an advance on previous questionnaire measures by including an expanded conceptual repertoire as covered by its four dimensions within a focused and practical instrument of 24 items. The BSF subscale includes a range of items in a single factor, adding strength to the argument of Lange et al (2000) that all of these items combine into a single component which they termed new-age philosophy. The other three dimensions have not been so clearly apparent in previous measures that did not include items covering aspects of them. The BAMC dimension combines three facets of belief: alien visitation, monsters, and conspiracies, into a single factor that seems to address the belief that there is knowledge kept hidden from the public. The BIGD combines these two aspects of belief into one dimension, not explicit in previous measures that did not tap into both

of these elements. The belief in consciousness existing beyond the body is now a well-focused, explicit belief, not subsumed into other more specific areas of belief (such as ghosts, or astral travel).

Some of the relationships between the subscales of the MQSUB and other existing measures are of particular interest. Self-perceived marginalisation in Study 4 was related bivariately to all subscales of the MQSUBs and independently in regression to belief in consciousness beyond the body, thereby supporting the Social Marginalisation Hypothesis of Irwin (1999). This contrasts with the absence of statistically significant multivariate relationships with the demographic proxy indicators of marginalisation such as educational status and household income, and with the absence even of simple bivariate relationships for most of the demographic variables in Study 2 and 3. Such demographic factors however, may not be good indicators of the more subjective aspects of self-perceived marginalisation, whereas the individual's *perception* of their status and influence in society would appear to be more pertinent to their individual beliefs.

Previous observations of gender differences were not repeated here with the exception of BSF in Study 2 and Study 4, with this difference disappearing in Study 2 when fantasy-proneness was also used as a predictor. It is possible that in recent times gender differences, which have generally been small, are becoming less pronounced (Blackmore, 1997; Vitulli & Luper, 1998; McLenon, 1994). Another possibility is that gender differences are not based on gender per se but on other, related psychological variables, for example fantasy proneness, which was not routinely included in previous research.

Notably in Study 4, various aspects of mortality awareness were found to be independent predictors of scores on three of the four MSQUB subscales. This

indicates that an awareness of one's three score years and ten has bearing psychologically on the degree to which one maintains scientifically unsubstantiated beliefs. Indeed, it is apparent that such beliefs may form part of a defence against such mortality awareness, though it should be noted here that Fafias, Newheiser, Kahane & Toledo (2013) have found that cuing mortality awareness increases belief in forms of rationality as well as irrationality, in particular in a belief in science and scientific reasoning. Therefore, mortality salience appears to have more general effect on beliefs, not confined to the scientifically unsubstantiable.

Future research needs to take account of the complexity of the nature of scientifically unsubstantiated beliefs in order for consistency of findings across studies to emerge. Studies 2, 3, and 4 have illustrated that distinct subscales of belief have different relationships with other psychological variables. No simple understanding can be reached for relationships between, for example, mortality awareness, marginalisation, rebelliousness, fantasy proneness, thinking style, or conspiracist thinking, and scientifically unsubstantiated beliefs without considering the nature of the belief.

Investigations of scientifically unsubstantiated beliefs should have sufficient scope in order to ensure that appropriate questions are asked. Too narrow a frame of reference can result in apparent relationships that may not align precisely with underlying psychological constructs. For example, gender differences may be due to differences in the level of fantasy proneness and not gender per se, and marginalisation as a covariate has not been apparent in the past using simple demographic measures but was evident in Study 4 where questions focused upon self-perceived marginalisation. This underscores the importance of measuring psychological variables appropriately.

Fantasy proneness as an individual difference variable was linked in Study 2 with all four subscales of scientifically unsubstantiated beliefs to varying degrees. Conceptually, it is feasible to see how the ability to lose oneself in an exercise of imagination and to create a fantasy that can be nearly as vivid as the real world might facilitate the maintenance of scientifically unsubstantiated beliefs. It would be of interest to investigate longitudinally the psychodynamic functions hypothesis of Irwin (2009) to ascertain to what extent childhood insecurity and trauma can lead to fantasy proneness, and thus to scientifically unsubstantiated beliefs.

Future research needs to examine how well the factor structure translates across cultures. There may be broad agreement regarding the factors, but with some specific items of belief aligning in different relation to the factors. For example, belief in astrology appeared here in the Belief in Supernatural Forces factor in conjunction with belief in superstitions and future prediction, but in other cultures with a different tradition (for example, Hinduism) astrology might be an element of religious belief.

Other research could examine whether the relationship between beliefs and other psychological concepts may vary under different religious traditions. For example, mortality awareness may prompt different kinds of belief in different spiritual contexts. Locus of control may not relate to belief in the same way in collectivistic cultures, where one's life options are more constrained by societal expectations, and hence locus of control is less internal, as compared with individualistic cultures.

Some research has demonstrated that experimentally increasing individual levels of mortality awareness or placing individuals under stress can result in heightened levels of declared belief in the paranormal (for example, Farias et al, 2013). Future experiments could manipulate mortality awareness or stress to examine the effect on scores on the subscales of scientifically unsubstantiated belief.

In conclusion, the new Multi-dimensional Questionnaire of Scientifically Unsubstantiated Beliefs (MQSUB) offers a concise but conceptually broad ranging measure with good psychometric properties. In the digital age, where information is so readily available and it is easier than ever to acquire beliefs outside of a formal educational setting, a valid and reliable measure of scientifically unsubstantiated belief is useful to understand how people come to acquire and maintain such ideas.

Declaration of Conflicting Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Appendix 1 Table 1: Rotated Component Matrix

Item	Factor			
	1	2	3	4
(5) Hanging a mirror in a special place can bring good fortune to a house.	***.79***	-.03	.19	.11
(22) Study of the stars can be used to predict the future for individuals.	***.77***	-.09	.16	.18
(4) Tarot cards can be used to predict major events in an individual's future.	*.77*	-.06	.12	.25
(35) The appearance of lines on a person's palm can be used to interpret their future.	*.76*	-.11	.14	.11
(45) Lucky objects, for example, a rabbit's foot, can protect against evil.	*.75*	-.04	.17	.13
(29) Crystals can have healing powers.	***.75***	-.02	.24	.21
(59) There is no evidence for the healing effects of crystals. (R)	*-.71*	.11	-.20	-.20
(16) Touching wood can bring good luck.	*.70*	-.02	.16	.10
(58) Good luck cannot be created by crossing ones fingers. (R)	***-.69***	.02	.02	-.01
(72) Natural events can be omens that predict the future.	***.67***	-.24	.10	.12
(17) Some people who have died a violent death can linger as a ghost near the place where they met their end.	***.65***	-.05	.27	.38
(3) Some people can read thoughts directly from another person's mind.	***.65***	-.13	.15	.26
(21) Some people can cast spells to cause good effects on other people.	***.65***	-.16	.21	.30
(41) There is no truth in astrology. (R)	*-.65*	.20	-.15	-.07
(55) Unlucky things are likely to happen on Friday the 13th.	*.61*	-.11	.04	-.13
(61) Chi is a flow of energy which permeates all living creatures.	*.60*	-.11	.30	.19
(11) Some people can move objects with the power of their mind.	*.60*	-.08	.24	.32
(42) Some people can see events before they happen.	*.59*	-.25	.25	.39
(20) Some people can locate water underground by using their special powers.	*.59*	.00	.31	.33
(54) Reading thoughts directly from a person's mind cannot happen. (R)	*-.57*	.13	-.22	-.39
(10) A horseshoe cannot protect against evil. (R)	*-.56*	.15	-.02	-.08
(65) Homeopathy is an effective form of medicine.	*.55*	-.28	.21	.08
(2) The appearance of tea leaves in the bottom of a cup has no influence on future events. (R)	*-.54*	.23	-.08	-.01
(62) The idea of Chi as a life force is a metaphor but is not literally true. (R)	*-.54*	.21	-.26	-.15
(14) There is no convincing evidence that anyone can move objects with the power of their mind. (R)	*-.54*	.09	-.22	-.25
(8) Some people can cause bad fortune for other people merely by looking at them.	*.52*	-.28	.11	.03
(52) Good fortune cannot be invoked by re-arranging the furniture in a home. (R)	*-.52*	.06	-.05	-08
(47) Inanimate objects have no power to predict the future. (R)	*-.51*	.15	-.14	-.09
(57) No day is luckier than any other day. (R)	*-.50*	.23	.00	-.03
38) If a person commits bad deeds then karma will intervene to punish them.	*.49*	-.36	.15	.03
(13) Any effects of homeopathy are due only to the power of imagination. (R)	*-.46*	.22	-.24	-.18
(26) Spells cannot cause bad effects on animals. (R)	*-.46*	.37	.00	-.08
(80) God has created rules for correct moral behaviour.	.01	***.81***	-.14	.19
(32) The world was created by a God.	-.05	***.79***	-.09	.35
(7) The world was formed through physical processes without the intervention of a God. (R)	-.08	*-.77*	-.08	.38
(23) God is an invention of the human imagination. (R)	.04	*-.76*	.05	-.37
(76) The creator of the universe takes an interest in human lives.	-.06	*.74*	-.07	.32
(48) What will happen to me after my death will be determined according to how I have lived my life.	.21	***-.70***	-.03	.32
(18) It is hard to avoid one's destiny.	.28	***.59***	.09	-.03
(39) Some events are fated to occur.	.35	***.56***	.21	.06
(43) Events occur because of tangible causes in the physical world. (R)	-.14	***-.51***	-.09	.12
(9) Some things are not meant to be.	-.24	*.41*	-.19	-.01

(66) Individuals, not destiny, are responsible for what happens in their lives. (R)	-.21	*-.41*	-.21	-.06
(67) There is no physical evidence on earth of alien visitors from other planets. (R)	-.23	-.03	***-.75***	-.2
(25) Some people have been abducted by aliens.	.31	.06	***.74***	.18
(36) Evidence of alien visitation has been covered up by governments.	.31	.02	*.73*	.12
(19) Aliens from other planets have visited earth.	.28	.09	*.72*	.21
(49) There is no tangible evidence of alien visitation. (R)c	-.29	-.01	*-.72*	-.20
(53) People who think they have been abducted by aliens are experiencing false memories. (R)	-.29	-.01	***-.63***	-.21
(33) There are large, unidentified creatures like the Loch Ness monster living in our rivers, lakes and oceans.	.31	-.14	***.55***	.04
(63) National governments routinely lie to the general public in order to retain power.	-.02	-.14	***.48***	.12
(46) Pharmaceutical companies and medical establishments conceal evidence that vaccines can be harmful.	.17	-.36	***.47***	-.07
(71) Most scientists present honest evidence that climate change is caused by human activity. (R)	-.07	.38	*-.47*	.16
(82) If the Yeti really existed then it would have been discovered by now. (R)	-.31	.02	*-.45*	-.16
(77) The factual claims made by most national Governments are usually broadly true. (R)	-.04	.19	*-.44*	.00
(75) Large companies seldom directly lie to the general public. (R)	.09	-.13	*-.42*	-.22
(44) There are no large cats roaming wild on Bodmin moor. (R)	-.21	.10	*-.42*	.06
(28) Large companies routinely lie to the general public for financial advantage.	-.06	.01	*.41*	.10
(64) Individual existence ends with death. (R)	-.18	.26	-.16	***-.73***
(37) Some part of a person's consciousness can survive their death.	.38	-.15	.16	***.73***
(15) When a person dies their consciousness dies with them. (R)	-.28	.28	-.10	***-.69***
(50) A person's consciousness cannot exist apart from their body. (R)	-.31	.19	-.14	***-.69***
(73) Some especially sensitive people can communicate with the spirits of the dead.	.70	-.05	.20	.48
(78) Some people can see events happening in a different place without being physically present (clairvoyance).	.65	-.15	.25	.44
(51) Some people are reincarnated into another body after their death.	.62	-.02	.22	.41
(30) Dead people cannot talk to the living through an especially sensitive intermediary. (R)	-.58	.03	-.19	-.47
(81) There is no such thing as reincarnation into another body. (R)	-.54	.01	-.26	-.45
(12) Some people can leave their body and travel in spirit to another place.	.54	-.09	.28	.48
(70) There are no such things as ghosts. (R)	-.52	.23	-.24	-.50
(40) Some people who come close to death have genuine glimpses of the afterlife.	.48	-.34	.18	.49
(24) The `evil eye' is just a superstition. (R)	-.44	.50	-.10	.00
(68) There are too many sightings of Bigfoot for them to be dismissed.	.43	-.08	.55	.05
(27) There is no life after death. (R)	-.22	.59	-.07	-.57
(1) Information cannot travel back in time. (R)	-.30	.26	-.24	-.09
(6) Believing that karma will punish a bad person is just wishful thinking. (R)	-.30	.28	-.19	-.05
(31) Vaccines are beneficial with little risk of side effects. (R)	-.26	.31	-.37	.02
(34) Natural events have no special significance for an individual's future.(R)	-.35	.24	-.17	-.06
(56) Rules for correct moral behaviour are decided by society. (R)	-.12	.15	-.06	-.13
(60) Scientists manipulate evidence to make the general public believe that climate change is caused by human activity.	.06	-.39	.36	-.17
(69) In order to see an event occurring one must be physically present. (R)	-.29	.09	-.21	-.34
(74) Water can be located underground only by using appropriate scientific equipment. (R)	-.35	.09	-.24	-.21
(79) We are responsible for our own success. (R)	-.04	.13	-.12	.03