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Editorial

We regret to announce that after 35 years this issue of the EJP will be the last issue published for the foreseeable future.

Due to a combination of factors, including a decline in submissions over the last couple of years (possibly related to the UK government's research evaluation framework which links university funding to the number of publications in larger, more mainstream journals) and unfavourable developments in the HE sector, we have decided that the journal will have to take a publication hiatus.

We plan to maintain the website (http://ejp.org.uk/) for as long as possible, with the aim of making back issues of the journal freely available in PDF format, and hope to re-launch the journal in more favourable times.

This has been a very difficult decision for us and we have done our utmost to prevent this from happening, but as the only independent journal in the field we are left with little choice.

Thank you all for your continued support over the years.

Ian Baker, Paul Staples, and Paul Stevens

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A Methodological Issue in the Study of Correlation between Psychophysiological Variables

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Abstract

We used previously accumulated skin conductance (SC) and EEG data to examine the effects of their respective autocorrelations upon hypothesis testing. We found that SC data remain auto-correlated for many seconds, and that EEG data remain auto-correlated for many fractions of a second depending upon filtering parameters. We show that the effect of these non-zero autocorrelations upon the interpretation of correlation coefficients using normal statistics can lead to substantially inflated significance levels. We demonstrate that standard Monte Carlo techniques can provide valid estimates of the significance levels. We critically review a paper claiming significant correlation between the EEG's of isolated participants Grinberg-Zylberbaum, Delaflor, Attie, and Goswami (1994); however, using uncorrelated EEG data from one of our previous studies and Monte Carlo methods to model the true null hypothesis, we compute a non-significant difference (Z = 1.22) between their non-"correlated" participants and their "correlated" ones in contrast with their claims of significance.

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Introduction

The field of research parapsychology has evolved to the point that there is now incontrovertible evidence of a statistical information transfer anomaly. In other words, we must reject the null hypothesis. Some of the recent meta-analyses that address issues of methodology, replication, and summary statistics can be found in Utts (1991; 1996), Bem and Honorton (1994), and Radin (1997). Note that we have been careful not to claim that the existence for ESP has been proved. Rather, given that ESP has a negative definition — it is what happens when nothing else should — the declaration of an anomaly is the only valid statement that can be made.

One of many possible avenues toward trying to understand the underlying mechanisms of this anomaly (hence forth called ESP) is to search for psychophysiological correlates. There is a substantial literature describing many different approaches, but it is beyond the scope of this paper to delve into an analysis of this work. Instead, we will focus on one technical aspect.

With the decrease of cost and increased capability of psychophysiological and computer hardware and software it becomes increasingly attractive and feasible to monitor psychophysiology of isolated participants in a variety of circumstances in ESP experiments. One method, for example, would be to search for correlations between data epochs of isolated pairs of participants.

Our paper reviews the well-known underlying assumptions on correlation statistics, shows examples from skin conductance and EEG data of what happens if the assumptions are violated, and suggests ways to use Monte Carlo techniques to obtain valid statistics when these assumptions are violated. In addition, we provide a critical analysis of one set of published experiments claiming an ESP-transferred event-related potential from one isolated participant to another (Grinberg-Zylberbaum, et al., 1994).

Method of Approach

It is not the purpose of this paper to provide an exhaustive methodological critique of previous studies nor do we wish to provide a complete view into the complex methodologies associated with the measurement of psychophysiological variables. Rather, we will focus on a single issue: what is the correct approach to measure a correlation between psychophysiological variables?

We have all been taught that a clear understanding of all the explicit and implicit assumptions is absolutely necessary before applying statistical formulae to a problem. However, while we may believe this to be important, it is often overlooked when it comes time to actually analyze data. It is tempting to take advantage of the sophisticated statistical software that is available that makes complex analyses a simple task of pressing a button. But, of course, this convenience has a negative side, also.

Let us review the familiar Pearson's correlation coefficient, *r*:

$$r = \frac{\sum_{i=1}^{n} \left(x_i - \bar{x} \right) \left(y_i - \bar{y} \right)}{\sqrt{\sum_{i=1}^{n} \left(x_i - \bar{x} \right)^2 \times \sum_{i=1}^{n} \left(y_i - \bar{y} \right)^2}},$$

where *n* is the number of pairs of data points and *X* and *Y* are vectors containing the data. As we recall, the assumption is that both *X* and *Y* are each distributed normally and are *random* variables (i.e., the data points in *X* are independent of each other and the data points in *Y* are independent of each other).[1] $\bar{x}$ and $\bar{y}$ are means of *X* and *Y*, respectively. If these assumptions are met, there are a number of methods to assess the significance level of a given *r* for *n-2* degrees of freedom. For example, we can use a Fischer's Z transform to arrive at a Z-Score that is distributed, under the null hypothesis as *N(0,1):*

[1] We can relax the normality requirement by using a non-parametric correlation such as Spearman's ϱ, however the random variable assumption remains.

$$Z = \sqrt{n-3} \times 0.5 \times \ln\left(\frac{1+r}{1-r}\right),$$

or a Student's t representation as:

$$t = r\sqrt{\frac{n-2}{1-r^2}}, \quad df = n-2.$$

We will only examine the degree to which the Z-score formalism holds for actual psychophysiological data, because the underlying assumptions for the T-score formalism are similar.[2]

To see the effects of the violation of the independence assumption, we used skin conductance and EEG data from separate experiments as a test bed.

Test Data Sets

To represent the central nervous system, we used 5-minutes of occipital (O_1) EEG data that we collected from two different people on two different days. To represent the autonomic nervous system we used skin conductance DMILS data from a study at Edinburgh University.[3] We randomly selected five minutes of data each from two different participants who's sessions were on different days. Thus with both data sets we assume that the expected correlation is zero.

Analysis: Autonomic nervous system variables

As an example of an autonomic nervous system variable, we begin with the skin conductance (SC) data. It is well known that SC varies slowly and is not random (Levenson & Ruef, 1992; Gottman, 1981). That is, each new data point contains a "memory" of the previous data

[2] Often in EEG research, coherence is used rather than a correlation measure. Coherence measures usually involve FFT's which are linear transforms of the data. Such a transform will not remove the autocorrelation so the interpretation problems will remain. We will not, therefore, include a coherence analysis in this paper.

[3] We thank Professor Deborah Delanoy for granting us access to her data from an as of yet unpublished sender/no sender DMILS study (Delanoy, Row, & Brady, 2001).

points. Figure 1 shows the autocorrelation function for one of the SC data sets.

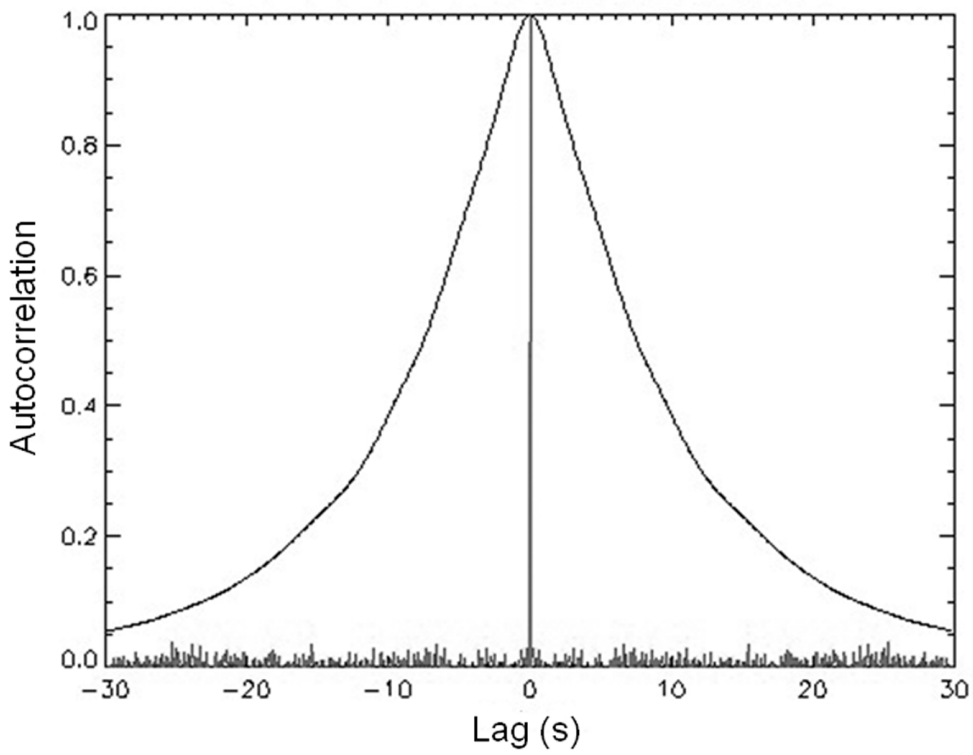

Figure 1. Autocorrelation: Skin conductance and random data

We computed the autocorrelation for lags from -30 to +30 seconds. The noisy curve with a "spike" at zero lag is the autocorrelation of normally distributed random data. That is, each successive sample of the random data has no "memory" as to the value of the previous sample. The skin conductance data are different. We notice that there is a correlation of about 0.5 for lags as long as about eight seconds. That means that the SC data point being measured now contains information about the SC data eight seconds previously.

Clearly this is a strong violation of the random-variable assumption built into both the Pearson's r and Spearman's ρ correlation functions which require an autocorrelation similar to the random one shown in Figure 1. The critical question is to what degree does a strong skin conductance autocorrelation affect a statistical evaluation?

To address this question, we used a Monte Carlo technique. For each of 1,000 passes, we randomly selected 10-second intervals (i.e., 160 points), one each from the two independent SC data records. In addition, for each pass, we computed two separate random vectors of the same length as the SC data, each of which were distributed as *N(0,1)*. We computed a Pearson's *r* and a Spearman's ρ for the pair of SC data and for the random data. The distributions are shown in Figure 2.

The effect of having such a strong autocorrelation is immediately obvious in Figure 2a. The correlation of random data, which is shown as the dark Gaussian-shaped histogram centered on zero, ranges from about –.25 to +.25 as expected for correlation coefficients with 158 degrees of freedom. The surprise is the nearly uniform distribution of correlation coefficients for both Pearson's *r* (lightest) and Spearman's ρ, which is shown as the more uniform darker distribution. The peaks of the distributions near unity correlation is expected for non-specific skin conductance in that the two participants were essentially relaxing in the absence of overt stimuli. So both SC records tended to decrease throughout the 10-second epoch leading to an excess of large positive correlation values.

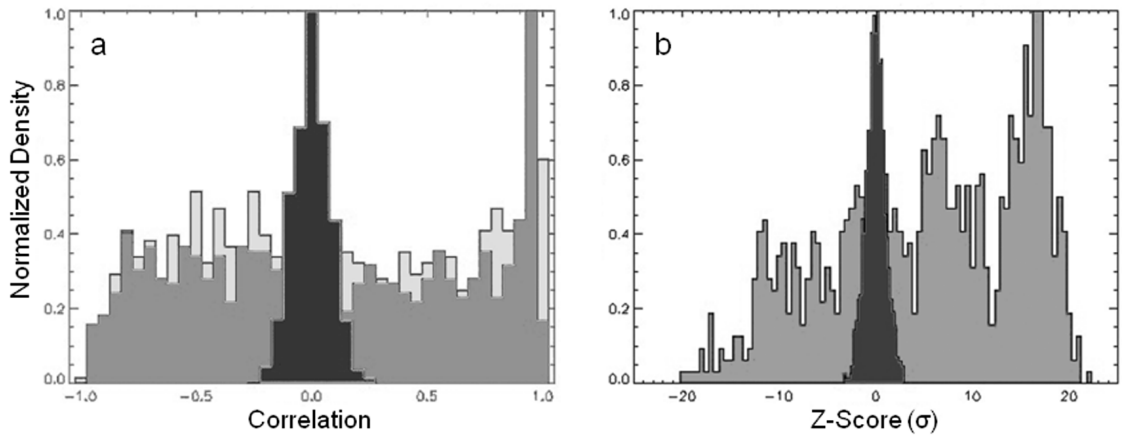

Figure 2. Skin conductance and random data

Figure 2b shows the distribution of Z-scores computed from the Fischer's Z as shown above. The darker histogram centered on zero shows the expected range of Z-scores for uncorrelated random data that meet all the criteria for the proper interpretation of Pearson's *r*. The highly auto-correlated SC data on the other hand, which fails the random-variable criterion, and is shown as the lighter histogram in Figure 2a shows Z-scores (Figure 2b) that range from misleading -20 to +20 even for totally uncorrelated data!

The proper way to asses a probability of an observed correlation between epochs which are themselves highly auto-correlated is to use a Monte Carlo technique.[4]

To demonstrate how this works, consider the lightest histogram shown in Figure 2a above. We generated that histogram from the correlation of 1,000 pairs of 10-second SC epochs. Suppose we wish to compute a Z-score for an observed correlation, r_o. The following are the steps to compute a valid one-tailed Z-score:

1. Order the 1,000 element correlation vector from smallest to largest.
2. Compute how many correlation values are greater than or equal to r_o.
3. Break ties by computing the centre position among the ties.

The *p*-value is computed as:

$$p = \frac{number\ of\ r's \geq r_o}{total\ number\ of\ correlations},$$

and can be converted into a Z-score by the usual method. Figure 3 shows the distribution of 10,000 Z-scores with SC data resulting from the Monte Carlo calculation described above.

[4] We do not claim to be the first to come up with the idea of applying Monte Carlo techniques to assess probability. This technique can be found in the literature under such names including permutation technique — partial or complete and bootstrap methods.

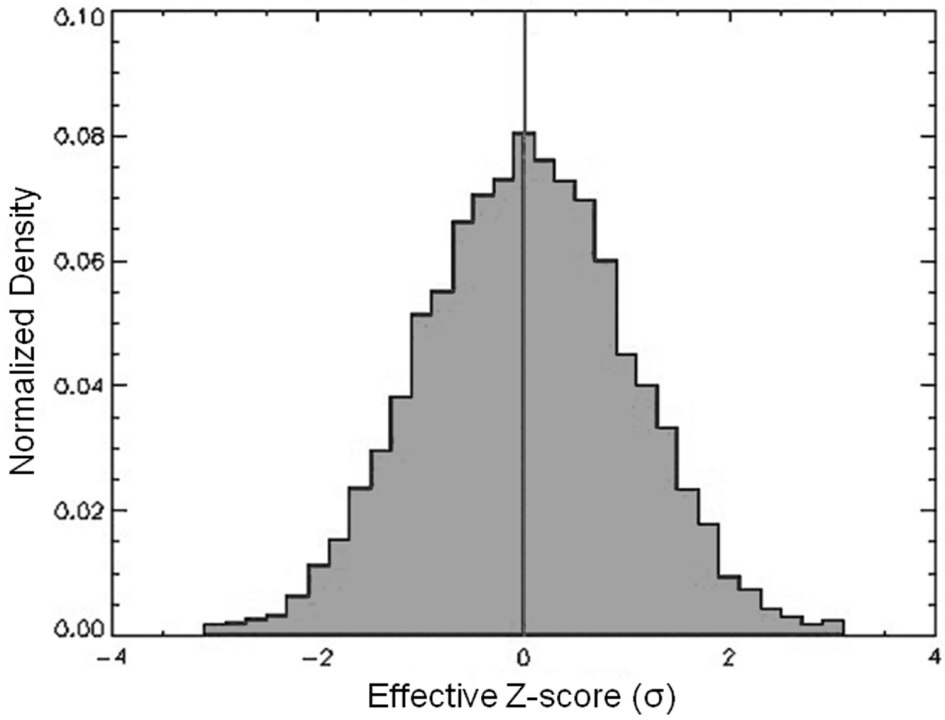

Figure 3. Monte Carlo derived Z-score distribution

This is a well-behaved *N(0,1)* distribution that is expected under the null hypothesis of no correlation even in the case of highly auto-correlated data. Although the standard formalism to compute Z-scores from correlations must be rejected in auto-correlated data, a Monte Carlo calculation can give reasonable non-assumptive and non-parametric estimates of the likelihood of such correlations given the data sets at hand.

We have used skin conductance to illustrate the problems associated with a slowly varying autonomic nervous system variable; however, the same problems will exist with other such variables that include heart rate, respiration rate, and blood volume. We recommend the use of Monte Carlo methods to make statistical assessments for all correlations among these types of variables.

Analysis: Central nervous system variables

The problem of correctly assessing correlations also exists with the central nervous system data, though less severely. We filtered five minutes of occipital (O1) EEG data from 8 to 10 Hz and computed the auto correlation for lags between -1 and +1 second. For comparison, we generated the equivalent length of random data which was distributed as N(0,1).[5] Both autocorrelation functions are shown in Figure 4. The "spike" at zero lag is for the random data as expected. In the alpha EEG case, the autocorrelation function, while significantly shorter than for skin conductance data, nonetheless is significantly longer than for random data. In Figure 4, we have shown both plus and minus lags to be complete; however, only the negative lags have meaning. That is, EEG alpha "memory" lasts for approximately one half second, or the EEG alpha value being measure "now" contains information about the EEG alpha value as much as 0.5 seconds earlier.

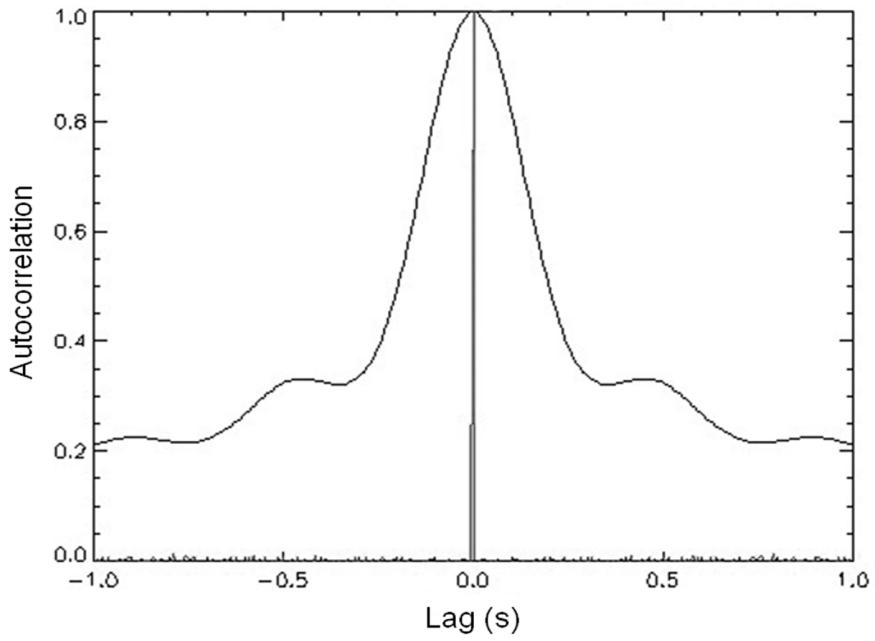

Figure 4. Autocorrelation of EEG alpha and random data

[5] For psychophysiological data, there are potentially two sources that contribute to the autocorrelation function. The first is inherent in the system, and the second results from applying filters to the data. In this paper, we show random data which is distributed as *N(0,1)* to illustrate the effects of non-zero autocorrelations.

The question is to what degree does this shorter autocorrelation influence the statistical assessment of correlations between two such sets of data? We randomly selected 1,000 10-second epochs from each of the two EEG records and computed correlations (i.e., Pearson's *r*) for each epoch pair. Figure 5a shows the distributions of these correlations.

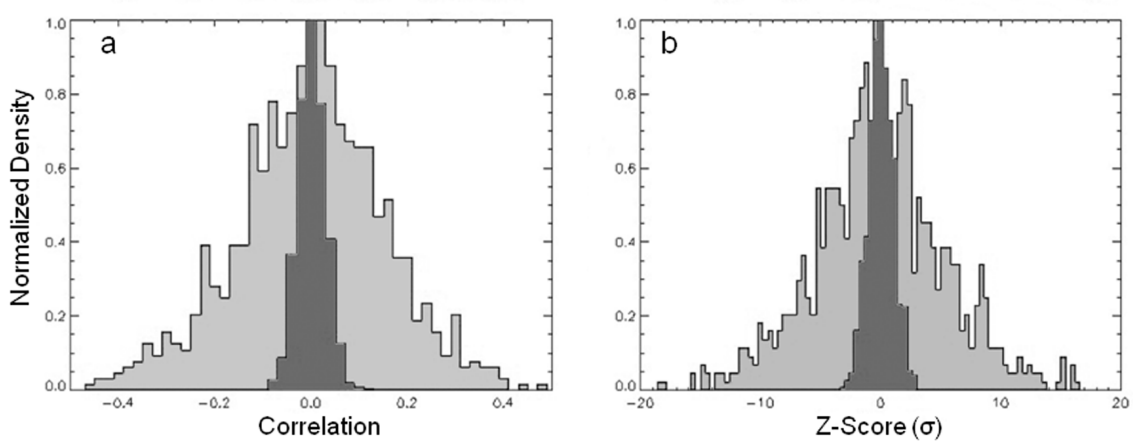

Figure 5. Correlation distributions of EEG alpha and random data

The wide, lighter, nearly Gaussian shape is the distribution for the alpha, whereas the narrow, darker distribution is for random data. So even with a sharply reduced autocorrelation function compared to skin conductance, nonetheless, EEG-α correlations can be seriously misleading. Figure 5b shows the equivalent Z-score distributions. We notice that the Z-score distribution for the random data is as expected; however, as in the skin conductance case, the Z-score distribution for the EEG data can lead to wildly incorrect answers.

As in the case of skin conductance data (Figure 3), a Monte Carlo approach gives a *N(0,1)* distribution and allows for a valid assessment for correlation between separate central nervous system alpha epochs.

Analysis summary

We have shown that the underlying assumptions that would allow the use of a Fischer's Z transform to compute the significance levels of a Pearson's *r* correlation are substantially violated with autonomic and

central nervous system data. Of course this is a well known result; however, in the next section we will show an example of a "land mark" paper that ignored these difficulties.

Discussion

Grinberg-Zylberbaum (1982) became interested in studying EEG correlation between communicating individuals, and he and his colleagues published similar studies for over a decade.[6]

The basic idea behind this research was to examine correlations between individuals at various stages of communication. For example, participants were sequestered together in the same room (Grinberg-Zylberbaum & Ramos, 1987) and broad-band (i.e., 3 – 45 Hz) EEG was measured simultaneously, or in isolated chambers using a "telepathic" paradigm (Grinberg-Zylberbaum, Delaflor, Arellano, Guevara, & Perez, 1992). Pearson's *r*'s were computed and displayed graphically for visual inspection and quantitative analyses. Grinberg-Zylberbaum and Ramos (1987) observed what they described as strong coherence between these sets of EEG records and presented means and standard errors for the correlations under various conditions. Since they do not mention any Monte Carlo methods, we assume they used normal statistics.

For the remainder of this discussion, we will focus upon a paper by Grinberg-Zylberbaum, Delaflor, Attie, and Goswami (1994) because it is the most detailed with regard to methodological issues and is often referenced as the quintessential example of quantum coherence between isolated brains.[7] Hence forth we will refer to this paper as ZDAG.

[6] It is not our purpose to single out this group for our critical remarks; however, their pioneering research has invoked substantial experimental, theoretical, and philosophical interest.

[7] We will only focus upon the methodologies associated with the correlation calculations and the resulting conclusions rather than providing a complete critique of the whole paper.

ZDAG overview

The basic idea behind this paper was to observe event related potentials (ERP) in the EEG record of an isolated individual while a second isolated individual was being stimulated with 100 random light flashes — the details of which were not described in the paper. EEG was also monitored from the participant who was directly stimulated. There were two conditions of interest:

Before interaction: In this condition called Condition 1 in the paper, the above measurements were made between individuals who had not met or interacted in any way.

After interaction: In this condition called Condition 2 in the paper, the individuals were introduced to each other inside the stimulation chamber and instructed to "get to know" each other and then to "feel one another in meditative silence" for 20 minutes before the above EEG measures were obtained.

Standard ensemble averaging was performed over the 100 stimuli for the "sender" from zero to about 0.5 seconds relative to the stimulus, and using the same stimuli markers, a similar ensemble average was carried out in the "receiver's" EEG record.

All EEG records were filtered between 12.7 and 35 Hz prior to the ensemble averaging. The goal was to observe an ERP in the sender and see a correlated ERP in the receiver. For 48 steps of 16 samples each, a Pearson's r was computed. Thus, a temporal record of the correlation could be observed for about 0.5 seconds relative to the stimulus. The authors do not indicate how significance levels were computed, a quantitative statistical measure between Conditions 1 and 2, nor do they mention whether any Monte Carlo methods were used; thus we presume they used a "standard" Z or T method.

Within the first 132 ms, they report correlation levels ranging from .700 to .929 corresponding to $p < .009$.[8]

Independent evaluation of mean chance expectation

For our evaluation, we used two 5-minute EEG records far from any putative stimuli from different days and different participants from our 1994 ERD study. The null hypothesis was that no significant correlation between these isolated records would be found.

Following the procedure described in ZDAG, we filtered both EEG records from 12.7 to 35 Hz and arbitrarily labeled one of the EEG records as the "sender" (i.e., the participant who experienced direct stimulation) and the second as the "receiver." For each of a 2,500 pass simulation, we:

- Randomly selected 100 entry points into the sender's record to simulate 100 stimuli.
- Identified the same entry points into the receiver's record.
- Ensemble averaged 64 data points (0.5 seconds) starting at each of all 100 stimuli separately for the sender and receiver EEG records.
- Followed ZDAG's computation and computed four 16-point Pearson's *r* correlation coefficients between the sender and receiver ensemble averaged data in each 64-point epoch.

Thus we computed a total of 10,000 values for the correlation coefficient. At the same time we computed 10,000 correlation coefficients for random variables, which were distributed as *N(0,1).* Figures 6a and 6b show these distributions and their equivalent Z-score distributions under the assumption of normal statistics, respectively.

The darker distributions are associated with the random data and, and the wider lighter distributions are associated with the correlations

[8] It is not clear how this value was computed since it does not correspond to any correlation in the range quoted in the paper.

as described above. As we can see, even for this relatively high frequency EEG data (i.e., 12.7 to 35 Hz), their remains considerable difference between truly random data and uncorrelated EEG.[9]

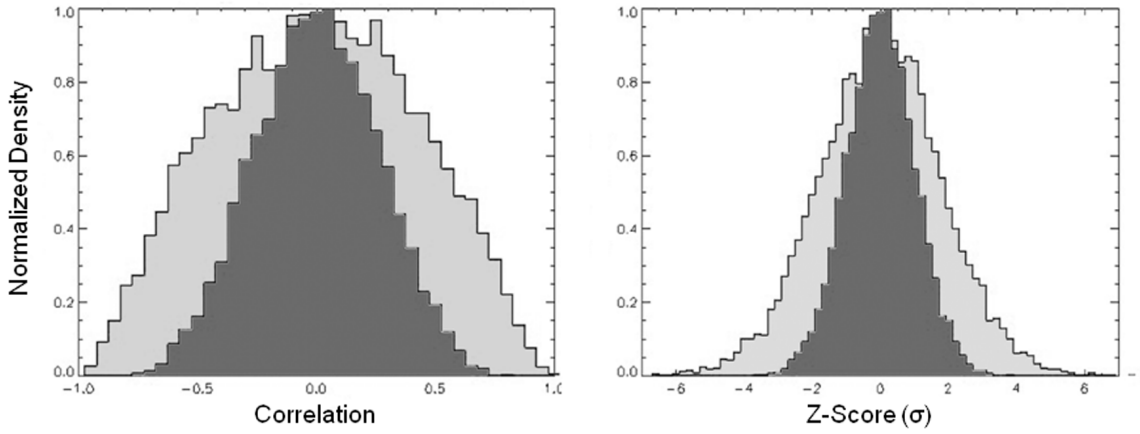

Figure 6. Pearson's *r* for ERP simulation and random data

We computed a Z-score distribution resulting from a Monte Carlo calculation, similar to that described above so that we could compute a valid Z-score for a given observed Pearson's *r*.

The consequences for the differences between the EEG correlation and that for random data can be seen in Figure 7. Note that the p-values are 1-tailed and are shown on a log scale. The lower curve represent the p-values associated with a given *r* under the assumption of random variables that are not auto-correlated. The upper curve represents a more valid assessment of the *p*-value from Monte Carlo analysis that does not require this assumption.

We have chosen to illustrate an enhancement of the *p*-value for a correlation value of 0.7 because that was the minimum value quoted in ZDAG. At larger values of the correlation the artifact becomes even larger. As Figure 7 shows, a *p*-value of .0009 (the lower horizontal line)

[9] The effects of frequency can be seen by comparing Figures 5b and 6b. The lower frequency gives a much broader Z-score distribution for mean chance expectation than does the higher frequency EEG.

will be found using normal statistics; whereas the correct value is 0.0418 (the upper horizontal line).

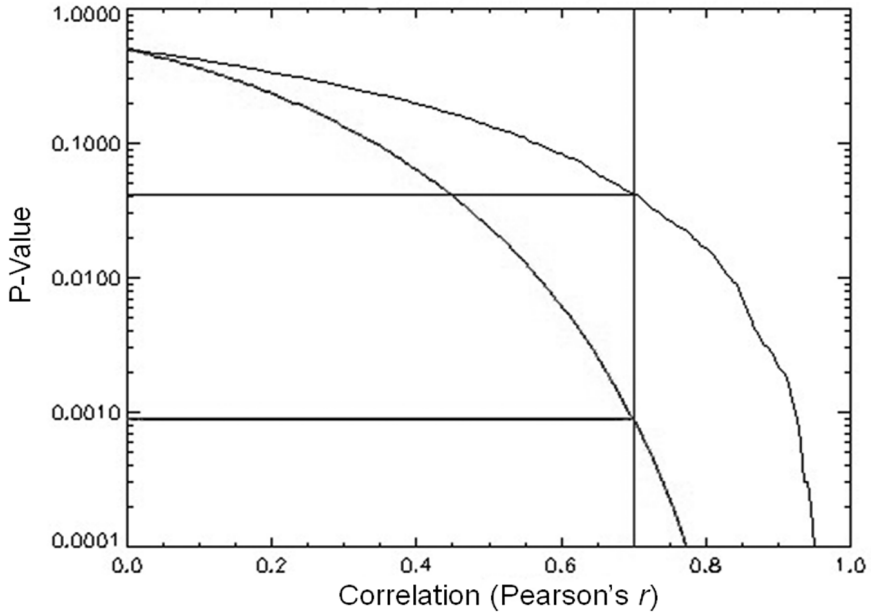

Figure 7. Values under a normal and Monte Carlo assumption

Unfortunately no correlation values were given for Condition 1 (i.e., before the sender and receiver met); however, selected graphical representations in ZDAG for the correlations are shown for Condition 1. ZDAG did not compute any quantitative difference between their conditions. If we assume, however, as ZDAG implies that Condition 1 yields no correlation (i.e., Z-score = 0) then there is no significant difference between the conditions for an observed correlation of .7:

$$Z_{diff} = \frac{(1.73 - 0.0)}{\sqrt{2}} = 1.22,$$

where the value 1.73 is the Z-score equivalent of the one-tailed *p*-value = .0418 shown in Figure 7.

The selected graphical representations for Condition 2 in ZDAG appear quite impressive until one realizes from Figure 7 above that

there is a sizeable likelihood of large correlation value even under the null hypothesis. So with selected epochs it is not surprising to see rather impressive overlaps between the sender and receiver ensemble averaged data.

We computed the autocorrelation function for this set of EEG data in the higher frequency bands and found that as expected it was narrower than it was for alpha, nonetheless, it is responsible for the breaking of the underlying assumption for the use of normal statistic and the resulting invalid *p*-values.[10]

Unfortunately, there is insufficient reporting in ZDAG to determine without question whether their claim of isolated EEG evoked responses are correlated is correct; however, in light of our results we urge caution in interpreting this and similar papers.[11]

Commentary

As we have indicated above, there have been a number of references to Grinberg-Zylberbaum and his colleagues' work. In this section we provide quotes from three of these articles selected from some of the papers shown in the References Section below. The purpose of this section is to demonstrate how a concept can become embedded into the research community even though it may be in error in the first place. For example:

Dossey (1997): "Grinberg-Zylberbaum's team, along with physicist Amit Goswami, propose that these 'transferred potentials' between brains demonstrate 'brain-to-brain nonlocal EEG correlations.' Nonlocal correlations have been a concern of physicists since they were proposed by Einstein, Rosen, and Podolsky in 1935. From the moment they were hypothesized, nonlocal effects have stretched the imagination of physicists to the limits. The fact that they occur

[10] We emphasize again that even higher frequency EEG data also fail the requirement for correlations that the data be random. That is, each data point must not depend upon early values of the data. This becomes increasingly less a problem the higher the frequency of the EEG data.

[11] In ZDAG, the authors claim an EPR-type correlation, yet do not address such critical issues of the quantum correlation that is required (i.e., their Condition 2) in the light of substantial evidence that environmental decoherence sets in at nano-degrees Kelvin; whereas the brain is at 300^0 Kelvin.

simultaneously between distant subatomic particles means that there is no "travel time" for any known form of energy to flow between them. But if there is no signal from one particle to the other, how could their behavior be correlated? How could one particle know what the other is up to? For almost half a century, nonlocal events remained hypothetical – until they were demonstrated experimentally, most notably in a celebrated study in 1982 by physicist Alain Aspect and colleagues.[12]

Physicists have assumed that nonlocal connections exist only between subatomic particles such as electrons and photons. But the pioneering work of Grinberg-Zylberbaum, Goswami, and colleagues strongly suggests that these events occur also between human beings."

Andrews (1996): "In fact, several generations of scientists have amassed evidence in support of remote communication anomalies. Numerous studies have provided evidence that identifiable and consistent electrical brain signals (as distinguished from electrical brain signals occurring during control periods) occurred in one person when a distant second person was either meditating or provided with sensory stimulation, or when a distant person attempted to communicate with the subject being monitored."

Goswami (1999): "The striking similarity between the correlated brains of this experiment and the correlated photons of Aspect's should be clear, but there is also a striking difference. The similarity is that in both cases the initial correlation is produced by some 'interaction.' In the case of the photons, the interaction is purely physical. But in the case of the correlated brains, consciousness is involved. For correlated photons, as soon as the possibility wave of one is collapsed by measurement, the objects become uncorrelated. But in the case of the

[12] Aside from ascribing special status to a flawed study, there is a huge error in Dossey's reasoning. It is understandable that classical thinking and gut level responses mislead with regard to quantum mechanics. Dossey is concerned with "…how could their behavior be correlated? This, of course makes the incorrect assumption that these outgoing particles in an EPR setup possess properties such as polarization or spin in the absence of measurement – a classical idea, only. This is not the case theoretically and experimentally in quantum systems. Given this fact and the notion that systems that are once correlated and remain undisturbed stay correlated, – even for quantum systems – regardless. Thus there is no mystery with the results of EPR experiments.

correlated brains, consciousness not only establishes correlation initially but also maintains the correlation over the duration of the experiment. To get a clear evoked potential, experimenters typically use an averaging procedure over one-hundred or so light flashes in order to eliminate the 'noise.' But the brains do not become uncorrelated as soon as one observer sees a light flash. The only conclusion is that consciousness re-establishes the correlation every time it is broken.

This difference between correlated photons (as in Aspect's experiment) and correlated brains (as in Grinberg-Zylberbaum's experiment) is highly significant. The nonlocality of correlated photons, although striking in terms of demonstrating the radicalness (sic) of quantum physics, cannot be used to transfer information, according Eberhard's theorem. Each photon that one experimenter sees in a stream of photons is correlated with its partner that is observed by another experimenter. But there is no correlation between the states of the photons within the stream observed by one experimenter. These states thus are randomly distributed, hence they can carry no message. But in the case of the correlated brains, since consciousness is involved in establishing and maintaining the correlation over the period of the entire experiment, Eberhard's theorem does not apply, and message transfer is not forbidden."

Conclusion

We have demonstrated that substantial errors can be made if the underlying assumptions concerning hypothesis testing with correlations are violated, and these errors can propagate within the research community. We used skin conductance and EEG data from previous experiments to show that even small autocorrelations can affect the resulting p-values by up to many orders of magnitude.

Fortunately, we were also able to demonstrate that by using standard Monte Carlo techniques, it is possible to extract meaningful hypotheses testing test statistics.

Given the simplicity of encoding Monte Carlo analyses into Microsoft's Excel spread sheets and other programming languages, we urge our colleagues to adopt this method in all further psychophysiological correlation studies and to resist the temptation to allow the elegant and sophisticated software packages to make decisions for us.

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Reality Testing, Belief in the Paranormal, and Urban Legends

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Abstract

This study investigated the role of reality testing deficits in the formation of paranormal beliefs and endorsement of urban legends. One hundred and fifty-five respondents completed an online questionnaire booklet comprised of seven urban legends (or myths), the Revised Paranormal Belief Scale (R-PBS), and the Reality Testing subscale of the Inventory of Personality Organization (IPO-RT). As predicted all urban legend attributes (retelling, likelihood, importance, scariness, strangeness and heard by others), with the exception of unusualness, were found to be positively correlated with reality testing scores and belief in the paranormal. Path analysis was conducted with paranormal belief and reality testing as the independent variables, and urban legend truthfulness ratings as the dependent variable. Controlling for reality testing reduced the size of the relationship between paranormal belief and truthfulness ratings. Results of the current study concurred with those of Irwin (2003a, 2004), who concluded that reality testing deficits were fundamentally involved in the formation and maintenance of some paranormal beliefs. The present study suggests that reality testing deficits may also play an important role with regards to the adoption and endorsement of other related beliefs, such as urban legends.

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Introduction

Urban legends are defined as enduring, apocryphal folk narratives that have reached a wide audience, usually by word of mouth or via email (Fox Tree & Weldon, 2007). Notable examples being: 'The killer in the back seat[1]' and 'gang initiation[2]'. The term urban legend is synonymous with other less frequently used idioms, such as urban myth, urban belief tale and contemporary legend. Urban legends also share common features with migratory legends. These are recurring tales, which are tailored to fit individual sites (e.g., place names and/or topographical details are adapted to particular locations). A related modern phenomenon is campus legends. These are stories, which are changed to accommodate people, events, or places on the campus of an educational institution.

Myriad urban legends, covering a range of issues and topics exist, and for each legend there are often several variants (see http://snopes.com for a comprehensive range of examples). Whilst the provenance of urban legends often remains unattested, and their veracity is questionable, story authenticity is frequently implied by the teller's assertion that the events happened to a 'friend of a friend'. Even when tales have some basis in truth, facts may be distorted by repeated retelling (Barlett, 1932; Fox Tree & Weldon, 2007).

Analysis of the content of urban legends has revealed a number of common features. The narrative contains surprising information, tales are designed to make an emotional impact, and story features may change with the passage of time (e.g., tales of heavenly intervention on the battlefield are updated to match a current conflict). Alternatively, new urban legends arise, which reflect modern developments and advancements (e.g., computer viruses). In an attempt to differentiate urban legends from rumours, Guerin and Miyazaki (2006) delineated the conversational properties of urban legends. They suggested that

[1] A good Samaritan warns a female driver about a dangerous man hiding in the back seat of her car.

[2] Gang members are initiated by driving without headlights. When another driver notices and flashes a warning they are required to pursue and kill the driver.

urban legends can be characterised in the following way: the narrative is of general interest to most listeners; the truth of the tale is difficult to verify; the account may be ambiguous; the story is typically long; the legend contains a story plot; attention is gained with horror (shock) or scandal; new or novel content is evident; the story may be humorous; and the tale is unusual or unexpected (Guerin, 2003, 2004).

Whilst useful, these categorizations were not intended to be definitive and are open to expansion. For instance, Brunvand (1981) observes that urban legends contain a symbolic message via an ironic twist (Robertson, 1987), which either warns of danger (e.g., computer viruses, health risks, etc.), or contains a consequence for the chief protagonist (e.g., person stealing a parking space suffers damage to their vehicle, exam cheat is detected and consequently failed, etc.) (Donavan, Mowen, & Chakraborty, 2001). The fact that urban legends purport to contain important helpful/advisory information may explain why they persist despite the passage of time. The pervasive nature of urban legends is demonstrated by the fact that they periodically resurface within the media (e.g., U.S. deports Israelis amid warnings of espionage activities).

Historically, literature on urban legends has been closely linked to work on rumours (Guerin & Miyazaki, 2006). The major difference between urban legends and rumours is that rumours are always speculative, whilst legends are generally presented as facts (Rosnow, 2001). Indeed, as Fox Tree & Weldon, (2007) point out, an important feature of urban legends is that they are told as true (Heath, Bell & Sternberg, 2001), or their truthfulness is the subject of discussion (Dégh & Vázsonyi, 1976). Coupled to this is the frequent disclaimer that the story may be untrue but there is a risk attached with not passing it on. The fact that implied truthfulness is a key component of many urban legends made them an attractive stimulus material in the current study. Particularly, we sought to determine whether endorsement of urban legends was related to belief in the paranormal and reality testing deficits. Previous work in the area of belief in the paranormal and reality testing deficits has been undertaken by Irwin (2003a, 2004, 2009).

Irwin (2004) argues that whilst the functions of paranormal belief have been extensively researched, the cognitive or information processing correlates of paranormal belief have been largely neglected. With this gap in mind Irwin (2003a, 2004) examined the formation of paranormal beliefs in relation to reality testing. Irwin (2003a, 2004, 2009) defines reality testing as the inclination to test critically the logical plausibility of beliefs. These studies were grounded in the work of Langdon and Coltheart (2000), who posited that pathological beliefs or delusions arise in part from a failure to subject hypothetical explanations of sensory experience to critical testing (Irwin, 2004).

Sensory experiences provide information about the environment and self, which frequently require explanations (casual attributions), and thus are subject to bias (Kahneman & Tversky, 1972; Weiner, 1986). Normal, non-pathological belief generation is characterised by critical evaluation of explanations, where each hypothesis is considered and its plausibility assessed. This approach has been extended to explain the development and maintenance of paranormal beliefs (Goode, 2000; Irwin, 2004, 2003a; Zusne & Jones, 1982). In this context, paranormal beliefs arise from intuitive-experiential interpretations of anomalous events, which have not been subjected to analytical-rational processing (reality testing) (Irwin, 2009). Paranormal interpretations are then maintained because individuals fail to rigorously test their self-generated explanations of the world (Irwin, 2004).

Irwin (2003a, 2004) investigated the role of reality testing deficits in the formation of belief in the paranormal. Irwin (2003a) used the Bell Objects Relations and Reality Testing Inventory (BORRTI) (Bell, 1995) and found that scores on two fundamental factors of paranormal belief (New Age Philosophy, NAP; and Traditional Paranormal Belief, TPB) predicted reality testing deficits. This was particularly true of factors measuring Hallucinations and Delusions and Reality Distortion. Irwin (2004) expressed caution with regards to the latter finding because the reality testing measure (BORRTI) contained items tapping into belief in the paranormal; possession, mystical powers, and mind reading. Whilst, these items did not impact upon the Hallucinations and Delusions dimension, Irwin (2003a) acknowledged that the results

should be replicated with a reality testing measure not contaminated by items related to paranormal belief (Irwin, 2004). Hence, in his follow up study, Irwin (2004) used an alternative measure of reality testing, the Reality Testing subscale of the Inventory of Personality Organization (IPO-RT — Lenzenweger, Clarkin, Kernberg & Foelsch, 2001). The IPO-RT was selected because it makes no reference to belief in the paranormal, and it canvasses a variety of aspects of reality testing. In addition to this the IPO-RT focuses on reality testing in the context of information processing style rather than defining it as a psychotic phenomena. Irwin (2004) argued that this approach was consistent with the evaluative processes account advanced by Langdon and Coltheart (2000): the IPO-RT was designed to assess "the capacity to differentiate self from non-self, intra psychic from external stimuli, and to maintain empathy with ordinary social criteria of reality" (Kernberg, 1996, p. 120).

Irwin (2004) asked participants to complete the Revised Paranormal Belief Scale (R-PBS) (Lange, Irwin, & Houran, 2000; Tobacyk, 1988, 2004) alongside, the IPO-RT. In total scores from 161 participants were included in the study. The sample was recruited through friendship networks within the general community of Australian adults and was heterogeneous in nature. As predicted by the results of his 2003a study Irwin (2004) found that reality testing deficits were predicted by NAP and TPB (Lange, Irwin & Houran, 2000). On the basis of this finding Irwin concluded that the results of his earlier study were valid; item contamination had not compromised the finding that reality testing deficits predicted belief in the paranormal.

Irwin's (2003a, 2004) results suggest that reality testing deficits play a central role in the formation and maintenance of paranormal beliefs. Irwin (2004) postulates that some people when faced with an anomalous experience may fail to thoroughly critically evaluate the belief and hence, may adopt a paranormal explanation. Irwin (2004) further evaluated his data and found that the reality testing deficits of the sizeable majority of ardent paranormal believers were below clinical levels. This finding was consistent with his earlier study (Irwin,

2003) and suggests that reality testing deficits in believers should be understood in terms of information processing style. Irwin and Young (2002) argue that people with an intuitive-experiential processing style will be predisposed towards accepting paranormal explanations because they find them appealing and therefore do not subject them to reality testing. Irwin (2004) argues that motivational factors, such as need for control may be important for the maintenance of paranormal beliefs (Irwin, 2000). The notion being that the paranormal belief provides a sense of reassurance, thus reality testing is suspended and contrary evidence is ignored (Singer & Benassi, 1981; Wiseman & Smith, 2002).

The present study was designed with reference to the earlier work of Irwin (2003a, 2004). Particularly, the current study investigated the relationship between core facets of paranormal belief (NAP and TPB), reality testing and urban legends. The key question of interest being whether Irwin's (2003a, 2004) reality testing findings could be generalised to endorsement of urban legends. In this context we considered Irwin's recent definition of paranormality, "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). Using this definition it is evident that there is potential overlap[3] between belief in the paranormal and acceptance of urban legends as true. Certainly, such accounts are generated within the nonscientific community, their veracity is rarely tested, and their existence is perpetuated by people, who might normally be expected by their society to be capable of rational thought and reality testing. These characteristics, together with inherent plausibility and believability suggested that urban legends would act as an excellent medium for further investigating paranormal belief and reality testing.

On this basis it was predicted that truthfulness ratings for urban legends (both individually and summated) would be positively

[3] Overlap in this context, refers not to content but to characteristics/attributes; paranormal content is not a defining feature of urban legends.

correlated with reality testing and belief in the paranormal. It was also hypothesized that other attributes of urban legends (retelling, likelihood, importance, scariness, strangeness and heard by others) would be related to belief in the paranormal and reality testing. In addition to this in line with the findings of Irwin (2003a, 2004) it was anticipated that urban legend endorsement and level of paranormal belief would be predicted by reality testing deficits. More particularly, it was hypothesized that the size of the relationship between belief in the paranormal and the endorsement of urban legend veracity would be reduced if reality testing was controlled.

Method

Participants

One hundred and fifty-five respondents participated in this study. There were 48 males and 107 females. The mean age was 30.41 years (SD = 11.08) with a range of 17–61 years. Participants included undergraduates and employees from the Manchester Metropolitan University (MMU) and volunteers from the wider community. Overall, 58% of respondents were students and 42% non students. The proportion of students vs. non students for males was: 44% vs. 56%, and for females: 64% vs. 36%.

Participation was voluntary, and respondents could terminate their participation at any time during the study. Respondents were recruited through a range of sources: undergraduate psychology classes, contacts at local colleges, research students using snowball sampling (encouraging contacts to take part in a study), and advertisement of the study (emails to staff and students at the university and posters placed around the university campus).

Sampling

The current study made use of internet-mediated research (IMR). This approach has been employed successfully in the past (Dagnall,

Munley, Parker, & Drinkwater, 2010b; Dagnall, Parker, Munley & Drinkwater, 2010a; Wiseman & Watt, 2004). IMR was used in the current study because it possesses a number of advantages (Whitehead, 2007): it enables a large pool of respondents to be tested, respondent access is facilitated, social barriers are reduced (Valaitis & Sword, 2005), and disclosure is often enhanced (Joinson, 2002; Weisband & Kiesler, 1996). In addition to this respondents can complete the measures in a comfortable and controlled environment at their own pace.

Some researchers have criticised IMR, particularly with regards to sampling bias and the validity of data collected (Whitehead, 2007). However, IMR samples have been found to mirror those associated with more traditional research paradigms (Dagnall et al., 2010a, 2010b; Hewson, 2003; Wiseman & Watt, 2004).

Materials

Participants were asked to complete in the following order: the Urban Legends Questionnaire (ULQ) (see Appendices), this was adapted from Fox Tree and Weldon (2007); the Reality Testing subscale of the Inventory of Personality Organization (IPO-RT — Lenzenweger et al., 2001), and the Revised Paranormal Belief Scale (R-PBS; Lange, et al., 2000; Tobacyk, 1988; Tobacyk, 2004; Tobacyk & Milford, 1983). Questionnaire order was the same for all participants.

The ULQ contained seven urban legends. Three legends (Kidney, Cactus and Cookie stories) were adapted from Fox Tree and Weldon (2007): "Kidney", "Cactus", and "Cookie" (see Appendices). Fox Tree and Weldon (2007) used four legends, however, following close examination of their materials it was decided to omit the Ethics story from the current study because it contained material that was pertinent to Psychology students.[4] To ensure that participants were exposed to a range of urban legends four further examples were included: "Airbags", "Airplane", "Ricin", and "Sandstorm" (see Appendices). Consistent with Fox Tree and Weldon (2007) these additional urban

[4] The current sample was not composed exclusively of Psychology students, however, it contained a significant number of respondents with experience of Psychology (current and previous students).

legends were obtained from the Snopes online database of legends (at http://www.snopes.com). The only restriction on selection was that the legends should be from different categories.

Each urban legend was followed by a series of questions based on Fox Tree and Weldon (2007). One question measured whether respondents had heard the story before and, if so, how many times and where. Another assessed whether respondents believed other people in the UK had heard the story (heard by others), 1 (*almost no one*) to 7 (*almost everyone*). Respondents were also asked whether they would retell the story in the future (retelling), 1 (*not at all likely*) to 7 (*extremely likely*). Further questions assessed whether respondents: believed the story was true (truthfulness), 1 (*definitely not true*) to 7 (*definitely true*); thought something like the story could happen to someone they knew (likelihood), 1 (*not at all likely*) to 7 (*extremely likely*); believed that it was important to pass the story on (importance), 1 (*not at all important*) to 7 (*extremely important*), considered the story to be frightening (scariness), 1 (*not at all*) to 7 (*extremely*); and whether they believed the event was out of the ordinary (strangeness), 1 (*not at all unusual*) to 7 (*extremely unusual*).

Reality testing was measured using the Reality Testing subscale of the Inventory of Personality Organization (IPO-RT — Lenzenweger et al., 2001). The IPO-RT is a 20 item, unidimensional, self-report measure, which assesses aspects of reality testing. Responses are recorded on a 5-point likert scale (1 *never true* to 5 *always true*), thus total scale scores range from 20 to 100, with low scores indicating high reality testing ability. The IPO–RT was 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). Hence it includes items such as, 'I can't tell whether certain physical sensations I'm having are real, or whether I am imagining them', and 'When I'm nervous or confused, it seems like the things in the outside world don't make sense either'. Irwin (2004) argued that because the IPO-RT places an emphasis upon information processing style rather than psychotic symptomology it is consistent with Langdon and Coltheart's (2000) account of belief

generation. The IPO-RT has been validated and its psychometric integrity has been established. Lenzenweger et al. (2001) report the scale to be internally consistent and temporally stable with nonclinical populations. The IPO-RT has demonstrated good retest reliability (r = . 73) and has good construct validity (Lenzenweger et al., 2001).

The R-PBS (Lange et al., 2000; Tobacyk, 1988; Tobacyk, 2004) is the most prevalently used self-report measure of paranormal belief (Irwin, 2004). It is an amended form of the Paranormal Belief Scale developed by Tobacyk and Milford (1983) and contains 26-items assessing seven facets of paranormal belief: traditional religious belief, psi, witchcraft, superstition, spiritualism, extraordinary life forms, and precognition. These items can be summated to produce an overall total, or scores for each belief facet can be used. However, purification of the scale to correct for differential item functioning (arising from age and gender bias), and subsequent factor analysis has identified an alternative two factor solution (Lange et al., 2000). This comprises factors measuring 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). Items on the R-PBS are presented as statements (e.g., "there is a devil" and "witches do exist") and participants respond on a likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores reflecting greater paranormal belief. The current paper, in line with Irwin (2004), will be using the two-factor solution suggested by Lange et al., (2000).

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 generally considered to be conceptually and psychometrically satisfactory (Tobacyk, 2004). Particularly, the R-PBS has been shown to

possess adequate validity (Tobacyk, 1995a, 1995b, 2004) and good test-retest reliability (Tobayck, 2004).

Results

Reliability and scale descriptives

The two Rasch scale factors of paranormal belief (New Age Philosophy, NAP; and Traditional Paranormal Belief, TPB) identified by Lange et al. (2000) were used alongside overall R-PBS scores in the current paper (see Irwin, 2004)[5]. Internal reliability was assessed using Cronbach's alpha (α). The R-PBS (α = .94) and NAP (α = .93) demonstrated excellent internal reliability, whilst the Reality Testing subscale of the Inventory of Personality Organization (IPO-RT; Lenzenweger, et al., 2001) (α = .87) and TPB (α = .82) were found to possess good internal reliability (George & Mallery, 2003) (descriptives for the survey measures are presented in Table 1).

Table 1. Summary statistics for the Reality Testing (IPO-RT) and Paranormal Belief (R-PBS amd ASGS) measures

		M	SD	α
IPO-RT		32.5	10.01	0.87
R-PBS		44.1	30.91	0.94
	NAP	19.64	6.65	0.93
	TPB	20.99	6.29	0.82

Urban legend descriptives

For completeness mean attribute ratings for each urban legend are presented alongside overall ratings in Table 2.

[5] Prior to the use of parametric statistics, exploratory data analysis (EDA) was conducted. This revealed that IPO-RT scores were skewed and consequently a log transformation was performed (Irwin, 2004). Screening prior to analysis ensured that normality assumptions were not violated (Bulmer, 1965).

Table 2. Urban legends: Individual and overall descriptives

	Kidney		Cactus		Cookie		Airbag		Airplane		Ricin		Sandstorm		Total	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Retelling	3.01	2.02	2.76	1.93	2.12	1.59	2.05	1.35	2.95	1.9	1.91	1.31	2.10	1.42	2.42	1.14
Truthfulness	2.97	1.54	2.90	1.65	3.25	1.71	2.68	1.44	2.19	1.33	3.01	1.58	3.23	1.56	2.89	1.03
Likelihood	1.99	1.24	1.63	1.11	2.12	1.53	1.59	0.92	1.52	0.94	1.46	0.96	1.63	1.23	1.71	0.70
Importance	2.61	1.66	1.81	1.14	1.76	1.21	1.97	1.21	1.67	1.11	2.15	1.54	1.86	1.29	1.97	0.93
Scariness	3.46	2.21	2.90	2.06	1.25	0.71	2.03	1.51	1.47	1.09	2.37	1.71	2.13	1.59	2.23	1.11
Unusualness	5.57	1.73	5.54	1.78	4.32	1.88	4.76	1.93	5.63	1.81	4.80	1.80	4.59	2.03	5.03	1.47
Heard (UK)	3.06	1.53	2.34	1.18	2.30	1.29	2.13	1.13	2.39	1.44	2.14	1.18	2.37	1.25	2.29	0.93

Looking at attribute scores for each urban legend it is clear that there is significant variation across the stories. All attributes were scored on a seven point likert scale. Scores on retelling ranged from Ricin (M = 1.91, SD = 1.31) to Kidney (M = 3.01 SD = 2.02). The overall mean (M = 2.42, SD = 1.14) was towards the lower end of the scale and indicated that respondents would be unlikely to retell the story in the future.

Scores on truthfulness ranged from Airplane (M = 2.19, SD = 1.33) to Cookie (M = 3.25, SD = 1.71). The overall mean (M = 2.89, SD = 1.03) was below the mid-point of the scale and indicated that respondents did not generally believe that the stories were true. Scores on likelihood ranged from Ricin (M = 1.46, SD = 0.96) to Cookie (M = 2.12, SD = 1.53). The overall mean (M = 1.71, SD = 0.70) was at the lower end of the scale and indicated that respondents did not think that something like the story could happen to someone they knew.

Scores on importance ranged from Airplane (M = 1.67, SD = 1.11) to Kidney (M = 2.61, SD = 1.66). The overall mean (M = 1.97, SD = 0.93) was at the lower end of the scale and indicated that respondents did not think that it was important to pass the story information on.

Scores on scariness ranged from Cookie (M = 1.25, SD = 0.71) to Kidney (M = 3.46, SD = 2.21). The overall mean (M = 2.23, SD = 1.11)

was at the lower end of scale and indicated that respondents did not rate the stories as frightening.

Scores on unusualness ranged from Cookie (M = 4.32, SD = 1.88) to Airplane (5.63, SD = 1.81). The overall mean (M = 5.03, SD = 1.47) was at the upper end of the scale and indicated that respondents found the stories to be unusual.

Finally, Scores on heard (UK) ranged from Airbag (M = 2.13, SD = 1.13) to Kidney (M = 3.06, SD = 1.53). The overall mean (M = 2.29, SD = 0.93) was towards the lower end of the scale and indicated that respondents thought that few other people in the UK had previously heard the story.

Paranormal Belief and Prior Exposure to Urban Legends

The association between belief in the paranormal and previously hearing urban legends was analysed using a series of point-biserial correlations. A separate correlation was performed for each urban legend. Only the correlation between level of paranormal belief and previously hearing the airplane story was found to be significant (see Table 3). A negative correlation was observed, indicating that individuals with high levels of paranormal belief were less likely to report having previously heard the airplane story.

Table 3. Percentage of paranormal believers (vs. non believers) who report previously hearing the urban legend

	Previously Heard			
	Yes	No	*r*	*p*
Kidney	18	82	0.03	> .05
Cactus	13	87	-0.05	> .05
Cookie	12	88	0.06	> .05
Airbag	4	96	-0.06	> .05
Airplane	16	84	-0.21	= .004
Ricin	5	95	-0.04	> .05
Sandstorm	1	99	0.04	> .05

Reality testing, paranormal belief and urban legend truthfulness

A series of Pearson product-moment correlations were performed between: the IPO-RT; the R-PBS, overall and two factors scores (NAP and TPB); and mean truthfulness ratings for each urban legend (see Table 4).

Table 4. Correlations for reality testing, paranormal belief and truthfulness ratings for urban legend endorsement

	1	2	3	4	5	6	7	8	9	10	11
1 IPO-RT											
2 R-PBS	.43**										
3 NAP	.40**	.89**									
4 TPB	.40**	.86**	.74**								
5 Kidney	.35**	.21**	.25**	.14*							
6 Cactus	.20**	.16*	.17*	.12	.32**						
7 Cookie	.17*	.20**	.17*	.15*	.26**	.47**					
8 Airbag	.18*	.12	.13	.11	.40**	.41**	.49**				
9 Airplane	.20**	.19**	.19**	.21**	.27**	.27**	.40**	.36**			
10 Ricin	.17*	.23**	.26**	.24**	.33**	.28**	.36**	.50**	.43**		
11 Sandstorm	.25**	.24**	.21**	.24**	.40**	.25**	.52**	.44**	.37**	.52**	

* $p < .05$; ** $p < .01$ (all probabilities one-tailed).

Whilst some variation was evident within the correlation matrix investigation revealed a clear pattern of results. Firstly, IPO-RT reality testing scale scores were found to positively correlate with the truthfulness ratings of each urban legend. Secondly, a similar result was found for R-PBS scores (overall and two factor), level of paranormal belief positively correlated with urban legend truthfulness ratings, with the exception of the airbag story. Finally, despite failing to correlate with level of paranormal belief the airbag truthfulness ratings was positively correlated with the truthfulness ratings of other urban legends. These results indicate that the truthfulness ratings of urban legends are related to reality testing scores and level of paranormal belief.

Reality testing, paranormal belief and urban legends attributes

A further series of Pearson product-moment correlations were performed between: the IPO-RT; R-PBS, overall scores and two factors scores (NAP and TPB); and the mean of each urban legend attribute (retelling, truth, likelihood, importance, scariness, strangeness and heard by others) (see Table 5).

Table 5. Correlations for reality testing, belief in the paranormal and urban legend endorsement

	1	2	3	4	5	6	7	8	9	10	11
1 IPO-RT											
2 R-PBS	.43**										
3 NAP	.40**	.89**									
4 TPB	.40**	.86**	.74**								
5 Retelling	.31**	.21**	.18*	.24**							
6 Truthfulness	.32**	.28**	.29**	.25**	.72**						
7 Likelihood	.30**	.22**	.18*	.23**	.55**	.54**					
8 Importance	.30**	.25**	.23**	.27**	.77**	.70**	.67**				
9 Scariness	.27**	.20**	.20**	.21**	.61**	.62**	.45**	.61**			
10 Unusualness	-.09	-.23**	-.19**	-.30**	-.08	-.14*	-.21**	-.15*	.04		
11 Heard (UK)	.23**	.26**	.25**	.22**	.28**	.22**	.41**	.28**	.11	-.16*	

* $p < .05$; ** $p < .01$ (all probabilities one-tailed).

IPO-RT and R-PBS were positively correlated with ratings for truthfulness, retelling likelihood, importance, scariness and heard by others. Negative correlations were observed between the unusualness rating and belief in the paranormal (overall, NAP and TPB); high paranormal belief scores were associated with lower ratings of unusualness. No correlation was found between the unusualness rating and IPO-RT. Overall, with the exception of unusualness, these results indicate that higher scores on the IPO-RT and R-PBS are associated with higher ratings on each of the urban legend attributes. Similarly, with the exception of unusualness, urban legend attributes were found to be positively correlated with each other; scores on one attribute were related to scores on another.

Paranormal belief factors and reality testing

The relationship between the R-PBS paranormal factors (NAP and TPB) and IPO-RT was explored using partial correlation. A significant positive correlation was found between NAP and RT controlling for TPB; r = .17, df = 152, p = .021 (one tailed). A similar significant positive correlation was found between TPB and RT controlling for NAP; r =.17, df = 152, p = .020 (one tailed). Both paranormal factors were similarly related to IPO-RT.

Multiple regression and path analysis

Prior to performing multiple regression and path analysis positive correlations were found between: the R-PBS (IV1; independent variable 1) and the dependent variable (DV; truthfulness of urban legends), r = .28, df = 155, p < .001; the R-PBS (IV1) and IPO-RT (IV2; independent variable 2), r = .43, df = 155, p < .001; and IPO-RT (IV2) and the DV (truthfulness of urban legends), r = .32, df = 155, p < .001.

Next a multiple regression using forward selection was performed. Forward selection enters the predictor variables into the model one at a time in an order determined by the strength of relationship between predictor and criterion. The selection method was used in the current study because it was predicted that IPO-RT would be more strongly correlated with mean urban legend truthfulness ratings. The forward method also enables the additive effect of subsequent variables to be identified. Before multiple regression was conducted multicollinearity was assessed using the variance inflation factor (VIF) (Mansfield & Helms, 1982). The observed VIF value (1.23) (IPO-RT – R-PBS) was within recommended tolerance; severe multicollinearity exists if a VIF is larger than 5 (Yang, 2007).

The significant predictors from each regression model are shown in Table 6.

Table 6. Factors predicting truthfulness ratings

		R^2	B	B (SE)	β	t	p
Step 1							
	Constant		-1.13	.977			
	IPO-RT	.094	2.69	0.65	0.32	4.13	< .001
Step 2							
	Constant		-0.44	1.02			
	IPO-RT	.114	2.05	.715	.242	2.88	= .005
	R-PBS		.006	.003	.175	.079	= .039

IPO-RT was a significant predictor of truthfulness ratings, $F_{(1, 153)} = 17.05$, $p < .001$, explaining 9% of the variance. Adding R-PBS scores to the model, $F_{(2, 153)} = 10.87$, $p < .001$, accounted for additional variance; the amount of explained variance increased to 11%, R^2 change = .03, $F_{(1, 152)}$ Change = 4.32, $p = .039$.

Examination of the partial correlations between truthfulness ratings and IPO-RT (controlling for paranormal belief), $r = .23$, $df = 152$, $p = .001$; and truthfulness ratings and R-PBS (controlling for reality testing), $r = .17$, $df = 152$, $p = .01$, produced the expected pattern of results. The relationship between belief in the paranormal and endorsement of urban legend veracity declines when reality testing is controlled (see figure 1 for path analysis diagram).

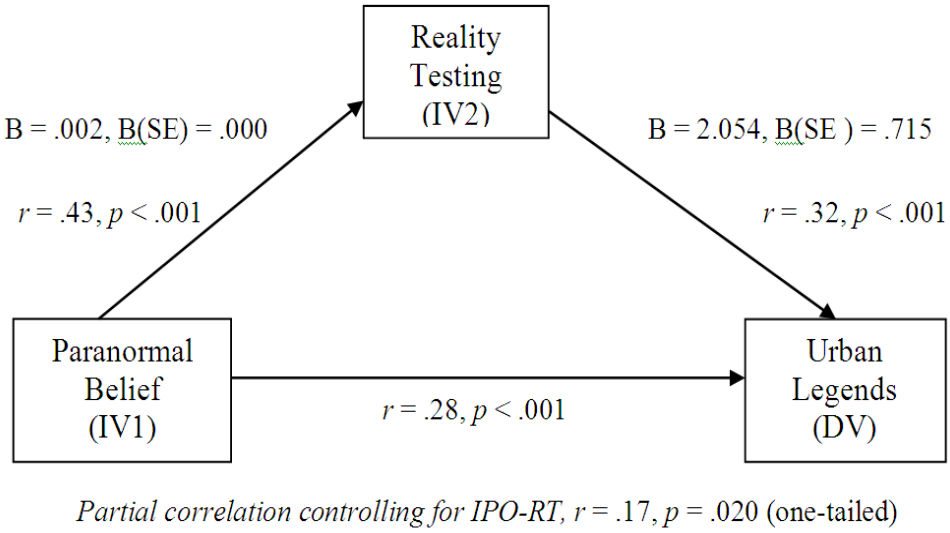

Figure 1. Path Analysis Diagram
(Key: B = Unstandardised Coefficient, B(SE) = Standard Error of B, *r* = Correlation Coefficient.)

Discussion

It was predicted that urban legend truthfulness ratings (individual and overall) would be positively correlated with reality testing scores and belief in the paranormal. It was also expected that other urban legend attributes (retelling, likelihood, importance, scariness, unusualness and heard UK) would be associated with reality testing scores and belief in the paranormal. These hypotheses were supported for all attributes with the exception of unusualness. Unusualness was found to be negatively correlated with belief in the paranormal (overall; New Age Philosophy, NAP; and Traditional Paranormal belief, TPB), but not with reality testing; only higher paranormal scores were associated with lower unusualness ratings. This may be because the stories were inherently 'strange' and therefore less likely to be affected by level of reality testing (M = 5.03, SD = 1.47; on a seven point scale). It is worth noting that the unusualness dimension produced less reliable 'inter-attribute' correlations; weak relationships were found with truthfulness, likelihood, importance and heard (UK), and unusualness failed to correlate with retelling and scariness. The reason for this difference merits further research.

As hypothesised, controlling for reality testing reduced the size of the relationship between truthfulness ratings and paranormal belief. This finding supports Irwin (2004, 2009), who proposed that reality testing deficits were fundamentally involved in the formation of paranormal beliefs (see also: Alcock, 1981, 1995; Goode, 2000; Irwin, 2004; Vyse, 1997; Zusne & Jones, 1982). With regard to interpretation of the truthfulness ratings caution is required because ratings were well below the scale mid-point (M = 2.89, SD = 1.03). This indicates that respondents did not generally consider the urban legends to be true. Thus, in the current paper reality testing scores were related to truthfulness ratings to the extent that respondents reporting higher levels of reality testing deficits were rating the truthfulness of the urban legends higher.

If we extrapolate Irwin's (2003a, 2004) postulations about the formation and maintenance of paranormal beliefs to the present study this may be because respondents scoring higher on reality testing deficits are less certain that the stories are untrue. To test this assertion an additional t-test was conducted upon truthfulness ratings for respondents scoring below (vs. above) the RPO-IT median. This, as expected, revealed that respondents scoring above the median (M = 3.20, SD = 1.10) rated the truthfulness of the urban legends higher than respondents scoring below the median (M = 2.65, SD = 0.96), t = -3.45, df = 153, p < .001, Cohen's d = .56 (medium effect size). This may be because respondents scoring higher on reality testing deficits were not subjecting the stories to the same degree of critical testing as those scoring lower (Irwin, 2003a, 2004). This notion is supported by Irwin and Young (2002), who argue that people with an intuitive-experiential processing style form conclusions on the basis of their innate appeal rather than rational, systematic analysis.

In the present study reality testing scores were found to be similarly related to both factors of paranormal belief (NAP and TPB). This finding is consistent with that of Irwin (2004), who reported that reality testing deficits predicted both dimensions of paranormal belief. Interestingly, partial correlation controlling for overlap between the two factors, revealed only small positive correlations between NAP

and reality testing, and TPB and reality testing (Cohen, 1988, 1992). This suggests that whilst reality testing may play an important role in the formation and maintenance of paranormal belief, other factors are also important. Indeed, reality testing explained only 18% of the variance in R-PBS scores leaving significant variance unaccounted for. This indicates that not all paranormal beliefs result from faulty reality testing and is consistent with Irwin's (2004) observation that paranormal beliefs can be generated in a number of ways. For this reason future research is required to identify, which paranormal beliefs are best predicted by reality testing deficits.

Finding factors which predict belief in the paranormal is difficult because there is no agreed definition of paranormality. Indeed, paranormal belief as measured by the R-PBS, encompasses many subjects, which vary in plausibility. This also applies to parapsychology more generally, where there are debates about which topics should be included. The consequence of this lack of theoretical agreement is that parapsychology incorporates a diverse range of topics, some of which have an established history of empirical study and are informed by scientific evidence (i.e., extrasensory perception and micro psychokinesis), whilst others have been less rigorously investigated (e.g., poltergeist activity and alien abduction), or are difficult to investigate scientifically (i.e., near death experience). This problem is exacerbated by the fact that beliefs are informed by myriad sources, which range in creditability from highly reliable (e.g., academic journal articles) to highly unreliable (the internet, media, anecdote, etc.). Thus not all paranormal beliefs can be tested and appraised in the same way, nor can they be explained by faulty reality testing; the failure to discriminate between subjective (intuitive-experiential processing) and objective (rationale-analytical processing).

The current paper examined urban legends because the authors considered they shared key characteristics with paranormal beliefs. This hypothesis was supported by the findings that urban legend truthfulness ratings were predicted by paranormal belief (and reality testing) and that endorsement of other attributes positively correlated with paranormal belief (and reality testing) scores. This relationship

may be explained by referring to Irwin's (2009) definition of paranormality. Like paranormal beliefs, urban legends are rarely subjected to scientific scrutiny, they are generated within the nonscientific community, and are extensively endorsed by people, who might normally be expected by their society to be capable of rational thought. In this context it is not particularly surprising that endorsement of urban legends is related to level of paranormal belief. Similarly, this may also apply to endorsement of similar phenomena such as, conspiracy theories (Douglas & Sutton, 2008; Sharp, 2008) and hoaxes. Research into factors effecting the endorsement of publicly shared/exchanged information is important because findings may extend to important mediums, such as news stories, public information (e.g., health campaigns) and government policies (e.g., global warming).

In summary, the paper adds to the growing body of literature exploring the relationship between reality testing and belief in the paranormal. The results demonstrate that belief in the paranormal is predicted by reality testing deficits and supports the work of Irwin (2003a; 2004). This study also suggests that reality testing deficits are associated with related beliefs, such as those supporting the veracity of urban legends. Further work is required in this area to determine which particular paranormal beliefs are generated by reality testing deficits and to ascertain whether the results generalise to other related beliefs (e.g., conspiracy theories).

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Appendices

Urban Legends for ULQ

1. Passage One ("Kidney")

A growing concern among international human rights organizations is the increasing problem that in countries throughout the world human organs are being taken from people without their consent and being sold on the black market. In some cases, the organs are taken from prisoners, or from very poor people and street children. In other cases people travelling alone are targeted.

The following warning was recently emailed to business travellers at major companies throughout the world:

Date: Monday, 3rd February 1997

Subject Travellers Beware!!

Dear Friends:

I wish to warn you about a new crime ring that is targeting business travellers. This ring is well organized, well funded, has very skilled personnel, and is currently in most major cities and recently very active in New Orleans. The crime begins when a business traveller goes to a lounge for a drink at the end of the working day. A person in the bar walks up as they sit alone and offers to buy them a drink. The last thing the traveller remembers until they wake up in a hotel room bath tub, their body submerged to their neck in ice, is sipping that drink. There is a note taped to the wall instructing them not to move and to call 911. A phone is on a small table next to the bathtub for them to call. The business traveller calls 911, who have become quite familiar with this crime. The 911 operator instructs the business traveller to very slowly and carefully reach behind them and feel if there is a tube protruding from their lower back. The business traveller finds the tube and answers, "Yes." The 911 operator tells them to remain still, having already sent paramedics to help. The operator knows that the business traveller's kidneys have been harvested. This is not a scam or out of a science fiction novel, it is real. It is documented and confirmable. If you travel or someone close to you travels, please be careful.

Regards

Jerry Mayfield Austin Ops Engineering Manager

Telephone: 512-433-6855 or Pager: 512-613-3710

2. Passage Two ("Cactus")

It is well known that some types of animals and insects live inside plants. For example, the corn earworm hatches from eggs laid in corn silk, and then lives inside the corn shuck eating the maturing corn kernels. The raspberry can maggot feeds downwards in the batches of "canes" of berry plants, causing a distinct drooping often referred to as "limberneck".

A particularly frightening example of the danger that can arise from insects that live in plants was recently reported. A woman in Scottsdale, Arizona, purchased a potted prickly-pear cactus from Orchard Supply and Hardware [a nursery]. The cactus has been imported from Mexico. She placed it near a south facing window in her living room. Several days later, the plant began to make a humming noise, almost inaudible at first, but gradually increasing in volume. As the humming got louder, the cactus began to move, and then began to vibrate. The woman became so frightened that she called, 911 [the emergency operator]. After hearing what was happening, the emergency operator urged the woman to take the plant outside immediately, and then to move a safe distance, keeping children or pets away from the plant. The woman followed the instructions, quickly carrying the vibrating cactus out to her front lawn, and then she retreated to the safety of her porch. Soon the fire department [emergency personnel] arrived dressed in thick protective clothing. But before they could gather up the plant, it split in two releasing hundreds of young, deadly tarantulas into the woman's yard.

3. Passage Three ("Cookie")

Trademarks, patents, and copyrights are big business, and many that we think are public property are not legally in the public domain. For example, the word Jell-O is trademark, and cannot be used for every gelatine dessert, even though many people would not know what to call the colourful concoction other than Jell-O. The song "Happy Birthday to You", which has become conventional to sing at birthdays, is also privately owned; if a television show or movie wants to use it in a scene, they have to pay the owner a fee.

Sometimes legal principles can conflict with common practice, as illustrated by [the following event] the following e-mail message currently being sent around the world:

From susanmk@goldfish.hyu.edu

Subject: Neiman-Marcus Secret Cookie Recipe

I am forwarding this message to you in the hopes that you will forward it to everyone you have an e-mail address for. Post as often as you like wherever you like. It is my attempt to achieve justice via the internet.

A month ago, I was having lunch at Neiman-Marcu, the ritzy departmental store [a gourmet shop]. I thought that the chocolate chip cookie served with lunch was equally good, so I asked the waiter if I could have the recipe. He frowned and said that he could not give the recipe away, so I asked if I could buy it. He smirked and said "Yes, for two-fifty". I said "OK, just add it to my tab."

This week [thirty days later] I got my VISA [credit card] statement and was shocked to see Neiman-Marcu chocolate chip recipe- $250. I called the Neiman-Marcu accounting department and explained that when the waiter said 'two-fifty' I had thought $2.50 not $250. I offered to return the recipe and have the bill reduced. The accountant told said she was sorry, but that recipes are expensive and that Neiman-Marcu [the gourmet shop] needed to protect its interests. The ease of reproduction meant that once the recipe was bought, it could not be refunded.

So I decided to get my $250 worth and some justice by sending out this recipe to everyone I know, and I hope you will forward it to everyone you know (to get revenge, the woman e-mailed the recipe and the story of the gourmet shop's treatment of her to everyone she knew, and asked each person to forward the message to as many people as possible], or print it out and give copies away.

Here it is:

1 cup butter	**2 cups flour**	**12oz. chocolate chips**
1 cup sugar	**1 cup oatmeal**	**1 cup chopped mixed nuts**
½ cup brown sugar	**½ tsp baking soda**	
3 eggs	**1 tsp baking powder**	
	1 tsp salt	

First Cream butter and sugar, then Beat in eggs. Combine dry ingredients and blend into batter by cupfuls. Mix in chocolate chips and nuts. Place one inch apart on cookie sheet and bake 350 degrees for 12 minutes; makes 60 cookies.

Enjoy!

Susan Klein

4. Passage Four ("Airbags")

Police officers coming to the aid of motorists locked out of their cars are dying in freak airbag accidents.

******SAFETY NOTICE******

One of the traditional services provided to the motoring public by Police Agencies and tow truck operators involves assisting those operators who unwittingly lock their keys inside their vehicles. Several types of devices are on the market which allow an officer, or tow truck operator, to unlock the vehicle by sliding a metal rod, commonly known as a "Slim Jim", between the door window and frame in order to access the control rods which unlock the door lock and handle. Once unlocked, the owner can enter the vehicle and retrieve the keys. Many devices have successfully been used for this purpose, including the well known coat hanger.

On Wednesday, December 3rd, the following Officer Safety notice was received at our Clifton Park, NY D&H District office via the New York State wide Police Information Network.

*****MOTOR VEHICLE ALERT*****

*****CAUTION*****

While attempting to gain entry to a vehicle with side impact airbags in a lockout, at least three Law Enforcement Officials have been killed using a Slim Jim Device. Inadvertent deployment of the airbag can cause the Slim Jim to be launched upward with great force. The force is strong enough to cause the device to penetrate the chin of the person attempting to access the vehicle, after which it can continue on to become lodged in the brain. Even when lockout assistance efforts do not prove to be deadly, the damage costs can be significant and may include thousands of dollars for replacement of the dashboard, which is designed to breakaway so as not to harm the driver or front passenger. The wiring for many of these side impact airbags is not shielded in any way, so a car opening tool can easily damage the wiring, causing malfunction or possible deployment of the airbag.

Employees who find themselves in a situation where they need to get into a locked vehicle should be aware of the possible danger of deployment of the airbags for their own safety as well as the safety of others.

5. Passage Five ("Airplane")

Tuesday January 22 8:58 AM ET

A plane passenger is giving bottom marks to an airline after getting sealed to a toilet seat. The woman passenger filed a complaint with Scandinavian Airlines System (SAS) after her ordeal on a Boeing 767 flight last year.

An American woman had no need to fasten her seatbelt on a flight from Scandinavia to the United States after a high-pressure vacuum flush sealed her to the toilet seat of the transatlantic airliner.

The passenger on the trans-Atlantic flight from Scandinavia (Olso) to New York was stuck to an airline toilet for more than two hours when flushing it created a vacuum that sealed her bottom to the seat. The American woman used the toilet, but pushed the flush button before standing up. To her horror, she realised that the powerful vacuum action had got her in its grip.

She "got sucked in after pushing the flush button while seated, activating a system to clean the toilet by vacuum" and "had to sit on the toilet until the flight had landed so that ground technicians could help her get loose". Her body was sealed to the seat so firmly that it took airport technicians to free her.

6. Passage Six ("Ricin")

Drug traffickers are hiding small amounts of the deadly toxin ricin in methamphetamine laboratories to kill law enforcement officers.

The Sacramento Regional Office of the Bureau of Narcotic Enforcement has offered this alert to all its personnel. The following alert has been confirmed and is being shared throughout the law enforcement and intelligence community. This alert advises that nationwide trend among drug traffickers is to "bait" law enforcement officers with a white powder called RICIN.

RICIN is a derivative of Castor beans and looks like powder methamphetamine. It is highly toxic and if it contacts human skin, it is fatal. The death process takes several days, depending upon the dosage, and is almost impossible to detect during an autopsy. Forensic experts advise that if you field test RICIN in the Scott Reagent Kit, it will foam and bubble extensively. The test will also produce a gas that is very similar to mustard gas and can also be lethal if inhaled. RICIN is 6,000 times more lethal than cyanide and there is no antidote. Symptoms of contact exposure to RICIN are: Fever, cough, weakness, and hypothermia, progressing to dangerously low blood pressure, heart failure and death. Due to this situation, in the event of suspect drug seizures, do not come into direct skin contact with any powdered substances, and exhibit caution of field testing any powdered substances.

We are forwarding this advisory to all California EMS Agencies and recommend that each agency contact the local hospitals in their area. We are unaware if RICIN can be detected on a toxicological exam. There is a potential for someone, other than law enforcement, to become contaminated with this substance.

7. Passage Seven ("Sandstorm")

Sandstorm in Iraq reveals location of thousands of mines to U.S. troops.

In March, 2003, Coalition forces closing in on Baghdad were halted by severe sand storms that reduced visibility to less than 50 feet at times and threatened the effectiveness of weapons. Troops also had to deal with mines in the sand and snipers all the way to the Iraqi capital.

Report from Marine Commander:

The order had come down at last. The ground invasion of Kuwait was about to commence. M Battalion would cross the Kuwaiti border as part of Operation Desert Storm. I was the second in command of 130 brave Marines who were about to face the most daunting challenge of their military lives. We'd already dodged heavy artillery fire and now we'd likely face more dangers, like land mines and oil fires. Thousands of Iraqi troops waited just beyond the Kuwaiti border. It was time for us to make the final strategic push.

Dear God, I prayed, help me to lead my troops wisely. Watch over us. Keep us safe. I walked from one group of Marines to another, talking to them about the mission and trying to keep their spirits up. Hunched against the dry, biting desert winds, we wrote letters home. Maybe our last. Just before dawn the next morning I gave the order to move out. The skies were clear. We slung our gear into our Humvees and began advancing toward the border. I felt a drop of rain, then another. In a matter of minutes it was pouring. The rain came down hard and fast, so thick we could barely make out the desert landscape ahead of us. It went on for days.

Each morning we'd awaken soaked to the bone after another night with only camouflage netting for cover. Bad enough we had the enemy to worry about. Now the elements were against us too. Father, please make this rain stop and protect us. The rain continued to pound us relentlessly until we finally neared the Kuwaiti border. There the battalion halted. On the other side, the enemy waited. Rain or no rain, we'd soon be going in. We awoke on the day of the invasion to clear skies and glorious sunshine. As we closed in on the border, we couldn't help but stare at the

astounding sight before us. The torrential rains had washed away the sand to reveal metal disks planted all across our path. It was an Iraqi minefield.

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A Parapsychological Perspective on a Recent Study of "Intuitions in the Workplace"

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Integrated Knowledge Systems

Abstract

A recent study by Lange and Houran (2010) found evidence that intuitions in the workplace are related to transliminal processes, but the validity of the sample's self-reported intuitions was not specifically addressed. Thus, we examined the correlation between self-reported intuitions and the propensity to exhibit emotional and cognitive biases in the previously collected dataset (n = 889). The misattribution hypothesis was not confirmed; in fact, intuitive experiences were associated (r = .38, p < .001) with a lack of confirmatory biases. The validity of intuitions is discussed in terms of transliminality deriving from enhanced neurological interconnectedness that consequently facilitates a confluence of unconscious information from tacit knowledge, pattern recognition and perhaps a "future orientation" that involves psi. Situational and motivational factors, akin to experimental effects in psi research, contribute to the process. Rasch scaling analyses found that transliminality and intuition form a continuum, with the highest levels of transliminality being associated with intuitions that are described as paralleling psychic ability.

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Introduction

"The only real valuable thing is intuition."

Albert Einstein

"Intuition comes very close to clairvoyance; it appears to be the extrasensory perception of reality."

Alexis Carrel

Shamans, mystics, psychics and *hysterics* — historically many cultures worldwide have shown special interest in individuals like these who have the ability to integrate or dissociate affect, imagery, ideation and perception (Kottack, 1987; Ember & Ember, 1988). Similarly, psychology has a long tradition of studying "mental boundaries" and the conditions under which such boundaries are permeable (for an overview, see Lange, Thalbourne, Houran & Storm, 2000). This subject interests researchers beyond the fields of parapsychology and transpersonal and abnormal psychologies. For example, cognitive and industrial-organizational psychologists actively study inexplicable knowings or realizations that sometimes occur in the context of managerial decision-making, as well as the related phenomenon of "entrepreneurial intuition" (e.g., Eisenhardt & Zbaracki, 1992; Parikh, Neubauer & Lank, 1994; Eisenhardt, 1999; Bradley, 2006; La Pira & Gillin, 2006). Popular culture refers to these experiences or states as "flashes of inspiration, genius or intuition." It might seem surprising that the analytical and rational mind of Albert Einstein would lend credence to intuitions, but there are a myriad of examples of intuition apparently playing a role in key discoveries in science and industry – including those of Einstein himself (see e.g., Conley, 2008). Then too is the phenomenon of multiple discovery (Koestler, 1970), whereby in the same time-frame different investigators developed the same idea. Familiar examples are the independent discovery of differential calculus by Newton and Leibnitz, and the independent development of the idea of natural selection by Wallace and Darwin (Reichenbach, 1959; Koestler, 1970).

Intuitive ability and its potential applications have been further popularized and legitimized in the popular press with publications like Malcolm Gladwell's (2005) bestseller, *Blink: the Power of Thinking without Thinking*.

What is intuition?

Intuition essentially appears to be an unconscious confluence of affect, imagery, ideation and perception. For example, Langley, Mintzberg, Pitcher, Posada and Saint-Macary (1995) concluded that decision-making processes are partially driven by emotion, imagination and memories all collectively crystallized into occasional insights. Eisenhardt and Zbaracki (1992) echoed this view in their multidimensional approach to decision-making encompassing bounded rationality, heuristics, insight and intuition. Moreover, most researchers acknowledge that; (1) intuitive events originate beyond consciousness, (2) information is processed holistically, and (3) intuitive perceptions are frequently accompanied by emotion (Shapiro & Spence, 1997; Sinclair & Ashkanasy, 2005). Sinclair and Ashkanasy (2005) therefore defined intuition as *a non-sequential information processing mode, which comprises both cognitive and affective elements and results in direct knowing without any use of conscious reasoning* (*cf.* Simon, 1987; Epstein et al., 1996; Shapiro & Spence, 1997).

This definition does not explicitly identify the source of the cognitive and affective contents of intuitions, and indeed there are two competing views on this issue (Shirley & Langan-Fox, 1996; Boucouvalas, 1997). One view defines intuition as an *experience-based phenomenon* that draws on tacit knowledge accumulated through experience and retrieved through pattern recognition (e.g., Isenberg, 1984; Simon, 1987; Behling & Eckel, 1991; Brockman & Anthony, 1998; Klein, 1998). The second view is that these experiences follow from a more spontaneous, natural *psychophysiological ability* that rely heavily on sensory and affective elements in the intuitive process (e.g., Bastick, 1982; Parikh et al., 1994; Epstein, 1998; Petitmengin-Peugeot, 1999).

Sinclair and Ashkanasy (2005) proposed a general model that incorporates both mechanisms simultaneously.

It is important to note that intuitive thinking often occurs in situations of significant ambiguity or uncertainty (Isenberg, 1984; Burke & Miller, 1999) — such as situations where problems are poorly structured (Behling & Eckel, 1991) or involve non-routine decisions (Simon, 1960), where problems do not have existing precedents (Parikh et al., 1994) or when an individual is faced with conflicting facts or inadequate information (Agor, 1984). Other contributing factors include motivational issues like the perceived importance of the decision (Goodman, 1993) and its potential impact on the decision-maker (Kriger & Barnes, 1992). Interestingly, intuitive thinking strongly resembles magical thinking and paranormal belief and experience as these phenomena also thrive during situations of marked ambiguity or uncertainty (e.g., Irwin, 1992; Lange & Houran, 1998, 1999, 2000; Houran, Irwin & Lange, 2001). Moreover, the situational and motivational factors associated with intuitions arguably parallel the well-known experimenter effects documented in the parapsychological literature (see e.g., Schmeidler, 1997; Watt & Wiseman, 2002; Storm & Thalbourne, 2005).

Transliminality and intuitions

We recently examined the idea that intuition is inherently a transliminal phenomenon. *Transliminality* is a perceptual-personality variable that reflects the tendency for psychological material to cross (*trans*) thresholds (*limines*) into and out of consciousness. Reviews show that, in addition to paranormal belief and sometimes self-report and laboratory-based paranormal experience (Thalbourne & Houran, 2003; Houran & Lange, 2009), the major correlates of transliminality are syncretic cognitions (Lange et al., 2000; Houran et al., 2006) – i.e., the fusion of perceptual qualities in subjective experience such as: *physiognomic perception* (the fusion of perception and feeling); *synesthesia* (the fusion of sensory modalities) and *eidetic imagery* (the fusion of imagery and perception). Accordingly, transliminality is

conceptualized as enhanced interconnectedness between brain hemispheres, as well as among frontal cortical loops, temporal-limbic structures and primary or secondary sensory areas or sensory association cortices (Thalbourne, Houran, Alias, & Brugger, 2001; Thalbourne, Crawley & Houran, 2003; Houran, Hughes, Thalbourne & Delin, 2006). Studies of perception, imagery and memory all provide evidence for a threshold that mediates unconscious-conscious awareness, and findings from several experiments are consistent with the neurological interconnectedness model of transliminality in particular (Crawley, French & Yesson, 2002; Houran et al., 2006; Fleck et al., 2008).

There are compelling reasons to hypothesize that business leaders or visionaries who have "flashes of genius" or strong intuitions about key decisions or discoveries are examples of transliminality manifesting in professional or occupational contexts. First, the phenomenology of intuitions summarized above agrees with the neurological interconnectedness model of transliminality and suggests that intuition is either caused or moderated by transliminality. Second, and consistent with neurological interconnectedness model, there is preliminary experimental evidence that intuitive processes involve interactions among the frontal, temporal, occipital and parietal brain areas, and perhaps even the cardiovascular system (McCraty et al., 2004a, 2004b). Finally, Lange and Houran (2010) recently found a moderately high correlation (r = .38, p < .001) between scores on transliminality and scores on a measure of self-reported intuitions in the workplace in a sample of individuals at different management levels. However, self-reported intuitions increased with higher management level, independently of transliminality. These findings are consistent with a two-mechanism of intuition (*cf.* Sinclair & Ashkanasy, 2005) whereby transliminality equates to intuitive predisposition which is subsequently honed or reinforced over time by tacit knowledge that comes from work experience or structured training. In other words, intuitive ability might build upon transliminality, but it then goes beyond it somehow.

We suggest that greater neurological interconnectedness (Thalbourne et al., 2001, 2003; Houran et al., 2006) leads to more frequent, vivid and perhaps accurate intuitions. Further, we expect that intuitions will be most robust when highly transliminal individuals have considerable tacit knowledge that has been accumulated through experience and retrieved through pattern recognition and at the same time are in situations conducive for intuitive thinking — namely during situations where the outcome has strong personal relevance to the intuitive decision-maker and the situation is inherently ambiguous such as with non-routine decisions or ill-defined problems without existing precedents.

A potential Psi factor?

Intuitions as a transliminal and syncretic process that involve past and present stimuli may not be the whole story. For instance, the findings of McCraty et al. (2004a, 2004b) give credence to the notion that intuitive processes involve interactions among the frontal, temporal, occipital and parietal brain areas, and perhaps even the cardiovascular system, yet these authors also reported evidence that experimental subjects show physiological responses to affective stimuli before such stimuli are even administered. Other studies with rigorous experimental protocols have similarly found that the human body often responds to a future, emotionally-arousing stimulus several seconds prior to experiencing the stimulus (e.g., Bierman & Radin, 1997; Radin, 1997; Bierman, 2000; Spottiswoode & May, 2003).

Of course, this leads to a major limitation in all self-report studies of intuitions, specifically the issue of the ontological validity of the content of the respondents' intuitions. We attempted to address this issue to some extent in the wording of some of the questionnaire items that defined the Business Intuitions Inventory (BII: Lange & Houran, 2010). Confounds like emotional or cognitive biases, i.e., misattributions, can create illusions of "accurate intuitions" similar to the psychological mechanisms that can produce illusions of déjà vu or extrasensory perception (see e.g., Brown, 2004). On the other hand, the

growing body of empirical evidence consistent with the psi hypothesis (Irwin & Watt, 2007) and specifically presentiment also means that consistently accurate intuitions could partly or fully involve psi (*cf.* McCraty et al., 2004a, 2004b). Our methodology did not allow us to test the latter notion, but we were able to address the former to some extent. This paper therefore presents the results of analyses not reported in-depth in Lange and Houran (2010).

In particular, the Intuitive Decision Making Profile (Andrews, 1999) includes two sub-factors that measure the extent to which Emotional Biases and Cognitive Biases influence an individual's decision-making. High scores on Emotional Biases indicate an attitude of openness to intuitive thinking and feeling, and high scores on Cognitive Biases indicate an attitude that reflects one's resistance to self-fulfilling prophecies or confirmatory information processing. The misattribution hypothesis would predict that self-reported intuitions in the workplace will correlate positively with scores on Emotional Biases and Cognitive Biases.

Method

The Lange and Houran (2010) study was designed to test the relationships among Transliminality, an Intuitive Decision-Making Style and Self-Reported Intuitions in the workplace.

Participants

Data were collected from members of a large and free social networking website. Invitations were sent randomly by the website administration to 1300 members' email inboxes. No incentives were offered and participation was voluntary. The instructions described participation as part of a larger study on intuitions, belief systems and the permeability of mental boundaries. The final sample (n = 889) consisted of 507 men and 382 women (*Mean age* = 33.4 years, *SD* = 29.2, range = 17 – 73 years) who came primarily from English speaking countries (USA = 492, UK = 124, Canada = 219, other = 54).

Respondents' were also asked about their employment and the management level of their jobs. The breakdown was: "Currently not Employed as a Manager" (control group) (n = 543), "Entry/Line Level" (n = 74), "Middle Management" (n = 167) and "Senior Level Executive/Company Officer" (n = 105).

Materials

In addition to the demographic information, respondents completed three questionnaires in the order below:

The Revised Transliminality Scale (RTS: Lange, Thalbourne et al., 2000, *cf.* Houran, Thalbourne & Lange, 2003): This is a Rasch scaled version of Thalbourne's (1998) original 29-item, true/false scale (Form B). Twelve items from the original scale are excluded from the scoring of the test due to age and gender biases. However, the remaining seventeen test items constitute a unidimensional Rasch (1960/1980) scale. These 17-test items share a common underlying dimension and span seven domains: hyperesthesia, (fleeting) hypomanic or manic experience, fantasy-proneness, absorption, positive (and perhaps obsessional) attitude towards dream interpretation, mystical experience and magical thinking. The Rasch reliability of the RTS is .82 (Lange et al., 2000). Also, Thalbourne (2000) found the 29-item scale to have a test-retest reliability of .88 (p < .001) over seven weeks, and further analysis (Houran et al., 2003) on this same data set showed that the 17-item RTS has a test-retest reliability of .82 (p < .001).

Intuitive Decision Making Profile (IDMP: Andrews, 1999): This is a 40-item questionnaire using a five-point Likert scale (anchored by "To a Very Great Extent" and "To a Very Small Extent") that addresses three proposed factors (and eight sub-factors) of an intuitive processing mode: *Resources and Readiness* ("knowing with precedence": three subscales of Knowledge and Experience, Reflection, and Stress and Time Management Techniques), *Overcoming Blocks to Accessing Resources* ("psychological biases": three subscales of Emotional Biases,

Cognitive Biases and Stress/Time Pressures) and *Practicing Intuitive Decision Making* ("pattern recognition": two subscales of Recognizing patterns and Recognizing Physical Cues). Andrews (1999, p. 31) provided a brief description of the technical development of this questionnaire and a table of preliminary normative data. In our sample the Rasch reliabilities (see Wright & Masters, 1982) for the three factors listed above were 0.87, 0.59 and 0.50, respectively (ignoring item misfit).

Business Intuitions Inventory (BII): This is a 17-item questionnaire on self-reported experiences of intuitions in workplace settings. Questions were designed by a panel consisting of social and industrial-organizational psychologists and employees at entry, mid-management and senior levels who claimed to have had frequent and accurate intuitions in their careers. The question set aimed to cover content related to the phenomenology of intuitions identified by Sinclair and Ashkanasy (2005). The response format was a four-point Likert Scale anchored by "Disagree Completely" and "Agree Completely." Table 2 presents the questionnaire items, which show no statistically significant response biases for age, gender or management level and have a Rasch reliability of 0.83.

Results

Main Findings

We refer interested readers to the main paper (Lange & Houran, 2010) for a report and discussion of the main results. To quickly summarize, the self-reported intuitions significantly correlated with an Intuitive Decision-Making Style and Transliminality (see Table 1). Gender was not confirmed as a consistent predictor of intuitions. Further, self-reported intuitions increased with higher management level, independently of transliminality. The findings were consistent with a two-mechanism of intuition whereby transliminality equates to intuitive predisposition which is subsequently honed or reinforced

over time by tacit knowledge that comes from work experience or structured training.

Table 1. Pearson correlations (and significance levels) between scores on transliminality, intuitive decision-making style and self-reported intuitions in the workplace.

	Intuitive Decision-Making Profile: Emotional Biases sub-factor	*Intuitive Decision-Making Profile*: Cognitive Biases sub-factor
Revised Transliminality Scale (RTS)	.05 (ns)	.06 (.06)
Business Intuitions Inventory (BII)	.02 (ns)	.33 (.001)

Rasch scaling

We conducted *post-hoc* Rasch scaling analyses (Rasch 1960/1980) for this paper to examine the extent to which intuitive and transliminal experiences overlap in a psychometric sense. By way of explanation, Rasch scaling is considered the gold standard approach to measurement in that it simultaneously measures items and respondents, and it does so in a common metric (called logits; progressively higher logit values correspond to higher traits levels) and at an interval-level of measurement (Bond & Fox, 2007). We found that the two questionnaires scaled together (see Appendix), which indicates that transliminality and intuition are phenomena that form a common factor or dimension. This finding offers strong psychometric support for Lange and Houran's (2010) contention that intuitions can be modeled, at least partly, as expressions of transliminality.

The Appendix also shows how the qualitative experience of intuitions varies by level of transliminality (low, medium, high). As witnessed by the high correlation between items' locations (r = .85, p < .001), the transliminality Rasch hierarchy obtained in the present sample replicated the transliminality hierarchy reported in Lange et al. (2000). It can be seen that low levels of transliminality are characterized

by basic physiological arousal such as experiences of racing thoughts and psychological absorption. This range of transliminality is associated with general intuitive feelings, but these intuitions take on more relevance as the level of transliminality increases to the medium range. Medium transliminality involves more physical manifestations and this seems to correspond to intuitions that are perceived as particularly potent or accurate during times of psychological pressure or stress. This might mean that increased physiological arousal enhances intuitive ability, which would explain why managers are more likely to notice and especially to rely on intuitions during periods of uncertainty, ambiguity and conflict (Simon, 1960; Agor, 1984; Isenberg, 1984; Behling & Eckel, 1991; Parikh et al., 1994; Burke & Miller, 1999). Finally, the highest levels of transliminality produce the most anomalous form of intuitions — the type perhaps alluded to in Alexis Carrel's introductory quote. Here the character and accuracy of the intuitions are equated with putative psychic ability.

Discussion

The quantitative and qualitative results presented here are consistent with the hypothesis that intuitions in the workplace are transliminal in nature and that a neurological interconnectedness model is a parsimonious explanation for an individual's intuitive predisposition — a predisposition that seems to be bolstered by state and trait variables very similar to experimenter and milieu effects documented in psi studies. Further, the qualitative themes in the psychometric transliminality-intuition continuum nicely corroborate previous empirical work that shows a positive correlation between transliminality and paranormal belief and ostensible experience (see Thalbourne & Houran, 2003). It also implies that the highest levels of transliminality might promote intuitive thinking to the point whereby the confluence of affect, imagery, ideation and perception also includes psi.

Drawing on the provocative experimental work and conclusions of McCraty et al. (2004a, 2004b) and other prestimulus effect researchers,

it may be that the holistic model of intuitions proposed by Sinclair and Ashkanasy (2005) should take into account more than just tacit knowledge and pattern recognition and natural intuitive predisposition. These variables arguably are grounded in a past and present "focus," respectively. The most vivid and accurate intuitions may also involve a "focus" on the future, and this is where psi would play a role. McCraty et al. (2004b, p. 333) regard the term intuition as an updated synonym for the traditional concepts of precognition or presentiment. But whereas precognition and presentiment imply a conscious knowing, current models of intuition, including Sinclair and Ashkanasy (2005) and McCraty et al. (2004a, 2004b), make no such requirement. Thus transliminality could be the primary mechanism by which conventional stimuli and psi stimuli are collectively gathered, synthesized and processed into an eventual conscious awareness. Situational and motivational factors, including tacit knowledge and pattern recognition, may then simply help to fill the available "pool "of cognitive and affective stimuli, as well as to prioritize or to filter such stimuli.

It might prove beneficial to screen and select subjects for psi experiments (e.g., Bierman & Radin, 1997; Radin, 1997; Bierman, 2000; Spottiswoode & May, 2003) and psychophysiological studies of intuition (e.g., McCraty et al., 2004a, 2004b) based on questionnaire levels of transliminality and self-reported intuitions in tandem. It can be argued that more popular questionnaires of thin boundary functioning might be more useful for this purpose. Concurrent validity studies and alternative approaches are always welcome, but it should be emphasized that the Revised Transliminality Scale is not merely a "hodgepodge" of previously established scales. Rather, the development and validation of the RTS (e.g., Lange, Thalbourne et al., 2000) revealed that previous measures of anomalous or aberrant feelings and cognitions were redundant and could be subsumed within the higher order factor of thin boundary functioning.

Moreover, the RTS strongly correlates with scores on other thin-boundary measures like Hartmann's Boundary Questionnaire and the O-LIFE (Houran, Thalbourne & Hartmann, 2003; Thalbourne &

Maltby, 2008), but unlike these instruments the RTS has superior psychometric quality based in Item Response Theory and scores are significantly related to performance on psychophysical threshold tasks using visual and vibro-tactile stimuli (Crawley et al., 2002; Houran et al., 2006). Thus, there are strong arguments for using the RTS in future research on transliminality and intuition. High scorers on both the RTS and the Business Intuitions Inventory would suggest both a strong intuitive predisposition and the presence of critical situational and motivational factors that lead to a future focus – and hence an inherent inclination to "scan the future" for information to complement one's current tacit knowledge and pattern recognition abilities. We are actively testing this idea ourselves and will report on the findings in a future paper.

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Appendix

Table showing the Rasch hierarchy of the transliminality-intuition continuum (lower logits indicate higher endorsement and lover trait levels)

Rasch hierarchy	Rasch *Logit* Value
Low Transliminality Range	
Intuitions in the Workplace (BII): Those who know my work best would say that my gut feelings about work decisions are extremely accurate.	-1.36
Transliminality (RTS): While listening to my favorite music, in addition to feeling calm, relaxed, happy, etc., I often have a feeling of oneness with the music, or of being in another place or time, or vividly remembering the past	-1.31
Transliminality (RTS): My thoughts have sometimes come so quickly that I couldn't write them all down fast enough	-1.21
Intuitions in the Workplace (BII): People at work often come to me for personal advice because they regard me as very perceptive or wise.	-1.21
Intuitions in the Workplace (BII): In general, my decisions at work are much more affected by industry experience and lessons learned than by the results of formal research and systematic evaluation of alternatives.	-1.08
Transliminality (RTS): I can clearly feel in my imagination such things as the feeling of a gentle breeze, warm sand under bare feet, the softness of fur, cool grass, the warmth of the sun and the smell of freshly cut grass	-0.74
Intuitions in the Workplace (BII): More often than not, effective solutions to important work problems spontaneously flash into my mind.	-0.74
Transliminality (RTS): A person should try to understand their dreams and be guided by or take warnings from them	-0.72
Intuitions in the Workplace (BII): I am extremely accurate when making important decisions at work	-0.58

even when I do not have all the hard facts or data at the time.	
Transliminality (RTS): I have gone through times when smells seemed stronger and more overwhelming than usual	-0.55
Medium Transliminality Range	
Transliminality (RTS): A the present time, I am very good at make-believe and imagining	-0.49
Intuitions in the Workplace (BII): I usually know the right decision at work before anyone decides what to do.	-0.49
Intuitions in the Workplace (BII): My gut decisions at work are almost accurate when I am under pressure.	-0.42
Intuitions in the Workplace (BII): I take important risks at work when my gut instinct or intuition tells me to.	-0.32
Intuitions in the Workplace (BII): Typically I do not know where my best work ideas come from -- they just come to me.	-0.26
Intuitions in the Workplace (BII): I seem to know what customers or clients want before they even do.	-0.25
Intuitions in the Workplace (BII): My unpopular opinions about important business strategies almost always turn out to be correct.	-0.14
Intuitions in the Workplace (BII): My best ideas or decisions usually happen when I am under significant pressure at work.	-0.06
Transliminality (RTS): I have sometimes sensed an evil presence around me, although I could not see it.	0.01
Intuitions in the Workplace (BII): The best ideas I come up with at work tend to come to me as intense or vivid thoughts, feelings or images.	0.05
Intuitions in the Workplace (BII): My best ideas or decisions usually come in the middle of a work crisis.	0.06
Intuitions in the Workplace (BII): I am surprised at how often I get flashes of genius when it comes to my work.	0.09
Transliminality (RTS): It is sometimes possible for	

me to be completely immersed in nature or in art and to feel as if my whole state of consciousness has somehow temporarily been altered.	0.23
Transliminality (RTS): Often I have a day when indoor lights seem so bright that they bother my eyes.	0.24
High Transliminality Range	
Transliminality (RTS): I think that I really know what some people mean when they talk about mystical experiences	0.37
Intuitions in the Workplace (BII): Sometimes I feel that have the uncanny ability to predict or know the future when it comes to important work decisions.	0.6
Intuitions in the Workplace (BII): Subordinates, peers or supervisors have joked or commented that I must have psychic ability, because I tend to know exactly the right thing to do at work.	0.65
Transliminality (RTS): I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me	0.67
Transliminality (RTS): I have experienced an altered state of consciousness in which I felt that I became cosmically enlightened	0.78
Transliminality (RTS): At times I perform certain rituals to ward off negative influences	0.82
Transliminality (RTS): I have experienced an altered state of consciousness which I believe utterly transformed (in a positive manner) the way I looked at myself	0.83
Transliminality (RTS): I have felt that I had received special wisdom, to be communicated to the rest of humanity	1.14
Transliminality (RTS): When listening to organ music or other powerful music, I sometimes feel as if I am being lifted up into the air	1.33
Transliminality (RTS): For several days at a time I have had such a heightened awareness of sights and sounds that I cannot shut them out	1.5

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Research Brief: The Effect of Priming of the Film Clips Prior to Ganzfeld Mentation

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Abstract

The report here concerns an attempt to subliminally prime film clips with participants prior to their ganzfeld sessions. In total, 64 trails (32 traditional psi ganzfeld trials and 32 comparison trials with primed targets) were conducted with receiver-sender pairs taking part in a digital real time ganzfeld. Prior to the session, the receiver-sender pairs viewed thematic material from all four potential film clips presented at 40 milliseconds exposures. Although there was clear evidence from the results that the imagery from the clips later re-emerged as a major part of the ganzfeld imagery, this appeared to concern the non-target clips more than as the target material. First place rankings on the target clips gave only 13.7% hits (MCE 25%) and it may well be that the methodology overloaded the participants with dynamic material to work through in the mentation.

Introduction

In his introduction to *The New Unconscious,* a book which benchmarks the progress of experimental research in this area, James Uleman writes: "Over the past decade or two, a new picture of unconscious processes has emerged from a variety of disciplines that

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are broadly part of cognitive science. Unconscious processes seem capable of doing many things that were, not so long ago, thought of as requiring mental resources and conscious processes." (Ulleman, 2005: p. 3). Although the formulation "perception without awareness" is sometimes preferred (Greenwald, 1992) to that of subliminal perception, it would seem that the area has following decades of controversy, finally gained acceptance. Since the progress that been made in this area has been attributed to multidisciplinary research (Hassin, Uleman,& Bargh, 2004), this provides also an opportunity for parapsychological research to contribute its findings to this new and growing knowledge base.

From the early days of psychical research onwards, there has been evidence that psi is largely an unconscious process. J. B. Rhine and his co-workers concluded in their monograph *Extrasensory Perception After Sixty Years* that the experimental studies of ESP and confidence calls indicated that psi is entirely an unconscious process (Rhine et al, 1940: chapter XIV). This was not say that are not the psi conducive conditions that are regarded as a means of influencing its conscious manifestation (Rhine, 1948). Some of the later work on psi and perception without awareness has been reviewed by Stuart Wilson (2002): Wilson notes that the methodology used in cognitive psychology, of influencing recognition memory of subliminal images, can be applied in parapsychology and it is this principle which underlies the present study to be reported.

Seen in a broader context, there are several somewhat convergent lines of contemporary research which lend conceptual validity to the idea of the unconscious mediation of psi. Attempts to make use of the Defence Mechanism Test (DMT) were based on the idea that a greater openness to subliminal stimuli would relate to greater openness to extrasensory signals. Indeed different measures of vigilance and defensiveness have been found to relate consistently to those of ESP scores (Watt, 1990). One complicating factor in evaluating this area of research is that many of the findings with the DMT may be due to an anomalous (possibly itself psi-based) experimenter effect and there appears to be a decline in the effect (see Haraldsson, Houtkooper,

Schneider, & Bäckström, 2002). Moreover the last study (Parker, 1993) which used Martin Johnson, the main proponent of the defense mechanism in parapsychology, in order to judge the defense mechanism records of participants, failed to replicate the earlier findings.

Another approach to the area concerns how primed emotionally loaded targets can influence choices or preferences at an unconscious level and that such influences can occur either proactively in the case of presentiment (Radin, 1997) or retroactively in the case of retroactive inhibition (Parker and Sjödén, 2010, Bem, 2010). This area provides conceptual support for the effectiveness of emotional target material in an ESP task being primed at an unconscious level.

From the point of view of gaining access to unconscious processes, the work with the Ganzfeld can be regarded as a means of facilitating such processes in forming the content of the altered state, although there is actually little empirical work on this. Since the findings with the ganzfeld continue to be promising (Storm, Tressoldi, & Di Risio, 2010) but primarily with selected participants, this was the methodology of choice here. Participating individuals were selected for their psychic belief and experiences. The target film clips were chosen because of their apparent emotional content and we wished to explore if these could be made more effective when they were primed prior to the ESP session in the participants' unconscious processes or so-called "perception without awareness".

There has been some discussion in the literature on priming of subliminal targets, if the ESP task should be an implicit one (in which the participant does not know about the psi task and the process would then be non intentional) or an explicit one. Previous work (Watt, 1993; Stuart, 2002) may be interpreted as indicating the implicit task is actually less likely to succeed. For this reason we chose to inform the participants about the nature of the task although they were not fully informed about as to why we were priming the target clips.

The aim here was to use the ganzfeld as a means of producing the potentially psi-conducive state in these individuals. The unique feature that occurred in the design here, is that the range of target film clip

material (standard to most modern ganzfeld designs) was first primed in the receivers, that is the potential targets were all presented close to the subliminal threshold prior to the ganzfeld period. The rationale is that if the material is already available or primed in unconscious processes, it maybe more accessible to psi.

In carrying out this procedure, we would also be experimentally studying if unconscious material can shape the content of the subsequent occurring altered state of consciousness. This is an assumed relationship which has been given much lip-service but for which there is actually a paucity of experimental studies showing it. In practice, the design of the study meant evaluating to what extent the film imagery, which had been subliminally presented to participants prior to the ganzfeld session, would later re-appear as part of the content of the ganzfeld imagery in the form of parts of the mentation report.

The technique we developed for this necessitates a priming session to be carried out prior to ganzfeld. Since two-minute film clips are the standard target material, we had to find means of presenting their essence at an exposure level close to or below conscious perception. Sets of representative thematic picture sequences were chosen for this purpose much in the same that modern previews of commercial films are often shown.

This procedure meant that during this priming session, the essential frames of the four film clips in the standard ganzfeld were presented at an exposure speed close to the threshold for conscious recognition. This is about 60 milliseconds, depending on the complexity of the exposed material used. Evidently, this recognition threshold will show much individual variation and be influenced by the variations in the complexity of the content of the film material. However, because of the limited resources available to us, we were unable to make individual assessments and we opted for a 'one size fits all' approach. This meant there would be some ambiguity over whether or not the material was truly subliminal and for this reason we prefer to use the term "sem-subliminal". A check was however preformed on the effectiveness of the procedure by asking participants

following each clip exposure, to draw what they saw. In nearly all cases at most very fragmented images were recalled.

Since this unique feature of the design in terms of priming, constitutes a major deviation from the standard ganzfeld (Storm et al , 2010), the study was not intended to be replication of the previous findings but was exploratory in design and purpose. Nevertheless it should be noted that one of the very first ganzfeld studies (Smith, Tremmel and Honorton, used a design in which the sender either viewed a target slide continuously for 10 minutes or else subliminally (tachistoscopically) for 1 millisecond and it was only the later aspect of the design that gave the significant findings. By contrast in the project to be described more fully below, the receiver and sender are both primed with the target material *prior* to the sending period.

Aside from the priming aspect, the experimental procedure here conformed to the digital real time ganzfeld test used in the Gothenburg laboratory. Pink noise was used as the source of the ganzfeld stimulation given to the participant in the role of the receiver. During this, the ganzfeld relaxation period, the sender was located in a separate room about 30 metres remote from the sender. The sender viewed at a normal exposure during this period one of the four film clips selected as the target by the randomisation program of the computerised set up. Full details of the procedure, the program, and the precautions against potential sources of error and deception have been detailed elsewhere (e. g., Parker, 2000; Goulding et al 2004).

In the Gothenburg set up, we have used a traditional receiver-sender psi or GESP methodology as the starting point. However, some recent findings (Roe, Sherwood and Holt, 2004) indicate that the sender may not be a necessary component but rather a psychologically advantageous one. The sender was retained here because of the expectancies of having a sender in an ESP experiment appear to be embedded in the population we are using.

One distinctive feature of the Gothenburg Ganzfeld is to use the real time digital recordings of the reported mentation images from the receiver. Another important feature of the procedure is that it enables

the use of a double session one of which can serve as a control comparison.

The control series can be enabled because the programming requires that the sender views successively *two* film clips rather than one. In effect this means there are then two trials per session and that each two-minute target film clip is shown 7 times giving a total viewing time of 14 minutes along with a two minute interval between the clips during the 30 minute ganzfeld period. This dual session had the advantage that it allowed us to use one set of films as the experimental set and the other as the control set.

For the study here, the experimental set in each session is defined as that belonging to the set previously subliminally presented and in this study it is the set which has been "primed". The control set of clips is non-primed and serves thereby as a comparison. Both film clips and the sets of four films which they belonged to, were randomly selected by the computer randomisation programme. The order for part of the session that was to be the primed clip, was also randomised.

Our hypotheses predicted that the content of the mentation reports will relate to the sets of films that were primed and can be distinguished from the non-primed set and the that the reports will have a psi-mediated content which will enable the target film clips to be chosen with an effect size consistent with previous ganzfeld studies.

Method

Design

In designing a procedure to subliminally present, that is to prime the film clips, a limiting factor concerns the refreshment time for computer monitor screens. Since each film length is 120 seconds, and the standard used for films is 25 frames per second, then this is potentially 3000 frames. Limits are imposed by refresh rates and thematic continuity. To resolve this, the *Inquisit* software was utililised. *Inquisit* includes a procedure for enabling the subliminal exposure of pictures inserted into the program. Our requirement was to provide 3

frames per picture for the 75 Hz monitor at an exposure of 3/75 seconds, that is 40 milliseconds, which is slightly below the threshold for conscious recognition (usually given as around 60 milliseconds). Twenty-four pictures were exposed for 40 milliseconds making the exposure time for each film sequence close to 1 second. As mentioned earlier, various factors, including individual variation, the complexity of the content of the film clip and the thematic connections between pictures, all meant there was an uncertainty as to whether the exposures were, in each individual case, truly subliminal. For this reason the term *semi-subliminal* may be more accurate; we termed the procedure *the rapid thematic picture presentation test*.

Participants

Thirty-two participants receiver-sender pairs took part in the experiment on a volunteer basis. Each pair contributed one session except for one individual who returned for a second session in the role of receiver. Participants were recruited through advertising at meetings and notice boards for New Age and spiritualistic societies and in a few cases through personal contacts. The majority of participants came as pairs but in two cases staff took the role of sender. In all, there were eight male-female receiver-sender pairs; and eight female-female pairs. The age range was between 18-60 with a mean of 31. The entry criterion for talking part in the study was personal experience and belief in psi. This entry criterion was formally assessed by using the *Australian Sheep-Goat Scale* for which a score of at least 1 standard deviations above the mean was required in order to take part in the study.

Since each session gave two trials, there would normally have been a total number of trials as 64 but one session had to be cancelled due to technical failure in the equipment. A further session was eliminated prior to the knowledge of the outcome because of the absence of any reported imagery. This meant that there were in total 58 trials.

Materials

Twelve sets of four film clips from our digital film clip library were used for the current project. The sets were chosen on the basis of their maximum dissimilarity from each other and apparent strong emotional loadings. The resulting forty-eight film clips were individually analysed in order to produce representative thematic pictures which were then added to the picture material in the *Inquisit* program for the purpose of priming them. These film clips were then also been given to an external judge who wrote a simple blow-by-blow content description for each film clip. These content descriptions provided the basis for a later assessment of matches between the mentation imagery and that of each control and each experimental film clip.

Procedure

The experimental procedure required both the receiver and sender to place themselves directly in front of the monitor and view the randomly selected set of 4 film clips. Following the viewing of each of the primed film clips, the participants sketched what they had seen and wrote notes on any feelings that were aroused by the material. The participants were not told fully about the purpose of the priming procedure until after the ganzfeld session was completed, whence they were fully debriefed.

The sketches and notes from the priming formed the basis for the later assessment by an external judge who had the task of identifying the objective correspondences between the film clips used for priming and the subsequent content of the mentation reports. On the basis of the assessment of this content, the judge would then attempt to identify which part of the mentation reports related to the primed trials and which parts were unrelated and therefore may have belonged to the non-primed trials.

The participant in the role of receiver spent 30 minutes in ganzfeld stimulation but using pink noise instead of ocean waves as the auditory source. Following the ganzfeld relaxation, the experimenter

who had accompanied the receiver, logged into the computer in the receiver room and located on the server the set of films that had been used to generate the choice of the first target film. The mentation report was then reviewed along with each of the four film clips (three dummy clips long with the target clip) in the set. Each film clip was finally rated on a 0 to 99 point scale for its likeness to the mentation. This procedure was then repeated for the second target set of four clips in the session.

During the assessment of the correspondences between the ganzfeld imagery and the primed film thematic pictures, the matches were classified as "direct correspondences" and as "associative correspondences". The method was partly based on the work of Moulton (2001): By identifying each meaningful utterance from the mentation report, Moulton was able to assess their correspondence to a checklist of single words that had been earlier determined as being commonly associated for each target photo as descriptors of each photo. Essentially the same method was used here after having first determined that an objectivity could be reached concerning what was a direct correspondence contra an associative one.

Results

It had been planned to analyse the whole series of mentation reports with a view to identifying correspondences with the primed material. However financial and time restrains dictated that we were able only to use a random sample. On the basis of the random sample of eleven mentation reports, the external judge was able, as predicted, to distinguish the primed from the non-primed mentation reports at a significant statistical level (t = 2.80, df =10, p = .019) with a large effect size of r = .8.

This indicates that the content of the ganzfeld imagery reflects, at least to a marked degree, the material that the participant has been exposed to prior to the session.

Contrary to our expectations and hypothesis, only 4 hits (first rank placements) were obtained with the primed targets (t = 1.64, df = 28, p

>.05). This gave a 13.79% scoring rate where MCE is 25% for the 29 trials that were carried out with the primed targets.

The non-primed control series gave double so many hits but this is a result which is close to chance expectancy: 8 hits of 29 (27.59% where MCE is 25%). A paired t-test showed the difference between direct hits for primed and non-primed target clips did not reach significance on a two tailed test ($t = 1.28$, $df = 28$, $p > .05$).

The results for the primed series could be said to be in the psi-missing direction, and as such give an small to medium effect size at .20 which is compatible with the usual effect size claimed for the psi-ganzfeld but in the opposite direction to the one usually predicted.

Discussion

Since the ganzfeld, including the real time digital ganzfeld, has a previous track record of success in our laboratory, it was thought important to preserve the same conditions that appeared to have facilitated this success. For this reason we selected participants who appeared to have similar beliefs and expectancies to those used our previous experiments and we attempted to carry out the sessions in a similar manner to that which previously had given positive results. Since the results here appeared to be the reverse of what we had expected, some analysis and speculation concerning the possible explanations may be deemed appropriate.

While in a very general sense the findings here could be regarded as a failure of the ganzfeld to replicate, it should be noted that the design, by presenting the film clip material prior to the actual ganzfeld session, involved a major departure from the standard design that has been recommended for replication studies (Storm et al, 2010).

Ideally we would have preferred to have run a pilot study prior to this study which might have enabled us to have avoided the pitfalls evident in this study but practical priorities meant much of our resources for the study had to be first be given to updating our equipment. Retrospectively, it now seems rather self-evident that the experiment was much too top heavy and over ambitious. Requiring the

participants to see four film clips at a semi-subliminal or subliminal level prior to the ganzfeld session, risked overloading them with emotional material from each of the film clips. Since priming the receiver for the target films was the major variable under study, a better alternative would have been to prime randomly only one of the four clips in the set. While preferable, in order to achieve the same number of trials, this would have extended the experiment in a fourfold manner in terms of time and trials.

As it stands, the effect may have then been such that instead of priming the material and making it available for psi to "potentiate" and distinguish the target clip form the others, the material merely overwhelmed the senders and receivers with imagery. It seems likely that a multiple working-through process in the fantasy and ganzfeld imagery may have thereby been elicited and these processes may have blocked any potential psi influence. Given that the potential psi influence is generally a weak or medium to weak effect, then any such influence would presumably have been swamped by the personal preferences in the associations brought out by the thematic material.

The notion of psi-missing (Rhine, 1952) is often claimed to occur in conditions of stress or over-demands which would be the case here. Naturally, some critics (e.g., Alcock, 2003) dismiss psi-missing as an ad-hoc hypothesis but it is hardly so, given that two-tailed tests are now customary. In the results here, the low scoring does not reach significance on a two-tailed test so we cannot conclude from the negative scores that this effect is present. Nevertheless effects similar to psi-missing have been found in the priming experiments of cognitive psychology. Here the effect is called "reverse priming" and it is speculated that they are an automatic correction of unintended bias – an overcompensation (Glaser & Kihlstrom, 2005). This suggests that in subliminal perception, there are some findings consistent to both cognitive and parapsychology. Although subliminal priming may not be the royal road to producing large effect sizes, it does provide a tool for influencing and loading target material. Moreover the present study does gives strong support for the existence of a causal connection between occurrence of the recent subliminal or semi-

subliminal imagery and the subsequent imagery reported as occurring in the Ganzfeld state.

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Research Brief: 'Twitter' as a New Research Tool: Proof of Principle with a Mass Participation Test of Remote Viewing

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Abstract

The social networking site 'Twitter' was used to conduct a mass participation remote viewing ESP study. The easy accessibility of Twitter made it possible to recruit and engage a large number of participants, and to give them almost immediate feedback. A majority voting technique was used to combine participants' calls, to avoid stacking effects and to detect any group-level psi effect. For each trial an experimenter visited the target location. Blind judging was conducted with photographs of the target location and four decoy locations. Over five thousand responses were gathered over five trials. The first trial employed a non-blind judging procedure to test the hypothesis that believers would be especially likely to exhibit confirmation bias. As predicted, a significant relationship was found between belief in psychic ability and level of perceived correspondence between the participants' impressions and the target location. The following four trials used blind judging. On each trial the group failed to identify the correct target. There was no significant relationship between belief in psychic ability and choice of target on any of the trials. Participants reporting a strong belief in psychic ability identified the correct target on one trial (exact binomial p = .41). Those participants who reported that they believed they were psychic and were confident of their response failed to identify the correct target on any trial.

Introduction

Since the 1930s, parapsychologists have used mass participation methods in an attempt to increase the statistical power of their studies

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and address the question of small effect sizes (Goodfellow, 1938; Milton & Wiseman, 1999). However, typically mass participation studies involve participants sitting at home trying to guess the identity of a distant target, and not receiving feedback until days or weeks later, something that is quite unlike laboratory ESP methods, and not at all engaging for participants. Today, the explosion of Internet technologies presents researchers with improved opportunities not only to involve large numbers of participants, but also to engage them with immediate feedback. The work described here presents the first parapsychology study to recruit and run participants using the popular social networking tool 'Twitter'.

Twitter is an Internet-based micro-blogging system that allows an individual to instantly send text-based messages of up to 140 characters (known as 'tweets') to a group of people that have chosen to 'follow' that individual (see https://twitter.com/). Since its creation in 2006, Twitter has gained considerable attention from the online community, attracted millions of users, and is consistently ranked as one of the world's most visited websites. To discover whether Twitter could be used as an effective research tool, this paper reports a proof of principle study exploring a form of alleged psychic ability known as 'remote viewing'. The study also explored reasons for participants' subjective perceptions of correspondence between target locations and their impressions.

Remote viewing is the alleged ability to gather information about a distant location using paranormal means. The best-known work into this apparent phenomenon was initiated by the American government in the early 1970s, and involved over twenty years of experimental and applied research exploring whether it could assist military intelligence (Mumford, Rose & Goslin, 1995). Some of this experimental research was examined by two reviewers on behalf of the American Institutes for Research (AIR) in the mid 1990s, with one reviewer concluding that the work had demonstrated the existence of a statistically significant effect (Utts, 1995) and the other arguing that it had not been independently replicated (Hyman, 1995).

In remote viewing research individuals are asked to try to psychically identify a distant target location, with their success being determined by the level of correspondence between their thoughts and the location. Skeptics have criticised some of the work, noting that any non-blind assessment of results is open to confirmation bias, with people overestimating the level of correspondence between their thoughts and a target by ignoring mismatches and interpreting any ambiguous elements in their favour (Marks, 2000). It has been further hypothesised that individuals who believe in psychic ability may be more especially likely to demonstrate this bias (Blackmore, 1992; Brugger & Graves, 1997), with indirect support for this notion coming from studies showing that believers are significantly more able than others to 'find' non-existent images within random dot patterns (Blackmore & Moore, 1994; Brugger et al., 1993), and illusory connections between randomly paired stimuli (Brugger, Regard, Landis, Krebs, & Niederberger, 1994; Wiseman & Smith, 2002; Pizzagalli, Lehmann, & Brugger, 2001). Only one previous study has addressed the issue somewhat more directly by presenting believers and skeptics with made-up data from a fictitious remote viewing study (French, Herrmann, Hales, & Northam, 1996). As predicted, the believers reported finding especially high levels of correspondence between the remote viewers' comments and the alleged target.

The first part of the current study was the first to employ a non-blind judging procedure during a genuine test of remote viewing to directly test the hypothesis that believers would be especially likely to exhibit confirmation bias. An experimenter travelled to a distant location and then asked participants to tweet their thoughts about the nature of that location. Participants then saw a photograph of the location and were asked to assess the degree of correspondence between their thoughts and the photograph. It was predicted that the overall level of perceived correspondence would be high (hypothesis 1), and that participants who believed in the existence of psychic ability would report significantly higher levels of correspondence than others (hypothesis 2).

Proponents of psychic ability could argue that these predicted effects could be due to participants possessing psychic ability, with those who believe in such abilities being especially gifted. A second part of the study assessed this notion by running a series of trials employing blind judging procedures. During each of four trials an experimenter travelled to a distant location and then asked participants to tweet their thoughts about the nature of that location. On each trial, participants then saw five images of different locations (the actual target and four decoys) and were asked to choose the one that best matched their thoughts. This modified procedure controls for possible confirmation bias (see Milton and Wiseman, 1997) and thus any significant effects would support the existence of psychic ability (hypothesis 3). This second stage of the study also acted as a further test of the remote viewing hypothesis, examining the performance of participants who might be expected to produce especially high scores – those who believed in the existence of psychic abilities (hypothesis 4) and those who believed that they possessed psychic abilities and were especially confident about their responses (hypothesis 5), as assessed by an online questionnaire.

While mass participation studies have the benefit of enabling large numbers of individuals to participate in ESP testing, this method can be undermined by an artefact called the 'stacking effect', which occurs when multiple calls are made on a single target (Greville, 1944). Although target guesses may be non-independent (e.g., due to stereotypical thinking or knowledge of others' guesses), statistical analyses typically assume independence. The simplest solution to this is to use the 'majority vote' technique (Thouless & Brier, 1970), which combines participants' calls for a single target. This technique has had some success in ESP testing (e.g., Barker, Messer & Drucker, 1976; Brier & Tyminski, 1970; Carpenter 1991); indeed it may have a theoretical advantage that goes beyond avoiding a statistical artefact. If there is a genuine but weak effect (in this case, a putative psi signal), it may be detected if calls are combined so that the noise cancels out – a phenomenon that has in mainstream research been termed 'the wisdom of crowds' (Surowiecki, 2005). The present study therefore

uses Twitter to engage large numbers of participants and present them with immediate target feedback, and averages their calls to exploit any group-level remote viewing effect. Only five trials were used in order to prove the principle that Twitter could be used to conduct such a study, and because Twitter is typified by short-term interactions.

Method

Procedure

Participants were initially recruited via media reports, resulting in approximately 3000 people following the Twitter account being used to run the experiment. News of the experiment then spread on Twitter, with people sending messages about the study to their networks, resulting in an additional 4000 individuals following the account. Different numbers of participants were involved in each trial, and the method cannot establish which participants took part in all five trials. Each trial took place at 3pm BST on five consecutive days. One hour before the start of each trial the experimenters sent a tweet reminding participants about the forthcoming trial.

Non-blind trial: During the non-blind trial the experimenter travelled to the target location (a weir) and sent a tweet asking participants to submit their thoughts and impressions about the location via Twitter. Twenty minutes later the experimenter sent a second tweet asking participants to complete an online questionnaire. This questionnaire asked participants to indicate their sex (response options: 'male', 'female'), whether they believed that psychic ability exists ('definitely yes', 'probably yes', 'uncertain', 'probably no', 'definitely no') and the degree of correspondence between their thoughts and a photograph of the weir ('very high', 'high', 'medium', 'low', 'very low'). Thirty minutes later the questionnaire was closed.

Blind judging trials: The 20 locations used during the blind judging trials were chosen and photographed prior to the experiment. The

images were sorted into 4 sets of 5 photographs, with each set consisting of locations that were visually maximally different. Each image in each set was then randomly labeled A through E, and each set randomly was assigned to one of the four trials.

During each of the four trials an experimenter randomly selected a target from the appropriate set of five possible locations. This involved visiting www.random.org – a website that generates true random numbers via atmospheric noise – and generating a random number between 1 and 5 (where 1 = Image A, 2 = Image B, etc.). The experimenter then travelled to the chosen location. Once there, they sent a tweet asking participants to submit their thoughts and impressions about the location via Twitter. All of the tweets sent after the target had been selected contained a standard wording to ensure that they could not contain any clues about the location.

Twenty minutes later the experimenter then sent a second tweet asking participants to complete an online questionnaire. This questionnaire asked participants to indicate their sex, whether they believed that psychic ability exists, and whether they thought that they had psychic ability ('definitely yes', 'probably yes', 'uncertain', 'probably no', 'definitely no'). Participants were then presented with five photographs, and asked to select the location that best matched their thoughts and rate how confident they were about their guess ('very confident', 'fairly confident', 'not very confident', 'not at all confident'). Thirty minutes after that the questionnaire was closed and a final tweet directed participants to a website revealing the target photograph.

Results

Non-blind trial

As predicted by hypothesis 1, many participants reported a large degree of correspondence between their thoughts and the target, with around 38% of the group rating the correspondence as 'medium', 'high', or 'very high'. As predicted by hypothesis 2, there was a

significant relationship between belief in psychic ability and level of perceived correspondence (N = 1093, $\chi^2 = 119.24$, $df = 16$, $p < .0001$, effect size *Phi* = .33), with those expressing a belief in the paranormal reporting higher levels of correspondence than others (see Table 1).

Blind judging trials

Each participant was able to see all of the 'tweets' sent by other participants, and thus their responses cannot be considered independent. Because of this, the data was analysed using a 'majority vote' technique that treats the group as a single unit of analysis (Brier & Tyminski, 1970). The location that received the greatest percentage of votes on each trial was seen as the group's selection. If this location matched the actual target location then the trial was deemed a hit. If not, it was deemed a miss. For the experiment to be considered significant, it had to yield three or more hits (associated binomial p = .02). On each trial the group failed to identify the correct target, thus hypothesis 3 was not supported.

Table 1. Percentage of respondents as a function of belief in psychic ability and level of perceived correspondence between their thoughts and the target.

		Belief in psychic ability					
		Definitely no	**Probably no**	**Uncertain**	**Probably yes**	**Definitely yes**	**Total**
Level of perceived correspondence	**Very low**	53.39	44.55	31.89	25.38	18.40	36.96
	Low	20.76	26.60	26.49	22.84	20.25	23.70
	Medium	13.56	17.95	23.24	22.84	30.67	20.68
	High	8.47	8.65	12.43	19.80	14.11	12.08
	Very high	3.81	2.24	5.95	9.14	16.56	6.59

Participants reporting a strong belief in the existence of psychic ability (answering 'definitely yes' to the belief question) identified the correct target on one trial (exact binomial p = .41), therefore hypothesis 4 was not supported. *Post-hoc* analysis revealed that there was no significant relationship between belief in psychic ability and choice of

target on any of the trials (Trial 1: N = 1322, χ^2 = 15.36, *df* = 16, *p* = .50: Trial 2; N = 1053, χ^2 = 13.60, *p* = .62: Trial 3: N = 815, χ^2 = 11.18, *p* = .80: Trial 4: N = 726, χ^2 = 15.11, *p* = .52).

Finally, those participants who reported that they believed they were psychic (answering 'definitely yes' to the psychic ability question) and were confident of their response (answering 'very confident' or 'fairly confident' to the confidence question) also failed to identify the correct target on any trial, thus providing no support for hypothesis 5.

The target locations, and the locations chosen by the majority of participants, are shown in Table 2.

Table 2. Targets selected by all participants, those who believed in psychic ability, and those who believed they possessed psychic ability and were confident about their responses (total number of participants and percentage who chose the location in parentheses).

	Target location	**Chosen location**		
		All participants	**Believe in psychic ability**	**Believe that psychic and confident**
Trial 1	Modern building	Wooded area (N=1322, 35.32%)	Wooded area (N=222, 39.19%)	Wooded area (N=57, 40.35%)
Trial 2	Play park	Set of stairs (N=1053, 26.69%)	Playpark (N=183, 29.51%)	Set of stairs (N=50, 42.00%)
Trial 3	Unusual canopy	Graveyard (N=815, 24.05%)	Split vote between tunnel and bridge (N=143, 23.08%)	Tunnel (N=37, 29.73%)
Trial 4	Post box	Canal (N=726, 23.83%)	Canal (N=127, 26.77%)	Canal (N=35, 34.29%)

Discussion

In the non-blind trial the overall level of perceived correspondence was high, and participants who believed in the existence of psychic ability reported significantly higher levels than others. In the blind trials (which eliminated potential confirmation biases) participants were unable to accurately identify the target locations, and there was no significant difference between the performance of believers and others. In addition, the one group of participants that might be

expected to produce especially high scores – those who reported possessing psychic abilities and who were especially confident about their responses – failed to identify any of the targets. Participants who believed in the existence of psychic ability identified one target, which is close to chance performance. These findings do not support the existence of remote viewing. They do, however, suggest that the use of non-blind judging procedures in remote viewing research is likely to inflate the level of perceived correspondence between participants' thoughts and a target location, especially for those who believe in the existence of such abilities. Interestingly, such uncontrolled procedures are frequently used by those running public workshops and seminars that claim to develop individuals' remote viewing skills, and thus could easily convince participants that they do indeed possess such abilities. In addition, although the present study explored this effect within the context of a remote viewing study, it is easy to imagine how the same mechanism could cause people to believe that their dreams predict the future or that an astrological reading accurately describes their past. As such, an individual's ability to find illusory correspondences between their thoughts and external events could play a key role in the formation and maintenance of belief in the paranormal.

The study does have some limitations. While it attempted to tap the wisdom of the crowds by using a majority vote method, it was not able to detect any evidence for remote viewing. With only four blind trials, though, there is a risk of committing a Type II error (failing to detect a genuine effect) and we would recommend using a greater number of trials in future research using this method (we could not estimate statistical power beforehand due to the difficulty in accurately estimating effect size with an untested method that also uses majority vote techniques). Additionally, the majority vote method will have the effect of detecting any group-level effect, and this could include group biases (e.g, a stereotypical preference for the leftmost target in an array of target possibilities; ideally the order of presentation of the array of target possibilities should be randomised so as to eliminate this potential bias). This kind of group level effect could outweigh any

more subtle group psi effect, once again suggesting that a larger number of trials would be needed in future.

This experiment also examined the potential of Twitter as a research tool, using this relatively new form of social media to both recruit and run participants. The results were, for the most part, very encouraging. Several thousand people signed up for the experiment and each trial attracted around a thousand people who contributed their data in a very short space of time. Although there was some attrition from one trial to the next, the study maintained a healthy rate of participation. In addition, the study attracted participants with a wide range of beliefs about psychic ability, and the large numbers involved meant that even focused sub-groups of individuals, such as those believing that they were psychic and confident about their responses, contained healthy numbers of people.

The remote viewing study worked well because it caught the interest of both the media and public alike, and utilised Twitter's ability to provide a near instant response from participants, and to give them near instant feedback. It seems likely that other studies that share these features are also likely to succeed on Twitter. This could include, for example, studies using the 'experience-sampling method', wherein participants report their thoughts and feelings the moment they receive a certain signal (see, e.g., Larson & Csikszentmihalyi, 1983; Hurlburt & Heavey, 2004). The inter-connectedness of Twitter users, combined with the potential for messages about studies to reach a large audience, also means that it may also prove a highly effective way of recruiting specialised groups of participants.

In short, this study did not yield any evidence for remote viewing, but did show that the perceived correspondences between a participant's thoughts and the target in uncontrolled remote viewing trials could be due to confirmation bias, and that individuals who believe in the paranormal are especially prone to this bias. The study also showed that Twitter can be used as a new form of research tool, and can be an effective way of recruiting and running participants. It seems that the nature of Twitter makes it especially well suited for studies that require an immediate response from a large number of

participants, and that would benefit from giving participants immediate feedback. We look forward to other experimenters utilising this tool in creative ways.

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Research Brief: The Effect of 'Sigilisation' on Forced–Choice ESP Task Success

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Abstract

This exploratory study endeavoured to test the possible enhancing capabilities of sigil magic, a form of chaos magic, upon forced-choice clairvoyant ability. An opportunity sample of 39 participants was employed in this repeated measures study. In the first condition a standard deck of Zener cards was used to measure ESP task success. In the second condition, a 'sigilised' deck was employed. Combined, a significant psi-hitting effect was produced. In the standard condition a non-significant, above chance, hit rate was found. In the sigilised condition, a highly significant hitting effect was evidenced. However, a comparison of the hit rates for these two conditions failed to show a significant difference. Although the results of this study are encouraging, methodological issues need to be addressed in order to determine the validity of these findings.

Introduction

Many researchers involved in conducting controlled tests of ESP are keenly aware of the effects of psi-conducive practices (Delanoy, 1997) and the possible effects of the researcher upon ESP task success (Schmeidler, 1997). However, the present authors are not aware of any research that has investigated the effects of the researcher's will, through the practice of 'magic' to manipulate task success. The research presented herein attempted to investigate this possibility.

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The particular form of magic used in this study is known as sigil magic and was popularised by Austin Osman Spare (for a recently published collection of his writings, see Spare, 2007). Hine (1995) describes sigil magic as "simple, results-oriented, and is effective regardless of one's beliefs or metaphysical speculations in general" (p.80). Essentially, a statement of intent is created by the practitioner and then any repeating letters within the statement are removed. The remaining letters are then abstracted into a symbol (sigil). The sigil is then 'charged' with the will of the person that created it in the belief that a desired outcome will ensue from this ritual. Thus, the purpose of sigilisation is to satisfy the desire of the practitioner.

David Luke (2007, p. 90) notes the "uncanny resemblance" between the work of Spare and the propositions put forward by Rex Stanford (1974) for his psi-mediated instrumental response (PMIR) model of psychic functioning. Essentially, Stanford proposes that psi is evolutionarily adaptive in that it serves to meet the needs of the individual. Operating at a sub-conscious level, need-serving information is acquired by psi so that an appropriate response can be made. Thus, the adaptive function is easily recognised if we consider how this ability may enhance our chances of avoiding predators, finding food, shelter, a mate, etc.

In the context of experimentation to investigate psi, Stanford (1981) notes that if his model is correct, then the psi task success may not be due to the participant, but rather the desire of the researcher (or practitioner). If we can accept the possibility of experimenter psi in ESP research (Kennedy & Taddonio, 1976; Scheimdler, 1997; White; 1976) then it would be equally legitimate to hypothesise that it may well be possible to use sigil 'magic' to exert the experimenter's will to influence something such as the outcome of an ESP task.

An adaptation of Rhine and Zener's forced-choice technique is an ideal method to explore the possible effects of sigil magic upon ESP. It allows the researcher to collect a great deal of data with relative ease and speed. Due to the method of sigil magic employed in the experiment, differences in hit rates are easily exposed. It was hypothesised that the will of the researcher, using sigil magic, would influence the hit rate of scores in a test of clairvoyance using the forced-choice method. It was predicted that this effect would be positive in that a sigilised deck of Zener cards would yield a significantly higher hit rate than a control deck. Finally, it was further

predicted that, due to the enhancement of the hit rate in the sigilised condition, the overall hit rate would be significantly above mean chance expectation (MCE).

Method

Design

A repeated measures experimental design was employed in this closed-deck, forced-choice test of clairvoyance. Two levels of the independent variable were manipulated; the presence or absence of sigil magic in testing. The effects of the 'sigil magic' condition were observed directly after the first 'non-magical' (or control) condition. The dependent variable was the number of 'hits' gained in each condition.

Participants

An opportunity sample of 39[1] participants was invited to take part in this experiment in return for course credit. There were 22 male and 17 female participants who were students of Coventry University studying for a B.Sc in Psychology. Recruitment was made through the use of discussion forums using the University's intranet service. No other demographic data were collected.

Materials

A number of materials were used during the testing phase. A set of 25 plain white laminated cards measuring 10.5cm × 11.5cm each bearing a single rune on their face was created in order to test for clairvoyant ability. The set of cards designed by the researchers was heavily influenced by Karl Zener in his creation of the 'ESP Deck'. In total there were five different runic designs and within the set of 25 cards there were five of each type of rune. A further ten prompt, or reference, cards were created (two for each type of rune); five of them were created for the control condition and the other five were for the sigil condition. The identifying factor of the sigil magic cards was the

[1] The researchers had aimed to recruit forty participants and this was achieved. However, one participant later requested that their data be withdrawn. This was done at a stage when it was no longer possible for the second author to recruit further participants.

prominent sigil design printed on the back of the cards. Although the sigil used on the backs of these cards was identical, the cards themselves were unique; each having one of the previous runes drawn on their face, matching the plain set. Instruction on the creation of a sigil spell was dictated by two books in particular; 'Condensed Chaos: An introduction to chaos magic' (Hine, 1995, p.81) and 'Basic Sigil Magic' (Cooper, 2001, p.39).

The modern technique of sigil magic is described as a simple magical process. In order to press the magical will onto the cards a specific sigil has to be fashioned in the mind of the individual who utilises the technique. In the context of this experiment this was done by writing one's will out in a sentence and then carefully eliminating repeating letters until there were only single cases left. These form a jumble of letters that were incorporated into a singular visual design.

Both Hine (1995) and Cooper (2001) stress the importance of getting the statement of intent as precise as possible in order to gain a beneficial effect. The magical will of the researcher (WB) in this case was: 'It is my will to enhance the bearer's clairvoyant ability'. This was broken down to 'ITSMYWLOENHACBRV'. Each of these letters was used in the design of the sigil.

The second half of the process required the researcher to fall into an altered state of consciousness or 'gnosis' with the purpose of empowering the sigil. There are several ways of achieving this state of mind, however due to the researcher's recent meditative practices a simple form of meditation was used. In a meditative state the researcher continually focused upon the statement of intent, 'It is my will to enhance the bearer's clairvoyant ability' and the sigil design outlined above. According to Hine (1995, p.85), this state projects the magical will "into the multiverse". It is this projection that purportedly empowers the sigil.

Procedure

Ethical approval to conduct this experiment was gained through Coventry University's ethics committee. Although this study and the experimental procedure in general were seemingly harmless to individuals, religious or personal belief had the potential to cause discomfort to sensitive participants. Generally witchcraft and sorcery are frowned upon by the religious groups and it is understandable

how discussion of metaphysical processes may invite confusion or dismay among certain people. It was therefore important to highlight the use of sigil magic and its proposed use in experimentation.

Participants were welcomed and made to feel at ease as the researcher handed them a participant information sheet detailing the purpose of the study and reasons for being approached by the researcher. Participants were then handed a set of written instructions that set out the general layout of the testing phase. To ensure that each participant had understood the test instruction and awareness of their anonymity and right to withdrawal the researcher repeated the instructions and outline of the experiment verbally. Before testing commenced, participants were reminded of their right to withdraw from the study at any point.

The general procedure of the experiment after gaining consent followed this course of action:

The researcher (WB) placed the prompt pack of five cards for the control condition face down besides the participant. The deck of 25 cards were then shuffled and laid out in a five-by-five grid in front of the participant. Due to there being five of each type of card present in the grid, the chances of gaining a hit is one in five (or twenty percent).

The participant was then instructed to pick the top card from the pile of prompt cards. They were then asked to hold onto the card and visualise a card in the grid that appeared to 'stand out' to them, or failing that to choose a card that they thought may match the one held. Upon choosing the card the participant would show it to the researcher and either a 'hit' or 'miss' would be recorded. The card used as the focus was then discarded and the set of twenty five in the grid were shuffled once again. This process was important due to the fact that a test of pure clairvoyance is impossible if the researcher knew even a single location of a rune in the set; turning a test of pure clairvoyance into a test of extrasensory perception with the inclusion of telepathy.

The process of discarding and reshuffling was repeated until the final card in the non-sigil condition was investigated. Upon completion of this condition the participant was informed of the significance of sigilisation and commencement of the second condition. This condition was the sigil magic condition. The five sigilised cards were placed face down next to the participant and (as in the control condition) the participant was asked to select the card at the top of the pile. In total,

ten trials were completed; five in the normal condition and five in the sigil condition.

Upon completion of the experiment, participants were verbally debriefed alongside presentation of a debriefing form stating the participants' right to withdraw from the study without giving a reason.

Results

As there was a one in five (20%) chance of participants correctly selecting the target, MCE for the total 390 trials would be 78 correct selections. However, overall results showed an overall hit rate of 101 (25.9%) correct selections. Using the formula for analyses of closed-deck tests of ESP given by Palmer (1986, p. 148-149), this hit rate proved to be significantly higher than MCE: $z = 2.91$, $p = .004$ (two-tailed). Therefore, the combined hit rate of both conditions would suggest support for the existence of a psi effect.

In the control condition, participants correctly selected the target 45 times over 195 trials (23.08%). While this was above MCE, it was not significantly so: $z = 1.07$, $p = .284$ (two-tailed). However, in the sigil magic condition, participants correctly selected the target on 56 occasions (28.72%), yielding a significant, above-chance, hit rate: $z = 3.04$, $p = .002$ (two-tailed). This would appear to support the possible presence of sigil magic and the magical will of the researcher in enhancing hit-rates.

However, a z-score contrast of the hit rates for the control and sigil magic conditions was not significant: $z = 1.39$, $p = .164$ (two-tailed). Thus, although the sigil magic condition evidenced more hits than the control condition, the hit rate was not significantly higher.

Discussion

Although the results of this exploratory study did not fully support the research hypotheses in that the difference between the control and sigil conditions were not significantly different, they are nonetheless encouraging. A significant hit rate was found in the sigilised condition whereas this was not the case in the control condition. Thus, there seems to be some support for the efficacy of

chaos magic on ESP task success. However, there are a number of other factors that may account for these findings.

It is clear (by the very nature of the sigilisation procedure) that, in the present research, the experimenter (WB) was highly motivated to impress his will on the sigilised deck of cards. Therefore, to avoid the argument that the findings may have been due to inadvertent subtle sensory leakage from the researcher in his enthusiasm for the desired outcome, it would have been beneficial to have a researcher test participants that was blind to the research hypotheses. In addition, the researcher and the participant could be shielded from one another by placing them in separate rooms and the forced-choice test could be presented via a computer (with the stimulus material being presented on monitors) rather than hand-held cards. Such procedures would greatly reduce the possibility of sensory leakage.

Even with the possibility of sensory leakage controlled for in a more rigorous manner, there may still have been a motivational effect on the participants due to the nature of the decks of cards. On one set (the sigilised set), there were symbols on the back of the cards whereas on the other set there were no markings at all. Thus, participants may have anticipated that the set marked with the runes were specifically developed with some experimental manipulation in mind. If we can assume that participants were motivated towards task success, this may well have promoted psi functioning – therefore accounting for the enhanced effect shown in the sigilised condition. To determine whether this is the case, in future research, an additional deck of cards could be included that also had 'un-sigilised', arbitrarily selected symbols on the back of the cards. This un-sigilised deck would then help to determine whether or not it was the mere presence of symbols which motivated participants to perform better. This would at least enable us to determine whether the effect was due to participant motivation or some anomalous manipulation by the experimenter. However, at this stage we cannot rule out the possibility that the effect may be due to a subtle psi interaction between the experimenter's will and the participants' motivation; a suggestion that is neatly accommodated by Thalbourne's (2004) theory of 'Psychopraxia' (for a succinct outline of the basic tenets of this theory, see Roberts & Hume, 2007).

Despite the apparent methodological shortcomings of the present research, there is nevertheless some evidence for an enhanced psi-

hitting effect. Thus, such a practice may be regarded as conducive to providing proof-oriented evidence for the existence of ESP. The process by which this happens warrants further systematic research.

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Book Review

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A review of "El Mundo Oculto de los Sueños/The Occult World of Dreams" by Alejandro Parra (2009)

The literature on dreams and the dreaming experience is vast. However, the escaping nature of this phenomenon and the diversity of approaches adopted make it difficult to answer key questions like whether dreams fulfil psychological needs or whether their interpretation can be of any use to us. In this book Parra reviews a large body of theory and research, making great effort to provide a clear picture of the current state of the art in relation to this intriguing cognitive activity.

In chapter one (*Teorías de los sueños*, Theories of dreams), Parra examines a diversity of theories, taking the reader from the classical psychoanalytical and Jungian theories to more contemporary cognitive approaches. Something I particularly liked from this chapter was the inclusion by the author of a description of dream-related disorders as well as a physiological account of the dreaming experience.

In a second chapter (*Análisis de contenido en el estudio de los sueños*, Content analysis in the study of dreams), the author deepens into the examination of the content of dreams, describing a series of methods, like Hall and van de Castle's method for categorising and analysing dreams. This chapter, interestingly, integrates a good body of research on individual differences in dreaming and dream content in relation to gender, age, and other variables. At the end of this chapter, Parra also discusses recurrent and traumatic dreams and includes some cases of dreams of survivors of natural disasters.

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In an interesting third chapter (*El potencial creativo de los sueños*, The creative power of dreams), Parra, using examples from the literature, writes about the creative value of the dreaming experience. This chapter offers an interesting overview of how dreams can help us solve everyday and professional problems as well as inspire art, creation, and science. Parra argues that dreams can also be motivators of personal development and spiritual change.

In chapter four (*Imágenes oníricas más allá del tiempo y la distancia*, Oniric images beyond time and distance), the author covers what, historically, has been one of the most controversial approaches to the study of dreams while generating most public interest: the paranormal meaning of dreams. This chapter includes an analysis of the empirical evidence for the value of dreams as a vehicle for extrasensory perception, premonition and spiritual guide.

Chapter five (*El trabajo con los sueños,* Working with dreams) is, from my point of view, the author's most valuable contribution in applied terms. Very few psychologists make use of dreams in their professional practice. In 50 pages, Parra takes us through a generous set of methods and techniques that could be used in a wide number of contexts. Among others, Parra analyses Hill's technique in cognitive therapy and Leuner's guided affective imagery technique. To finish this chapter, the author also describes a method to deal with recurrent nightmares.

In brief, Parra's book is a synthesis of the current state of the art of theory and research in this area as well as a basis for new development, as depicted, specially, in his fifth chapter. My only criticism would be the succinctness with which the author covers neurophysiological aspects of dreams and dreaming, though this would take a whole new book and would, probably, be more suitable in areas of science other than psychology. The impartiality with which Parra deals with the huge diversity of approaches, integrating research findings throughout, is a clear strength of this book.

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