EXPERIMENTAL EVALUATION OF A FEEDBACK-REINFORCEMENT MODEL FOR DYADIC ESP

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ABSTRACT: A model for certain instances of dyadic extrasensory perception (ESP) is proposed wherein a 'psi stimulus' is generated by a sender in response to real-time feedback of target-relevant receiver mentation. This stimulus need act only to reinforce current mentation by momentarily changing physiological arousal, reducing the need for complex information transfer and highlighting the idea that psi may be a blanket term for a variety of information channels utilising different mechanisms rather than a unitary phenomenon. Experimental evaluation of the model involved two extensions to the standard Ganzfeld design: (1) in one condition the sender received false feedback of receiver mentation; (2) receiver skin-conductance was recorded during mentation. No evidence of ESP was found based on target-rank (pi = 0.49) but the predicted skin-conductance response to target-relevant mentation was observed, with significantly higher arousal for relevant mentation than in baseline periods (p=0.04, 1-t). Arousal was increased in both conditions, indicating a response to the sender's perception rather than directly to target-relevant mentation. The True Feedback condition showed a surprising negative correlation with magnetic variance (p=0.06 but opposite to prediction), and only the False Feedback condition showed the predicted negative correlation with magnetic field intensity (p=0.002, 1-t).

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Since the publication of the Bem and Honorton (1994) meta-analysis of Ganzfeld ESP experiments, the Ganzfeld protocol has become one of the most common experimental procedures used in parapsychological research. The majority of such experiments are dyadic[2], involving a target-aware participant (the sender) and a target-unaware participant (the receiver). With sensory shielding in place, an attempt is made to transfer information about the unpredictable target from the sender to the receiver, the former often being given real-time feedback of the receiver's mentation. However, a smaller meta-analysis of later studies (Milton & Wiseman, 1999) found a much reduced effect size, questioning the reliability of the technique. Such results may indicate that there is a need to standardise the exact procedure used in Ganzfeld ESP studies - an approach advocated by Bem, Palmer and Broughton (2001) who find a positive correlation between adherence to a standard protocol and study effect size – but could also suggest that some aspect of the phenomena being studied is too variable to be made consistent using such techniques.

This latter possibility is one which has been suggested before, with various researchers suggesting an inherent elusiveness to psi, either through some form of cognitive resistance (e.g., Braud, 1985) or directly due to its proposed nature (e.g., von Lucadou, 1987). Others, myself included, feel that it is '...not a crisis of replication that faces parapsychology; it is a crisis of theory and explanation.' (Edge, 1983). Even though practically nothing is known about how information might be transferred, several potential mechanisms are generally considered to have been ruled out by theoretical considerations of the bandwidth which would be necessary to transmit the complex information required to identify the target. Such 'mental radio' models do indeed have many problems - the low emissive capabilities of biological systems, the distances over which ESP has ostensibly been demonstrated and the problem of noise degrading the intelligibility of a putative psi signal's information content - and this is generally taken to mean that psi must not be a signal in classical terms. However, an alternative suggestion may be that no target-specific information is transferred at all. Instead, 'signaling' of a much simpler kind may play a vital role in producing some dyadic ESP phenomena.

1. The feedback-reinforcement model

With this in mind, a simple model has been constructed, termed PRiSM - an acronym standing for **P**si **Rei**nforcement of **S**tochastic **M**entation. By this, I mean that some form of unknown stimulus - which would generally be covered by the term 'psi', meaning the unknown factor(s) in the experiment - is generated by a sender and acts to reinforce aspects of the receiver's mentation. It should be noted that “mentation” refers to the ongoing mental processes of the receiver , not just those expressed during the traditional mentation collection period in an experiment. The described process of psi reinforcement could occur whenever a sender was able to monitor that mentation, so may be as likely to occur during judging periods as during traditional mentation periods. For the purposes of the model, it is assumed that the receiver's mentation is stochastic (i.e. having a random component, especially with respect to the target material), although the degree of stochasticity will depend on a number of uncontrolled factors: the subjective biases and expectations of the receiver, their memory of recent events and their perception of the current situation. From the perspective of the model, any biases (subjective or externally-cued) will simply result in overall ESP results being degraded. The psi stimulus itself would operate in the manner seen in studies into direct mental interaction with living systems (DMILS): the receiver showing a change in arousal when the “sender” has the aim of bringing about such a change. An overview of DMILS studies can be found in Braud & Schlitz (1997) and a recent meta-analysis was performed by Schmidt, Schneider, Utts and Walach (2002). It should be noted that the latter study is a much

[2] Bem and Honorton (1994) report that only 12 sender-less studies were found and that these gave overall non-significant results (effect size pi= 0.56, which corresponds to a four-alternative hit rate of 29%).

more conservative evaluation, making use of weighting based on quality indices that rely on an ideal-standards methodology; as such, its claims of a much reduced overall effect size are unsurprising

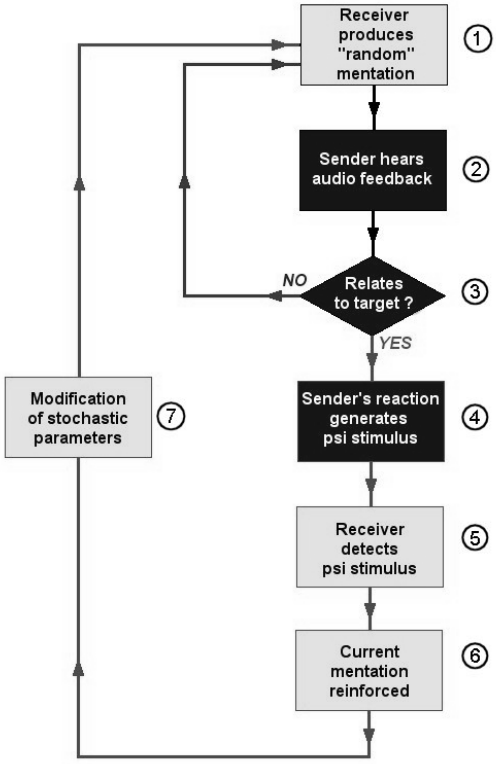

Figure 1: Sequential steps involved in the PRiSM model

To explain the details of the model, the different stages are displayed graphically as a flowchart in figure 1. These stages are:

1. The receiver's mentation is relayed to the sender . At this stage the mentation would display its most random aspect, with images, feelings and concepts being retrieved or synthesised from past experiences.
2. The target-aware sender monitors this mentation.
3. The sender then decides whether the mentation is relevant to the target. If the answer is no, the sender should not generally exhibit any strong reaction, and will continue to make use of whatever strategy they have chosen to attempt the 'information transfer'. Meanwhile, the receiver continues to generate "random" mentation (back to step 1)
4. If the mentation is relevant to the target, then the sender undergoes some reaction (excitement, positive thoughts/feelings, increased motivation, etc). Under the PRiSM model, some aspect of this reaction is considered to relate to the generation of a 'psi stimulus'.
5. The receiver, on some low level, detects the presence of that psi stimulus. This detection may result in a specific (e.g., positive emotion) or ambiguous (e.g., awareness of some somatic change) response.
6. This response tends to act to reinforce the mentation that was occurring at that moment, making it more likely to be repeated or to be used as a theme for subsequent mentation and/or to be better remembered during the final choice of target video clip.

7. This reinforcement can thus be either seen as acting to modify or limit the parameters governing the stochasticity of mentation generation, or at least to repeatedly select out any relevant themes from the ongoing "random" stream.
8. This process then loops back to step 1 and repeats until the mentation is concluded.

An interesting comparison is with the process of cold-reading wherein topics are introduced by the cold-reader in a generalised form and selected for discarding or elaborating through observation of the client's behavioural responses e.g., see Roe's (1991, p.475) figure 4 on “cold reading using non-verbal feedback” . With the PRiSM model, the sender acts as client, giving psi responses (possibly relating to their behavioural responses) to the receiver-introduced topics (the mentation). The receiver then “reads” the psi responses and this prompts them to elaborate on specific topics.

1.1 How much information needs to be transferred?

This model arose directly from the question of how much information would need to be transferred from sender/target to receiver to get the results seen in experimental work. It is generally assumed (e.g., Stokes, 1987) that psi acts to transfer information about the target. This has led to supposed theoretical constraints (e.g., psi cannot ever be due to electromagnetic signals as the bit rate of the frequencies utilised by biological systems is generally very low and no encoding/decoding apparatus is known that could handle such complex signals). The PRiSM model reduces the need for complex information transfer between the participants as it only requires the presence of a stimulus ("psi") that acts to reinforce the instantaneous mentation. Much of the complexity associated with dyadic free-response ESP could be transferred by conventional means via the sensory feedback link. Psi in its simplest form would thus act to allow the receiver to select the appropriate mentation.

This stimulus could be as simple as a on/off cue that reinforces receiver mentation, although this would mean that ESP would be extremely sensitive to similar stimuli from extraneous people who just happened to be undergoing strong reactions at the time of the experiment. A more robust candidate would be a stimulus which had some characteristics unique to the sender (an analogy would be the timbre of a voice - the speaker may still be identified even when the words themselves are obscured by noise). The receiver would then reinforce that mentation which occurs concurrently with a 'sender-tagged' stimulus, ignoring extraneous stimuli. Fortunately, there is some experimental evidence to support the notion that the psi stimulus of an individual may have identifiable characteristics: Berger (1987) and Radin (1989, 1993) found idiosyncratic patterning in data from random systems which individuals had attempted to mentally influence. Interestingly, an earlier Ganzfeld meta-analysis (Honorton et al, 1990) found that studies in which participants were free to bring in friends to serve as senders produced significantly higher hit rates than studies that used only laboratory-assigned senders - a finding which ties in with anecdotal reports which suggest ESP is more common among people who know each other well. Although speculative, this could suggest that there are identifiable characteristics and that they can be learned through close association with the psi-stimulus source. However, whether the signature aspect is a necessary component for the described process to occur is not yet known but could form the basis of useful future research.

Apart from 'signature' aspect, the model suggests that the content of the receiver's mentation could be purely due to their ongoing cognitive processes and not to an external source of information. Thus if they *happen* to think about themes and images which the sender considers to be relevant to the designated target, then they may ultimately be successful in the ESP task. However, if none of their mentation overlaps with the target, then they will have to make their final choice of target (e.g., The video clip in a ganzfeld ESP task) acting purely on guesswork. This may

go some way to explaining the elusive nature of ESP - it may fundamentally rely on a process with a large stochastic component. Without the chance occurrence that the receiver's mentation covers some aspect of the target image, reinforcement (and so success in the ESP task) would be unlikely.

1.2 The nature of the stimulus

To recap, I am suggesting that, in the dyadic sender-receiver situation, the psi channel is based on stimuli generated by the sender's reaction on perceiving target-relevant mentation via some form of conventional sensory feedback. Moreover, I suggested that the stimulus could have some characteristics unique to the sender that would allow the receiver to 'recognise' (on some level) that the stimulus was from a known source. The most obvious suggestion is that the psi stimulus relates to the physiological reaction of the sender, possibly a combination of somatic reactions and the concomitant brain activity. So, for example, the former could provide basic reaction signals (e.g., an increase in heart rate would generate increased frequency magnetic pulses). The latter could provide identifying characteristics as it has been demonstrated that brain activity has characteristics unique to the individual (i.e. an EEG signature), due primarily to 'hard-wired' neuronal structures that are consistent over long periods of time. This results in an EEG spectral profile that recognisably belongs to a specific individual (Stassen, 1980) as well as displaying more general traits that are shared by people who are genetically related (Stassen, Katsanis, Malone & Iacono, 2002). Thus there may be merit in looking at the physiological reactions of the sender and how they may relate to those of the receiver, much as is done in some DMILS research (e.g., Delanoy, Morris, Roe & Brady, 1999), especially when considering the emotional nature of target material. Note that this signature idea does not imply that any such signal would require complex interpretation or decoding. It is envisioned as being a pattern that has characteristics unique to the sender but which does not contain any encoded information about the target. Think again of the analogy with the timbre of someone's voice, which we learn to recognise even when we do not understand the language or cannot make out the words.

Note also that the model itself does not depend on the psi stimuli being of any specific type. It would work as well with magnetic fields as with some more exotic stimulus, or a combination of signals. It would equally allow for sensory leakage to act as the reinforcing stimulus if the experimental conditions allowed it to occur. It simply allows a way of conceptualising some psi experiences in a way which helps with formulating testable predictions for future research. It also highlights the idea that psi in general may not be a unitary phenomenon but may instead be a blanket term for a variety of non-sensory information channels.

1.3 Experimenter effects

One point which should be made clear is that the described PRiSM model could also be relevant to the idea of experimenter effects. If the experimenter were aware of the target and monitoring the receiver's mentation, then they could essentially play the role of an additional sender, adding their own psi reinforcement to the system. Even if they were unaware of the target, their reactions (for example, getting excited because the mentation theme related to a clip that they knew was at least in the target pool) to hearing the receiver mentation could still produce psi stimuli that might act as “noise”, falsely reinforcing the wrong theme. The extent to which this could happen, either in an additional sender role or as a source of noise, would depend on the importance of the 'signature' idea mentioned earlier: if reinforcement occurred only when a 'sender-tag' was present, then the experimenter's reinforcement role could be neglected. However, if the sender is not known to the receiver, or the study is investigating the effect of not having a sender, then a mentation-aware experimenter could play a major role, including during judging periods, as

discussed earlier.

1.4 Past findings supporting the model

One of the strengths of the PRiSM model is that, if valid, it goes some way to bringing together some isolated observations made by psi researchers over the years. It has often been suggested that there is a link between a receiver's lability and their success in ESP tasks (Palmer, 1987). Under the PRiSM model, the best receivers would be those who were good at generating a wide range of fairly random mentation, as these people would produce the largest possible pool of concepts to be matched to the target. This may also link in with the finding (e.g., Schlitz & Honorton, 1992; Dalton, 1997) that better ESP performance is found within a self-identified creative population, as creativity has been linked with the lability of brain activity (Reinsel et al, 1992).

The model may also be relevant to the finding that a free-response protocol, in which participants are free to describe the target as they see fit, has been much more successful than a forced-choice protocol, in which participants are asked to choose from a small set of possibilities (Utts, 1995). The PRiSM model suggests that ESP works best when the receiver's mentation is initially wide-ranging, giving the greatest chance it including target-relevant material that can be reinforced. Forced choice, which tend to reduce the amount of receiver's verbalisation and the time taken to reach a decision, restricts the possibility of reinforcement being able to occur. The model may still be applied to forced-choice situations where the receiver is asked to choose from displayed potential targets (i.e. those situations that are akin to the judging period of the ganzfeld ESP protocol), as a sender who is monitoring the situation could send reinforcement stimuli at the time of viewing the correct target, but would have problems being applied to card-calling type phenomena. This latter would presumably require the reinforcement stimuli to be extended to include some semantic content – a situation that is outwith the current formulation of the model.

Bem and Honorton's (1994) meta analysis suggested that the emotions evoked by dynamic targets made them superior to static ones, a suggestion which ties in with anecdotal reports of spontaneous ESP, where high emotion on the part of the sender is likely to be involved. Subsequent studies appear to confirm the importance of emotions, with increased effect sizes being found for specifically emotional target material (Parker, Grams & Pettersson, 1998; Dalkvist & Westerlund, 1998; Bierman, 1995). This has often been interpreted as showing that the receiver is more likely to pick up on emotionally-charged targets, but perhaps the success of emotion-inducing targets acts via the sender as the emotional states resulting from viewing the target would be associated with a more globally coherent state of mental activity, giving higher amplitude waves of brain activity (Andreassi, 1989). Such a state could, under the PRiSM model, generate a stronger or more consistent psi stimulus.

Finally, the basic process involved with the model - that the receiver will show a measurable response relating to sender activity - is an effect already established in the experimental database. DMILS studies show exactly such a process and are often quoted as being one of the strongest effect sizes in the field (Schlitz & Braud, 1997).

1.5 Testable predictions

The primary predictions of the model are that:

I: Target relevant mentation should be marked by a 'reinforcement' event on the part of the receiver. The most likely way of detecting this would be via some form of physiological monitoring such as changes in skin conductance (SC).

II: False feedback of mentation to the sender should show as a decrease in success at the ESP task, the average magnitude of the decrease giving some indication of the relative importance (if any) of the proposed process. Given that clairvoyance studies suggest that there must be other modes of psi beside the one described in this paper, then it seems logical that no sender studies would show a decreased success rate comparable to no-feedback studies (i.e. a different psi process would have to be in operation) whereas false-feedback studies would show the lowest success rate as here reinforcement would be acting specifically to mislead correct target selection (i.e. There would be direct interference with any other psi process).

Secondary predictions could also include the following:

i. Known senders would be more successful than unknown senders as the former would have spent enough time with the receiver, enabling the receiver to learn to recognise any sender-unique characteristics of the psi stimuli. However, this does not mean that the two need be 'emotionally close', merely that they have spent a substantial amount of time with each other (e.g., workmates may be as successful as family members), though obviously emotionally close people will tend to pay more attention to each other and may still be the most successful participants.
ii. Although it would depend on individual mentation styles, there may be some form of progressive development in mentation themes as reinforcement occurs. Obviously by chance the receiver could come up with extremely complex, relevant mentation at any point, but a progressive trend would be found in most successful mentation.
iii. Elusiveness in Ganzfeld ESP relates largely to the stochastic nature of free-response studies (though the complex nature of psi experiences doubtless plays a role too). An experimental design that applies some parameters on spontaneous mentation should thus show an increased effect size. For example, rather than the pure free response design used, perhaps a restricted design wherein the receiver is shown a sequence of fixed words relating to the target pool and asked to free-associate on each word would be better. Then at least we could be sure that the reinforcement process had a chance of working.
iv. Task success will relate to discrete reactions on the part of the sender. That is, if the sender also shows a physiologically-similar reaction every time the mentation is incorrect, then there would not be clear reinforcement (this is based on the assumption that the psi stimulus is related to the physiological response of the sender - an idea put forward based on an analysis I performed on a DMILS study which included sender monitoring: Stevens, 2000)

2. Experimental evaluation of the model

2.1 Rationale

An initial test of the primary predictions of the PRiSM model was performed using a typical dyadic Ganzfeld ESP protocol (utilising the standard experimental suite at Edinburgh University, full details of which have been published before. See Dalton et al, 1996) but with two additions. First, the audio feedback loop in the experiment was manipulated such that all participants undertook two trials, one in a true-feedback condition - where the sender heard the receiver's mentation - and one in a false-feedback condition - where the sender heard prerecorded, unrelated mentation. The same false feedback audio sequence was used for all participants and was initially created by having the experimenter sit in the ganzfeld room during a dummy run and describe any random mentation that occurred. This resulted in a sequence with sparse mentation covering common themes such as running water, patterns of colour and kinaesthetic sensations. Trials were conducted back-to-back, with a pseudo-randomised condition order. A schematic of the setup is

shown in figure 2: condition A shows true audio feedback to sender of receiver mentation; condition B shows false audio feedback. False feedback was used as it would show a higher contrast between conditions (if any existed) by actively creating erroneous reinforcements, whereas a null feedback condition could leave open the possibility that other modes of psi (assuming it is not a unitary phenomenon) might come into play if the simpler channel postulated by PRiSM were unavailable. An analogy would be the apparent increase in audio and tactile sensitivity found in participants who have been blindfolded or who otherwise neglect a particular modality– although sensitivity does not actually increase in the short term, more information processing resources are available to the remaining channels (Dittmann-Balcarr, Thienel & Schall, 1999).

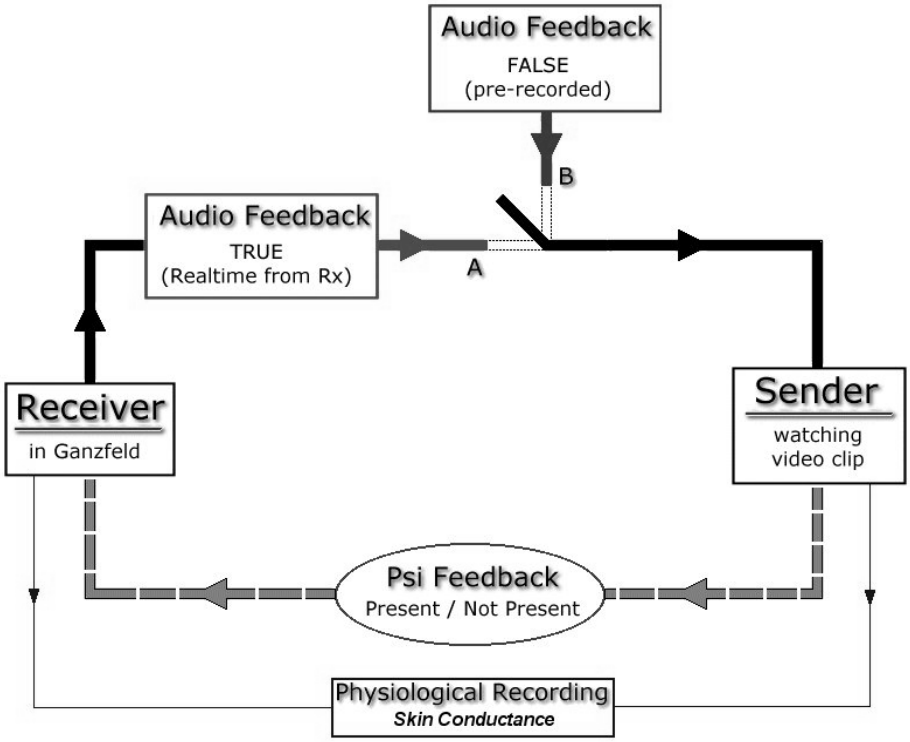

Figure 2: Experimental evaluation of the model

As the sender knew the receiver, they would probably realise that the false-feedback voice did not sound like the receiver, so a cover story was used: senders were told that the two conditions looked at whether the familiarity of the receiver's voice was a relevant factor in the way ESP might occur. To study this, they were told, one condition involved a voice filter that was used to alter the characteristics of the receiver's voice. A voice filter that slightly lowered the pitch of a voice was actually applied to the false audio feedback to make this believable.

Secondly, the receiver's SC was monitored to see if they showed the predicted reaction (i.e. a change in arousal indicated by an increase in skin conductance) relating to target-relevant mentation, indicating (under the model) that they were reacting to a sender-originated signal.

2.2. Experimental Hypotheses

Based on the primary predictions of the model, the pre-planned hypotheses are:

H1: At the time of the sender deciding the mentation is relevant (indicated by a timestamp-recording button press), the receiver will show a higher SC response in both True and False-Feedback conditions than at other times.

H2: The True-Feedback condition will show greater success at the ESP task (in terms of proportion of first-ranked targets) than the False-Feedback condition.

For comparison to past research showing that geomagnetic activity shows a negative correlation with ESP success, and based on an earlier paper by Dalton & Stevens (1996) looking at effects of local magnetic field intensity[3], there were two further hypotheses:

H3: The variance of the local magnetic field activity would show a positive correlation with the rank of the ESP target

H4: The intensity of the local magnetic field will show a negative correlation with the rank of the ESP target.

2.3. Method

50 participants were recruited by poster, newspaper articles and word of mouth to take part as receiver in two experimental sessions, both occurring on the same day. Participants were asked to bring along a close friend, partner or relative to act as either their sender or their receiver, depending on their individual preference. On arrival, participants were greeted and given a brief summary of the experimental protocol involved in dyadic ganzfeld ESP sessions. The receiver was shown into a sound-attenuated room and seated in a reclining chair with the sender present. After a brief explanation concerning their use, two electrodes were attached to the second phalanx of the index and second fingers of the non-dominant hand. These were sintered Ag-AgCl round cup electrodes with an 8mm diameter, affixed with adhesive collars and using pH balanced aqueous gel. They were connected via preamplifier to a model SC5-SA with 24-bit A/D conversion [PsyLab/Contact Precision Instruments, London, UK] and interfaced via serial port to a Pentium III PC. Data were sequentially sampled and saved to hard disk at 40 Hz. Headphones with boom microphone were placed on their heads and SC changes in response to receiver's deep breathing were then checked to ensure good electrode connection. Eye shields were not used as previous studies showed that participants found them irritating. Instead, receivers were told to relax with eyes open or closed as they preferred. Low-level red light was used to illuminate the room and all walls and ceiling were plain white.

The sender was then shown to a remote room 25m away and seated in a comfortable chair in front of a monitor. They were told that their role in the study was to in some way “send” the information about the target to the receiver and to press the button every time they heard the receiver say something that they considered to be relevant to the target ***for whatever reason***. It was emphasised that they could use any strategy they wished to send the information and that they could press the button as little or as often as they thought it was necessary. They were also told that one of the two sessions they were about to undergo would involve a voice filter being used on the audio feedback from the receiver, to see how familiarity of vocal feedback might affect the outcome (i.e. the cover story used to disguise the use of false audio feedback in one condition).

The first session was then initiated by the experimenter, who was situated in a separate control room. Once started, all stimulus presentation and physiology data collection was under automatic control by the computer; each session could be aborted but not interrupted. The controlling program was written by the author using Microsoft Visual Basic version 6, with all

[3] The correct term is actually *flux density*, however the simpler term *intensity* conveys the approximate meaning.

pseudo-randomisation making use of the inbuilt rnd() function, running under Windows Me. The computer first determined the feedback condition order according to a pre-existing pseudo-randomised and counterbalanced schedule. There was then a pseudo-random target pool selection from 25 possible sets of 4 one minute video clips, and pseudo-random selection of one of these clips as the target. The feedback condition order remained double-blind until after both sessions had been completed. A visualisation-based progressive relaxation MPEG file was then played to the receiver. By this point, sufficient time had passed for the electrode gel to have reached chemical equilibrium with the receiver's skin, so data collection was started. The target video clip (an MPEG stored on the computer hard disk) was then repeatedly played, with 1 minute rests in between each clip, to the sender for a period of 15 minutes. During this time, white noise was played to the receiver over the headphones, and both mentation and SC data was saved to hard disk. The receiver was then shown each of the 4 video clips in the selected pool and asked to rank each one for correspondence to their mentation. The audio link to the sender was switched off during judging to avoid them having an influence at this time (as the PRiSM model could apply at any time the sender is receiving feedback from the receiver). However, SC was not measured during this period as the receiver was typically much more active and excited during the judging period, which would make any meaningful analysis impossible. The receiver was then shown the actual target.

After a short break to check that sender and receiver were both okay (during which time the sender and receiver were kept separated), the second session was started. This was identical to the first session except for the differing feedback condition. At the end of this, sender and receiver were both debriefed as to the nature and purpose of the study. They were also later given feedback sheets summarising findings once the data from all 50 participants had been analysed.

Additionally, during all sessions, ambient magnetic field levels were monitored using a 3-axis fluxgate magnetometer (Mag03-DAM: Bartington Instruments, UK) sited approximately 1 metre behind the receiver's head. Initial investigation showed that the normal range of movements of receivers wearing headphones and SC did not produce a detectable change in ambient fields.

3. Results

During the debriefing session, all but two of the participants expressed surprise that the false-feedback was not actually the receiver: one had a vague thought that the false-feedback might have been a different person (i.e. that we had given them a different receiver) and the other was convinced that the true-feedback was false and vice-versa.

3.1 Skin conductance profiles

Raw SC data for each participant was converted to standardised z-scores i.e. expressed in units of each participant's standard deviation: $z_n = \frac{x_n - \bar{x}}{s}$

where z_n is the nth standardised SC datapoint, x_n is the nth raw SC datapoint, x is the mean raw SC level for the entire recording period and s is the standard deviation for the entire recording period. This technique allows between participant comparison and reportedly gives a robust measure for subsequent analysis (Sersen, Clausen & Lidsky, 1978). Standardised data were then epoched for the 6 seconds immediately after a sender-button press was recorded, detrended using a linear fit to remove the slight relaxation decline, and set to zero at t=0. Of the 100 participant datasets, 56 contained one or more button presses and so were included in the analysis. Mean number of button presses was 5.3 (s.d.=7.2) in the True Feedback condition and 1.1 (s.d.=2.3) in the False Feedback condition.

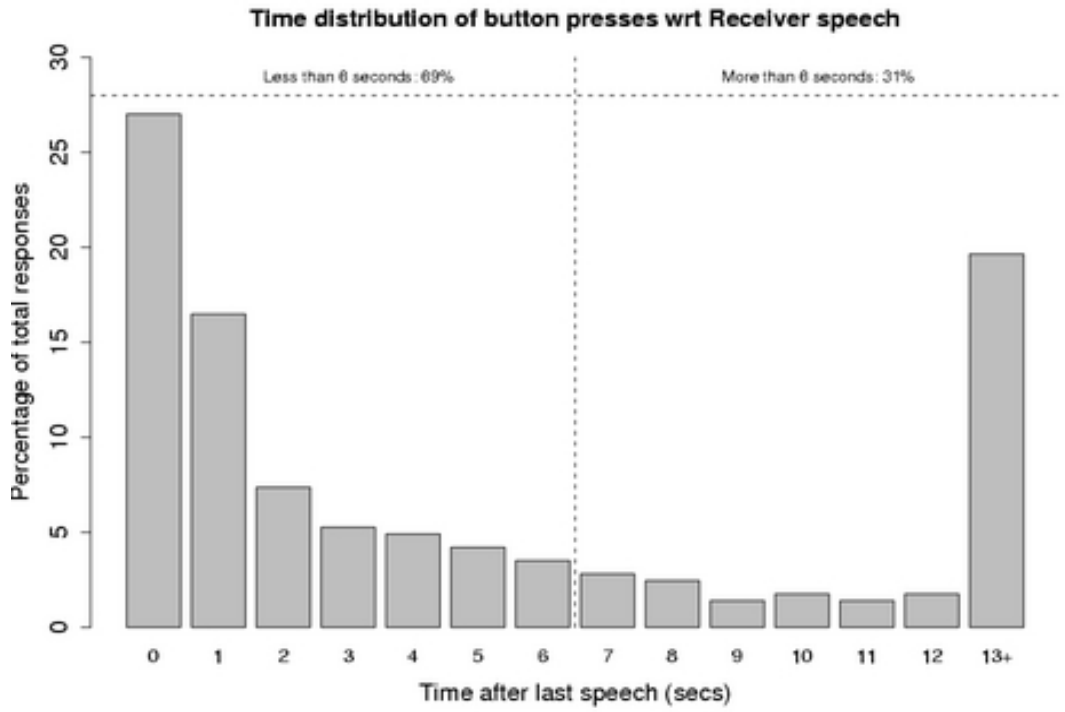

Figure 3: Histogram of button press distribution with respect to time since last receiver speech

However, it was possible that any increase in SC would be caused solely by the receiver speaking and did not represent a response to the hypothesised psi-signal (in either condition). To address this, the distribution of sender-button presses with respect to the length of time since the receiver had last spoken was first looked at. Figure 3 shows this distribution, irrespective of condition.
From this it can be seen that 69% of button pressed occurred in the first 6 seconds after the receiver last spoke, 27% of them being while the receiver was still talking, but 31% occurred at times greater than 6 seconds. The mean time was 8 seconds (s.d.=15), the median 2 seconds and the maximum 111 seconds.

Given that the majority of button presses occurred during or near speech, all SC responses to button presses that occurred within 6 seconds of speech ("UnderSix") were compared to all those responses to button presses which occurred more than 6 seconds after speech ("OverSix"). A value of 6 seconds was chosen as any arousal engendered by the act of speaking should have dissipated within this time. If any effect seen were related *only* to receiver speech and not to the button-press tags then we would expect to find that the UnderSix responses would be greater than the OverSix responses. To give some idea of the size of any effects, a baseline profile was generated by taking the same number of samples as there were button-presses from a participant's dataset using regions of SC data that did not themselves contain a button-press section. An attempt was made to ensure that these baseline periods were also more than 6 seconds after any speech or unusually deep breathing, although a full 6 second gap was not always possible due to some very talkative participants. The baseline thus represented the resting SC activity of a participant.

Figures 5 and 6 show the comparative profiles for the UnderSix and OverSix datasets respectively. Surprisingly, consistent SC responses do not occur where button presses are within 6 seconds of speech, but are apparent where button presses occur in quiet periods. This suggests that,

rather than speech creating an artefactual effect, it might instead interfere with the production of any effect. It was thus decided to use only the OverSix subset of data for statistical analysis, to maximise the effects seen as well as allowing a valid comparison to the speech-free baseline. SC responses from the OverSix set were thus collapsed into a single mean value for each participant. This resulted in an Experimental dataset consisting of 35 mean SC values, contributed by 29 different participants. Baseline data were similarly collapsed. The Experimental and Baseline datasets were then compared using a Wilcoxon signed rank test. This gave W=459, p=0.04 (1-tailed), indicating there was significantly greater arousal during speech-free button presses than during speech-free baseline periods. Splitting this data by feedback condition gives: True Feedback condition, N=28, W=332, p=0.03 (1-tailed); False Feedback condition: N=7, W=127, p=0.9 (1-tailed). Hypothesis 1 is therefore partly supported in so far as higher SC was found during times of relevant mentation, but this was only true for those times when the button presses were separated in time from any speech. This was also only supported statistically for the True Feedback condition, although the small N in the False Feedback condition makes it difficult to draw firm conclusions for this subset of the data .

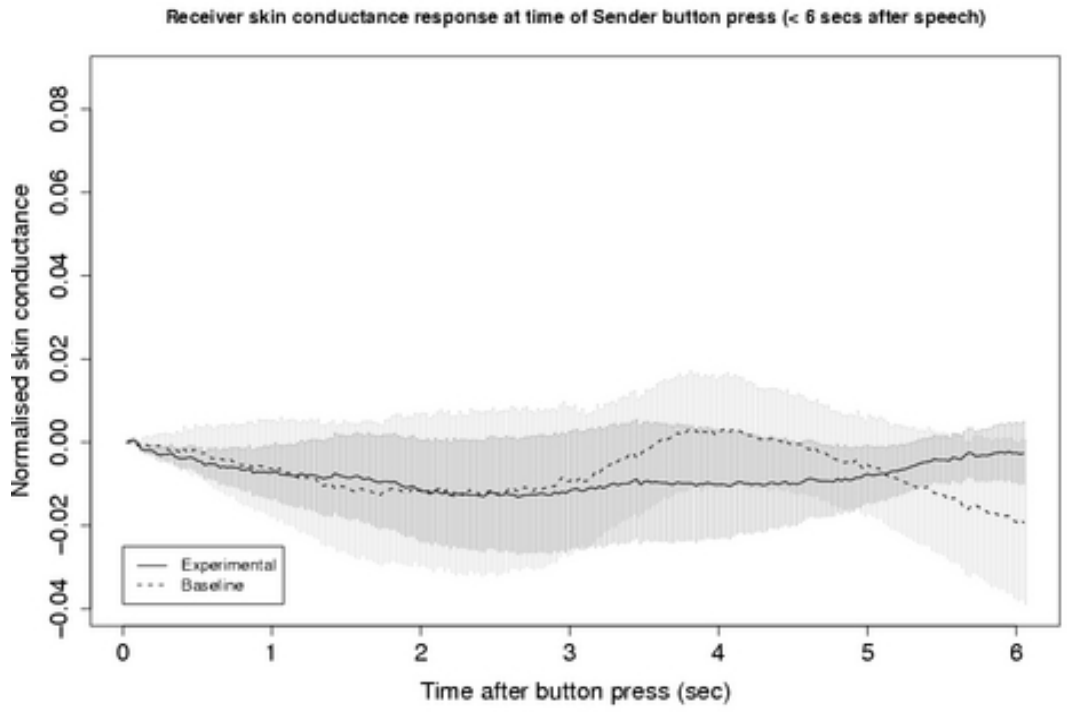

Figure 4: SC Profile showing average response to button press for UnderSix data subset, compared to baseline

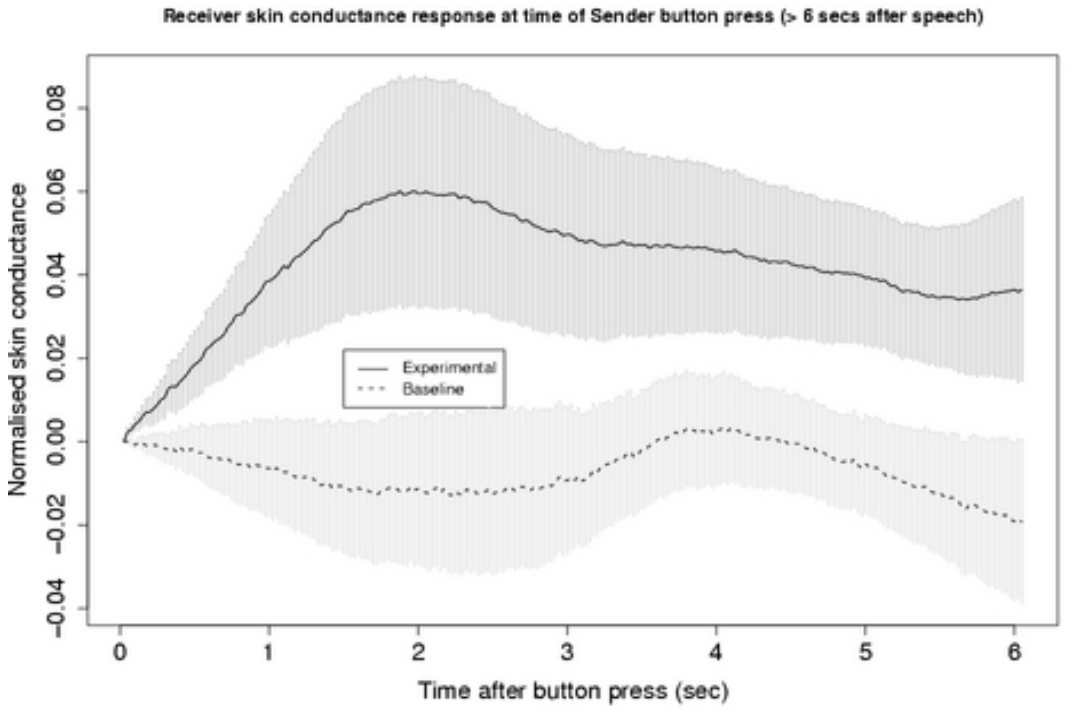

Figure 5: SC Profile showing average response to button press for OverSix data subset, compared to baseline

3.2 Success at ESP

Table 1 shows the degree of ESP success along with Rosenthal's Proportion Index, pi (Rosenthal & Rubin, 1989) as a measure of direct hits. The calculated value for this study does not support the notion that ESP was present in the study (p=0.45, 0.45 and 0.33 for True-Feedback, False-Feedback and overall), comparing unfavourably to the mean value for pi = 0.62 given by Bem and Honorton (1994) in their ganzfeld meta-analysis. Hypothesis 2 is therefore not supported.

Table 1: ESP success by rank and condition, along with Rosenthal Proportion Index and significance values

	Feedback Condition		***Total*** *(N=100)*
	TRUE *(N=50)*	***FALSE*** *(N=50)*	
No. Ranked 1st	12	12	24
No. Ranked 2nd	14	13	27
No. Ranked 3rd	16	15	31
No. Ranked 4th	8	10	18
Mean Rank	2.4	2.46	2.43
pi	0.49	0.49	0.49
Standard Error	0.08	0.08	0.06
p (1-t)	0.45	0.45	0.33

3.3 Possible relationship between the psi stimulus and magnetic fields

Table 2 shows the Spearman correlations between the measured local magnetic field and the rank of the ESP target (note: N=92 as 8 sessions did not record valid magnetic field data due to some initial technical problems with the magnetometer). It can be seen that the predicted positive correlation with the variance (target rank increases as magnetic field activity activity increases) was found only for the false-feedback condition. For the True-Feedback condition (where the PRiSM model could be operating to influence the ranking process) the direction of the correlation reverses. Hypothesis 3 is therefore partly supported, the exception being the condition under which the PRiSM model may operate!

Table 2: Local magnetic field measurements correlated with rank of ESP target

	Variance of Total Flux Density		***Mean Total Flux Density***	
	rho	**p (1-t)**	**rho**	**p (1-t)**
Overall (N=92)	+0.076	0.24	-0.198	0.03
TRUE Condition (N=45)	-0.235	0.94	+0.011	0.53
FALSE Condition (N=47)	+0.310	0.02	-0.415	0.002

A significant negative correlation between the intensity of the magnetic field and target rank was found overall, although this appears to be due only to the false-feedback condition data. Hypothesis 4 is therefore also partly supported, the exception again being the condition under which the PRiSM model may operate.

4 Discussion

The described study was intended as an empirical test of the primary predictions of the PRiSM model. The first prediction - that the receiver in a dyadic ESP situation would show a SC response during those times when a sender decided that the receiver's mentation was relevant to the target material – was partly supported, although the analysis proved to be less straightforward than was originally anticipated. It was realised that there might be a potential artefact in that any increase in SC seen after a sender-button press could be purely because most button presses occurred shortly after speech. It was thus decided to separate the SC data into 2 sets, corresponding to button presses which occurred 6 seconds of less after receiver speech (which totalled 69% of the entire SC data) and button presses which occurred more than 6 seconds after receiver speech (31% of the SC data). An apparent effect of increased SC was observed only in the over six seconds data, implying that not only was there no consistent artefact caused by the occurrence of receiver speech but that either the observed effect simply did not occur close to speech or that speech interfered with it. Subsequent analyses thus only used the over six seconds after speech data. Comparing the over six data to a speech-free baseline, a significant difference was found (p=0.04, 1-t), with similar results for the True Feedback subset of data (p=0.03, 1-t) but not for the False Feedback subset (p=0.9, 1-t), although the very low number of data points (N=7) in the latter makes any firm conclusion unreliable. In appearance, the normalised profile of receiver SC shows a response which looks similar to a small magnitude sensory response to a stimulus. The magnitude of the response is itself similar to that found in some DMILS research (e.g., see Stevens, 2000). An interesting point arises from the fact that an increase in arousal was found both when the sender was given accurate

feedback (i.e. they could hear the receiver's mentation in real-time) and when they were given false feedback (i.e. they thought they were hearing the receiver but were actually listening to a prerecorded audio track), implying that the receiver showed their SC change in response to the sender decision *irrespective of whether or not what they were saying related to the target*. This sheds some light on the question as to what the receiver might be "perceiving" during a ganzfeld ESP task: whatever causes the change in arousal cannot be directly related to the receiver's perception of the target material but instead must relate to the sender's perception or reaction to it. The simplest model would be that the receiver is responding to some sort of stimulus that originated from the sender: that the sender either causes the arousal or emits some sort of signal that the receiver then detects.

There was no support for the second prediction concerning a decrease in ESP success with False Feedback. However, this was primarily due to there being, in terms of the traditional analysis based on a first-ranked target measure, no evidence of ESP success at all (Rosenthal pi=0.49 for both conditions). One indication as to why the observed increase in receiver arousal at times of relevant mentation did not correspond to increased ESP success can be seen when correlating the number of sender button presses (representing a measure of how well the receiver's mentation matched the target) with the final rank given to the target. Based on the True Feedback condition data, this results in a Spearman's rho=-0.11 (nonsignificant) i.e., in the right direction but very small. This indicates that, even when the receiver is describing things that appear to relate to the target, this has relatively little effect on which target they finally choose. As was found with earlier DMILS studies (e.g., Sah and Delanoy, 1994), conscious indicators are often a poor measure of unconscious responses, a finding which lead to the increased use of unconscious measures such as skin-conductance. Likewise, if the amount of relevant mentation produced by the receiver only rarely leads to the correct identification of target, then doubt is cast on the reliability of the Ganzfeld protocol for exploring ESP effects. One suggestion might be to make use of a combined measure, using a physiological or other unconscious response in parallel with conscious responses. For example, with further work looking at the characteristics and reliability of the sort of responses seen in this study, it may become possible to use a physiological response to 'tag' the mentation. Tagged mentation only could then be passed on to an independent judge for target selection, essentially removing the 'noise' of irrelevant mentation.

Despite this lack of evidence for ESP based on the first-rank measure, the expected correlation between increasing local magnetic field variance and decreasing ESP success was found, though only in the False Feedback condition (rho=0.31, p=0.02). However, the direction of the correlation was reversed for the True Feedback condition, possibly implying that different primary processes were operating in each condition. The reversed direction in the True-Feedback condition (which represents the condition under which the proposed PRiSM model could be operating to influence the receiver's ranking process) possibly suggests that the PRiSM process is more akin to that seen in microPK studies, which also tend to show a negative correlation between success and magnetic field variance (e.g., Gissurarson, 1992; Nelson & Dunne, 1986). It is also interesting to note the finding that although the magnetic field intensity appeared to correlate with overall ESP success, this was due only to the False Feedback subset (rho=-0.415, p=0.002), again suggesting there may be different processes involved in ESP under different conditions.

One problem with this study arose from the difficulty of having the receiver engaged in an activity (in this case, verbally describing their mentation) while attempting to take SC data, as any activity may in itself be associated with a change in arousal. This was overcome by splitting the data into near to and far from speech subsets, but this meant that a lot of data was unusable. A better solution[4] in future studies of this type might be to specifically instruct the sender to wait for a few

[4] One referee suggested that an alternative protocol would be to give the sender 2 buttons, one to indicate relevant mentation and one to indicate irrelevant mentation. While this would be useful in marking mentation for later

seconds before pressing the button (or to make use of a more sophisticated software routine that inserts such a delay automatically). It might even be possible to construct a template of SC response at specified durations after speech, and to subtract this from the experimental data. That is, treat the occurrence of speech as an unwanted artefact and remove it.

Alternatively, a better approach may be to investigate the PRiSM model using a simpler protocol than the Ganzfeld, perhaps making use of a forced-choice protocol where the sender-reinforcement related to the receiver's viewing of potential target symbols chosen by an external random source to replace the receiver's verbal production of mentation generated by an internal "random" source.

4.1 Summary

This paper presents a model that could apply to cases of anomalous information transfer between people where there is some form of sensory feedback from receiver to sender. It is not intended to cover all psi experiences which appear to involve information transfer, or even to be a complete explanation for Ganzfeld ESP type experiments. What it does do is to offer a testable model that could help us to better understand what occurs during some psi experiences. It is intended to be a starting point for looking at some psi experiences with the notion that the information transferred may be less complex than is often proposed, and one that allows for the psi stimulus involving a range of physical processes rather than being a unitary phenomenon. Although traditional ranking measures of ESP did not show any difference between conditions in this study, there was a good degree of internal consistency for the more detailed analyses, suggesting that the proposed PRiSM process may indeed be involved in Ganzfeld studies with sender-feedback. There is some suggestion that the PRiSM process may be akin to microPK/bioPK i.e. that the sender is influencing the receiver, changing their arousal at times of relevant mentation.

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judging, and would provide a way of determining a good comparison skin conductance baseline, it does not get around the problem of any effect being lost in the arousal caused by the act of speaking. There is also the possibility that, by associating irrelevant responses with a specific sender action, that action might in itself generate a reinforcement psi-stimulus (remember that the psi stimulus in this model is hypothesised as having no semantic content but instead is generated by the sender's reaction to "significant" sensory input).

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