

PRECOGNITIVE HABITUATION*

An attempt to replicate previous results

Gergö Hadlaczky

This study was an attempt to replicate the positive results of a precognitive habituation (PH) experiment devised by Bem (2003). The procedure is based on the subliminal mere exposure (SME) design. In an SME procedure subjects are exposed to image-pairs in a preference task, after being exposed to one of those images (the target) subliminally. The target is preferred significantly more often due to the mere exposure effect. In the PH procedure the preference task precedes the exposure and images are of negative and erotic valence. It was hypothesized that due to exposure (in the future), subject preference will increase for negative and decrease for the erotic target images, especially for subjects classified erotically or negatively reactive (Bem, 2003). Also, that an overall (negative and erotic) effect would be shown. The results were not significantly above chance expectation for any of the hypotheses (50.0%; 47.2%, $p = .149$; 50.8%, $p = .279$).

Introduction

The goal of this study was to replicate the results attained by Bem (2003), in his precognitive habituation experiments. The purpose of those experiments was to measure if it is possible to demonstrate precognition, using unconscious processes. Current findings and the present state of parapsychology research in precognition will be described. Further, in order to have full understanding of the underlying concepts used in the present study, the theories and methodologies of research dealing with perception without awareness will be explored in detail.

Parapsychology

Long before the school of parapsychology was established, there existed numerous accounts of psychic phenomena dealing with dreams that come true, thought transference, shamanic healing etc (Rhine, 1961). Today it is not uncommon for the media to explore such phenomena in the form of fiction or pseudo-scientific documentaries. Further, there are professional healers, fortunetellers and clairvoyants at the disposal of the public. The fact that there have been accounts of such phenomena and that people claim to possess powers like fortunetelling and clairvoyance, does not prove their existence the least bit. However, it does point to that some people seem to have a vast interest in such phenomena.

Unfortunately the reliabilities of these accounts are quite low, as several reasonable explanations can be thought of to explain them. It could be possible that the author of such an

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account, although no dishonesty intended, might have colored his experience, simply to make the story more interesting. It could also be possible that while attempting to give a completely honest account of a psychic experience, the author was so impressed by the events surpassed, that he forgot to mention details that might have helped others find a reasonable explanation to the event. In fact, it happens quite often that an event that seems very unlikely or impossible to explain is in fact not so inexplicable at all. Here is an example: X is sitting in front of the television on a rainy day, watching a boring documentary about sunflower-seeds. The documentary is so boring, that X's mind starts wandering off, daydreaming about amongst other things an old friend Y. X hasn't seen Y for a number of years and it would be a great thing to find out what she's up to nowadays. All of a sudden the daydreaming is interrupted by a telephone call. X sluggishly answers the telephone only to find that the caller is none other than Y! "Oh my God!" screams X "Its telepathy!" Unfortunately, however the deduction of X is rather hasty. Namely, X forgot to take into account that the last time he and Y were on vacation together in Hawaii, they had been upset about the terrible weather. They stayed in the hotel all week and watched the only channel available: discovery and on it they had seen a wonderful documentary about sunflower-seeds. This detail, that slipped X's mind, gives a perfectly simple explanation to the whole scenario. As it was bad weather at both X's and Y's whereabouts at the time of the phone call, they both decided to watch TV. They both chose to watch the documentary in question and it reminded both of them of the above-described vacation. Finally, Y was close to the telephone and made the call that X hastily interpreted as telepathy.

Another possible explanation to why remarkable coincidental events might be interpreted as supernatural phenomena could be that the human mind is inclined to assign a coherent meaning to the random events that perspire around it. This possibility was investigated by Westerlund, Parker, Dalkvist and Hadlaczy (2005). In an experimental design called digital ganzfeld used in telepathy experiments (described in detail later) participants were asked to telepathically send the contents of a film they were watching to other participants. Those who were supposed to be "receiving" the telepathic information gave a verbal description of the thoughts that entered their minds while the "senders" were viewing the films. Finally, an independent judge listened to the descriptions of the receivers and compared them to four different films, one of which had been seen by the sender, the so called target film. The hypothesis was that the judge would be able to guess which of the films was seen by the sender, using the verbal description given by the receiver. While the experimenters did find a number of remarkable correspondences between the descriptions and the target films during the judging procedure, interestingly they also found them in films that the senders had *not* seen!

The correspondences in both the target and non-target films were rated equally remarkable by a "jury". This supports the idea that the correspondences in these trials were due to a cognitive illusion (Westerlund et al., 2005).

One question that comes to mind after reflecting on these arguments is whether there is any point in scientifically investigating psychic phenomena. The first argument springs from the first paragraph of this chapter namely that some people have a vast interest in it and that if such phenomena were proven to exist it would probably have a significant change on our daily lives. Another and perhaps more profound argument is that if such phenomena do not exist, it is important to demonstrate their inexistence. This is, amongst other things important to make sure that people that claim to have healing powers or other psychic abilities, really do have those abilities. It is important that for instance a cancer patient with good chance of

survival when treated in a hospital does not choose to undergo shamanic treatment instead, *if* that treatment is ineffective (or less effective) and will therefore lead to her death. It might seem logical that those who claim to have these powers should have the burden of providing evidence of their effects, especially so if they are selling them. It is often the case however, that there is nothing compelling those people to provide evidence of their psychic or healing abilities.

The majority of the studies concerning psychic phenomena have targeted the area of psi, more specifically its existence. Psi is a descriptive term denoting the anomalous process of information or energy transference (Bem & Honorton, 1994). This is further broken down into two subclasses called extrasensory perception (ESP) and psychokinesis (PK). ESP consists of three further categories, telepathy, clairvoyance and precognition. The common denominator amongst these three categories is that they deal with perception without the use of any of the known senses. Telepathy is the direct transference of information from one living organism to another. Under the definition, these transferences occur consciously or unconsciously in the forms of mental imagery, emotions or plain thoughts. Clairvoyance is the perception of objects or events from a distance. Finally, precognition is defined as the perception of future events not foreseeable by any means of known derivation. For all these three categories of ESP, it is by definition assumed that no use of any of the known senses is involved (Dalkvist & Westerlund, 2003). Lastly, PK refers to the influence of the human psyche on physical objects and future events.

Previous research and findings

In the past century there have been a number of investigations concerning psychic phenomena. The initial research projects employed rather unscientific methods and only yielded modest amounts of information on the subject. However, in the late 1920's J. B. Rhine and his colleagues took a pioneering step in the field of parapsychology by being the first to use established scientific methodology to research psychic phenomena. They had developed a technique, which made use of a special set of 25 cards consisting of five different symbols: square, circle, star, triangle and wavy lines. These cards were shuffled and given to a "sender" who lifted the card on top, then tried to inform the receiver about the symbol, using telepathy. If the receiver named the correct symbol, it was denoted as a "hit". If not, it was a "miss". When all the cards were exhausted, the number of "hits" was then compared to chance expectation (Rhine, 1938). This experimental style, while continuously improving with the aid of other parapsychologists and critics, yielded what looked like considerable support for the existence of PSI (Radin, 1997). The support initiated a modest bloom of parapsychologists and research funding, unfortunately though the majority of the parapsychologists are still unpaid workers and the funding is predominantly from charity or private investors. Nevertheless, the modest bloom also brought with it an increase in critics, which (at times) resulted in the significant improvement of experimental designs. It should be noted that Rhine's work is no longer viewed as "considerable support" for psi by the majority of contemporary parapsychologists. Although it has been criticized, Rhine's research is still regarded as a landmark in parapsychology.

One of the most prolific contemporary protocols in current parapsychology research is the above mentioned technique, developed in the early 70's called the ganzfeld method. This method was designed primarily to measure the existence of telepathy and is one of the most used methods up to date. At the same time -yet independently- of each other Honorton,

Parker, and Braud each developed this method (Braud, Wood & Braud, 1975; Honorton & Harper, 1974; Parker, 1975). It is based on the idea that, in order for a receiver to be more susceptible to telepathy, the perception of the usual senses has to be reduced, so that the “noise” does not interfere with reception of telepathic information (Parker, 1975). In the ganzfeld state, a homogenous light stimulates the entire retina. It has no contours or forms and is totally undifferentiated forming a stimulation that is equivalent to no stimulation at all (Reber, 1995). In the experiment the receiver is in a state of relaxation sitting or lying in a comfortable sofa or bed and further steps are taken to reduce perception in the other senses, e.g. by homogenous sound stimulation.

In total there have been hundreds of ganzfeld experiments with varying results. In order to produce acceptable scientific evidence, it is vital that experiments are independently replicated. In 1997 Julie Milton and Richard Wiseman performed a statistical test, named meta-analysis, which is developed for the purpose of measuring how much replication has taken place in these experiments (Milton & Wiseman, 1997, 1999)*. The main feature of this analysis is that it takes all experiments in a certain field into account (in this case ganzfeld telepathy experiments that begun after 1987) and makes combined interpretation of the results. The outcome of their analysis was statistically insignificant ($p > 0.05$). However, in later analyses where experiments after 1997 were included (but also only experiments after 1987), the results were considerably better, with a statistically significant outcome ($p = 0.005$) (Palmer, 2003). Although this seems convincing an important fact must be noted: without the database of one experimenter, Kathy Dalton, the new meta-analysis would yield an insignificant result. While it is perhaps unlikely that foul play is involved in her experiments, it is not a correct reflection of independent replication if the positive results are dependent on one experimenter. Therefore, it is safest at present not to consider telepathy a proven phenomenon. Further, even if the results were significant without the database of Kathy Dalton, it could still be stated that positive results of ganzfeld meta-analyses may be contributed to methodological artifacts as opposed to a communication anomaly.

Overall results in parapsychology are diverse, depending on researcher and research methods and the area the research is concerning. It could probably be said that there is a lack of homogenous evidence supporting the existence of phenomena like precognition, telepathy, clairvoyance or psychokinesis.

Perception without awareness

Perception is the recognition and interpretation of sensory stimuli. Basically it could be said that all the things we have heard, smelled, tasted, seen and felt, we have also perceived. The fact that we can talk about our perceptions to others is because we have a conscious knowledge about them. However, an interesting question is whether it is possible for us to perceive things unconsciously and if so can this perception shape our behaviour?

The first time the general public gained interest in these questions was 1957 (Merlike, 2000). A market researcher named James Vicary made the claims that the public in a movie theatre in the USA had been exposed to subliminal advertising messages during the presentation of a movie. Subliminal messages or images are shown for very short periods of time of approximately 3 ms, and are therefore impossible to perceive consciously. These messages stated “Eat popcorn” and “Drink Coca-cola” but due to their hasty presentation, no one in the

* The results of this meta-analysis was first presented in 1997 at a Parapsychology conference and published in the Proceedings of the Parapsychological Association, then re-published in 1999.

theatre noticed anything. Nevertheless, the sales of popcorn and Coca-cola rose 60% and 20% respectively in the next 6 weeks. Vicary never released any detailed description of his study and no independent replications were made. Further, in 1962 he admitted that the study was a fabrication (Merlike, 2000).

Despite the popularity the phenomenon of perception without awareness enjoys and has enjoyed in the entertainment industry, research has been done in the area since the beginning of experimental psychology. The first laboratory experiment regarding perception without awareness was provided by Pierce and Jastrow in 1884 (Bornstein & Pittman, 1992). They had devised an experiment where the subjects (themselves) received two weights and their task was to point out, which of the weights was heavier. Then they had to assign a confidence level to their answer ranging from three to zero where zero meant that the subject had not the faintest idea as to which of the two weights were heavier and therefore it seemed nonsensical to answer at all.

Pierce gave 706 out of his 1125 trials a zero confidence level (Bornstein & Pittman, 1992). On these 706 trials he was correct in determining the heavier weight 436 times, which constitutes 61.8%. Jastrow gave 1123 out of 1975 trials a zero confidence level and got 783 correct answers constituting a 69.7% hit rate. The expected hit rate for trials that have a confidence level of zero is 50%, if the subjects are merely guessing. The results provided by Pierce and Jastrow, exceed this amount significantly and were replicated by other researchers later on (Bornstein & Pittman, 1992).

The confidence level of zero indicates that according to the subject, he or she is not receiving any sensory information at all that could be used to answer the question of which weight is heavier. If this was the case, the subject would not be capable of guessing the right answer significantly more often than guessing the wrong answer. However, the fact that the subjects did get significantly more correct answers than expected, points to a discrepancy between what the subjects report they perceive and their true perception.

Assuming that the subjects are not lying about their confidence levels (it is unlikely that they had been lying considering, amongst other things, the successful replications) a simple explanation to this discrepancy is that the subjects do in fact receive sensory information (explaining the correct answers), but they are not conscious of it (explaining the confidence level of zero). In other words their perception was without awareness (Bornstein & Pittman, 1992).

The dissociation Paradigm

The results of Pierce and Jastrow generated further research and debate about the phenomenon of perception without awareness (Bornstein & Pittman, 1992). A great amount of research in this area utilizes one or another form of an experimental approach known as the dissociation paradigm. The basic logic underlying this approach is that two measurements are compared. The first, is the amount of perceived information available to consciousness (x); the second, is the measure of the perceived information available regardless of whether it is conscious or unconscious (y) (Bornstein & Pittman, 1992).

The underlying idea is that if the first measure (x) is zero, then that means that the stimulus information is completely unavailable to consciousness. If at this point, it is shown that the second measure (y) is greater than zero, then that must mean that stimulus information is

perceived, despite the fact that no stimulus information is available to consciousness. Consequently the perception is without awareness. Therefore if y exceeds x , it could be said that perception without awareness has been demonstrated. (Merikle & Reingold, 1998).

According to Merikle and Reingold (1992) three criteria must be fulfilled in order to show awareness without perception through the dissociation paradigm. First, an adequate measure of perceived information available to consciousness (x) needs to be selected. Second, this measure must be null sensitive. Finally given that this measure is null sensitive the other measure, for perceived information available regardless of consciousness (y), has to show significant sensitivity. Here is an illustration: When Pierce and Jastrow indicated that they feel zero difference between the weights of the two objects, then that is an indication of that there is no perceived information available to their consciousness (i.e. $x = 0$) regarding the weights of the objects. However, despite this fact they managed to guess the correct answer significantly more often than chance (i.e. $y > 0$). This means that they must have perceived information about the weight of the object but they were not aware of the information.

The main controversy regarding the dissociation paradigm approach is the choice of measure used for perceived information available for consciousness. First of all, there is no general consensus as to what constitutes an adequate measure. Secondly, most experiments utilizing this approach use either self-reports or perceptual discrimination and both measures have shortcomings (Reingold & Merikle, 1988).

A problem with self-reports, is that in different experiments there might be different instructions as to when the subject is to report zero awareness. This constitutes an instruction bias in the study. Even if this would somehow be evaded, another problem is that not all subjects have the same subjective definition of awareness, which also constitutes a bias. Basically, the burden of defining awareness is placed upon the subject as opposed to the researcher (Merikle, 1984).

In an experiment on semantics subjects were first shown a word (for instance “fork”) after which they were asked to discriminate between words and non-words (knife vs. fnike or ball vs. blaak). It was shown that people could discriminate faster, when the second word was semantically related to the first. So “fork” followed by “knife” was faster than “fork” followed by “ball”. An example of the other possibility of measuring perceived information available for consciousness through perceptual discrimination is illustrated by a design based on this semantic experiment (Marcel, 1983).

In this design the words first shown (“fork” in this example) were blurred to such an extent that it was impossible for the subject to tell apart occasions when the words were present and when they were not. Despite this, the results remained the same: subjects were better at discriminating words that were semantically related. So because “knife” is semantically related to “fork”, it was discriminated faster than non-related words like “ball”. Despite the fact that the subject could not tell whether s(he) had seen it or not! This experimental procedure is free of the shortcomings of those based on self-reports.

Comparable direct and indirect measures

A different approach for measuring perception without awareness is by making use of comparable direct and indirect measures of perception. A direct measure of perception is when a subject’s response to a task is a part of the task’s definition. While, an indirect measure

of perception is when a subject's response to the task is not a part of the task definition (Reingold & Merikle 1988). Basically when the experimenter asks the subject the clear cut question that she wants the answer to then it is a direct measure. However, an indirect measure is when the experimenter asks the subject a question and from the answer, it can be derived whether x has been perceived or not.

As an example imagine that perceiving a stimulus called x would automatically lead to that the subjects start clapping when they hear the word "apple". After the exposure to x, the direct measure of perception would be asking the subject whether she had perceived x. The indirect measure would be to say apple and then see whether they clap.

It is assumed that, in the case of conscious perception, the sensitivity of direct measures is higher than or equal to the sensitivity of indirect measures. This assumption is based on the following supposition: When a subject is asked to complete a task on the basis of a particular stimulus, then the subject should use all the available conscious information about that stimulus in order to solve that task.

However, if she is asked to perform an indirect task, she can at most utilize an equal amount of conscious information. Therefore, *if* the indirect measure provides greater sensitivity than the direct measure, then the process must be unconscious (Reingold & Merikle, 1988). A study utilising this train of thought was carried out by Zajonc (1968).

Mere exposure using subliminal stimuli

In this study, Zajonc (1968) attempted to produce mere exposure effects using subliminal stimuli. However, in order to understand how this design can be employed to demonstrate perception without awareness, the concept of a mere exposure effect has to be elaborated upon. The main idea behind it is that if humans or even animals are repeatedly exposed to the same stimulus they will develop a preference to it. For instance, Zajonc (1968) showed subjects Chinese ideographs and asked them to guess what they meant. The more they were exposed to the same ideograph the more positive adjectives they used to guess their meanings. Further, Taylor and Sluckin (1964) exposed domestic chicks for periods of time to either other chicks of the same age or matchboxes and noted that preferences were to whichever stimulus they had been exposed to.

The explanation to this phenomenon proposed by Zajonc (2001) is that it is a unique form of conditioning that occurs. In classical conditioning the unconditioned stimulus (meat) elicits an unconditioned response (salivation). If the unconditioned stimulus is combined with a conditioned stimulus (bell) enough times, the conditioned stimulus will elicit a conditioned response (salivation due to the bells sound). In the case of repeated mere exposure however, being exposed to a novel stimulus is the conditioned stimulus and developing a preference to it is the conditioned response. The unconditioned stimulus is the fact that there are no negative consequences following the exposure. In other words there is a *lack* of stimulus. When one is confronted with a novel stimulus it elicits both avoidance and approach responses but because of the unconditioned stimulus (which in this case is the lack of negative consequences) the avoidance responses disappear with each exposure while the approach responses continue. This way positive affect can be attached to neutral stimuli by repeated mere exposure.

Subliminal mere exposure (SME) studies fulfil the methodological requirements (direct-indirect model by Merikle & Reingold, (1988) for demonstrating perception without awareness. The first one of these studies was conducted by Kunst-Wilson and Zajonc (1980). In this study participants were first, subliminally exposed to 10 randomly selected irregular polygons for 1ms. Each of the polygons was presented 5 times and none of the subjects reported seeing any of them. After this the participants were exposed to pairs of polygons for 1s. Each pair included one new polygon and one that they had been subliminally exposed to before. The task was two-fold: subjects had to indicate, which of the two polygons they had seen previously (recognition task) and which of the two polygons they preferred (affect task). The order of the tasks was counterbalanced across subjects.

As described earlier perception without awareness can be demonstrated, using a direct measure and an indirect measure of perception. In this case the recognition task was the direct measure, as it instructed the subject to indicate which of the two polygons they recognised. The affect task on the other hand was the indirect measure, as it instructed the subjects to indicate which of the polygons they preferred but actually measured recognition. This is because according to the mere exposure hypothesis the polygons that subjects had been exposed to previously were more likely to be preferred.

The results of the study showed that subjects correctly identified the previously presented polygons 48% of the time in the recognition task, while they preferred the previously presented polygons 60% of the time. This means that the indirect measure of stimulus discrimination was significantly more accurate than the direct measure of responding. Further, the direct measure shows zero sensitivity because the results are as dictated by chance. This in turn means perception without awareness had been demonstrated (Kunst-Wilson & Zajonc, 1980).

An interesting variation of this experiment was done by Dijksterhuis and Smith (2002). Instead of showing neutral stimuli, like the polygons used in the previously described experiment, they subliminally exposed participants to 6 extremely positive words and 6 extremely negative words. After exposure subjects were asked to rate the valence of 24 words on a scale from -10 (extremely negative) to +10 (extremely positive). Twelve of these words were the original positive and negative words and 12 were new words (6 positive and six negative). The results showed that words that the participants had been exposed to previously were rated less extreme both positively and negatively. In other words it is hypothesised that if an organism is exposed to extreme stimuli, it will become used to it and the stimuli will seem less extreme than initially. This process is called affective habituation (Dijksterhuis & Smith, 2002). The basic logic that is put forth to support this idea is that during the initial exposure to the extreme stimulus, the evaluative system of the organism gives a signal that something is happening (either positive or negative) that craves attention. However, once such a signal is given there is no point in giving it over and over again and so habituation to the stimulus occurs (Dijksterhuis & Smith, 2002).

Precognition

As stated previously, this study uses a method that requires the understanding of perception without awareness, but essentially it is a parapsychology study dealing with precognition. The most common type of experimental design in precognition research has been forced choice

tests (Radin, 1997). Usually in this experimental design subjects are told to pick one of several (most often two) stimuli. After they indicate their choice, one of the stimuli is selected again but this time it is done randomly or pseudo randomly (most often by a computer). So, basically the subjects are supposed to predict the stimulus that is going to be chosen in the future. If the stimulus chosen by the subject is the same as the randomly selected one, then the trial is a success and is noted down as a hit. If they fail to select the stimulus that is shown to them in the future, then the trial is noted down as a miss.

Finally the experimenters compare the ratio of hits and misses to the ratio that would be expected if the subjects were choosing according to chance. If the subjects had no precognitive abilities they would only be guessing and because there are only two options, out of which one is right, they would be correct half of the time they guess. In other words if there are two stimuli then the expected proportion of hits and misses is 50%, thus if the subjects received a significantly higher proportion of hits than 50%, then that would count as support for the precognition hypothesis.

The experimental designs differ slightly, for instance a large range of stimuli have been used, such as cards (Tart, 1983), colored lamps (Palmer, 1996) or images (Radin, 1997) and as mentioned earlier the randomization procedure varies as well. Nevertheless, a meta-analysis used to measure the overall effects of all the forced-choice tests conducted on precognition between 1935 and 1987 was published by Honorton and Ferrari (1989). The results showed an extremely small effect size of 0.02 and an astronomical combined Z-score of 6.3×10^{-25} .

These significant results were not due to a single investigator receiving many extremely high scores (which would severely lower the reliability of the analysis). Nevertheless, it could be argued that the significance of the meta-analysis is due to that the earlier studies, inferior in quality, were more successful than the latter ones with better quality. However, it is noted that there was a slight positive correlation between quality and effect size, which is an indication of the exact opposite: that the higher the quality in a study had the more successful it was (Utts 1991). Despite these results, meta analyses should often be interpreted carefully, as the success of the replications could be due to one (or several) artifact(s) present in all (or several) of the studies included in the specific meta-analysis (Parker, 2004).

Unconscious precognition

In order to travel the path of the unconscious precognition discussion, a small detour has to be taken in an area not entirely related to this subject. A research study based on the Stroop-paradigm called cognitive interference was published by Klintman (1983). In this study, the subject was first shown a patch of color that s(he) had to identify as fast as possible. Then s(he) was shown a second stimulus: the written name of a color that had to be identified as quickly as possible as well.

In the trials where the color patch matched the written word (for instance if a blue patch is followed by the written word blue), the task is simple and causes little difficulty if any. This is because when the patch is seen, the associations to that color are activated in the memory. However, when there is a mismatch between the patch and the word (for instance if the color patch shown initially is red followed by the word green), it was hypothesized that the task would become more difficult (Klintman, 1983).

To test this Klintman measured the response times for the second stimulus, hypothesizing that for the mismatching trials it would take a longer time to identify the written color name than it would for the matching trials. Also, to obtain a baseline which he could compare the results to, he decided to measure the response times for the first stimulus (the color patches) as well. As expected, the response times for the second stimulus were significantly longer in the mismatching trials than in the matching trials, showing a cognitive interference effect (Klintman, 1983).

During the analysis of the data however, Klintman noticed a strange anomaly. The response times for those first stimuli that were followed by a matching second stimulus were shorter, than for those first stimuli that were followed by a mismatching second stimulus. To illustrate, when a blue patch was followed by the word blue, the subjects identified the *patch* faster, than in trials when it was followed by the word green (or any other mismatching word) (Klintman, 1983).

An explanation to this phenomenon entertained by Klintman is that, one perceives the second stimulus in the future through precognition, this information then travels back in time to the point when one is exposed to the first stimulus. If the trial was using mismatching stimuli then it would create a phenomenon that Klintman called a time-reversed interference (TRI). This interference he states is responsible for the delayed response times in mismatching trials. Another aspect of this study was that if the subjects had perceived information in the future, they were completely unaware of that (Klintman, 1983).

Several years later, Camfferman (Radin, & May, 2001) attempted a replication of Klintman's TRI effect. He exposed participants to colour names followed by colour patches (name-colour task), or colour patches followed by colour names (colour-name task), the order was counterbalanced within groups. The replication was successful for the name-colour task only. However, due to a positive correlation that was found between the response times for the first and second stimuli, Camfferman concluded that the tasks are not independent. The TRI effects were more likely due to a general alertness than precognition.

More recent attempts to demonstrate unconscious precognition have taken advantage of a psychophysical reflex called the orienting response. This response constitutes changes in a set of physiological functions (like the dilation of pupils, sweating, increased heart-rate), when the subject is exposed to strong emotional stimuli (Radin, 1997). The purpose of this reflex is to sharpen our perception, make us physically stronger and to make the mind sharper for decision making when for instance we are confronted with a lion or in other dangerous situations. In humans, these reactions can be elicited by emotionally provocative pictures, films etc (Radin, 1997).

In an experiment by Radin (1997), electrodes were attached to subjects' fingers to measure electrodermal activity. This is basically a measure of some of the reflexes that occur when there is an orientating response to an emotionally provoking stimulus. Once the electrodes were attached, subjects were comfortably seated in front of a computer screen. As soon as the subject pressed the mouse, indicating that she was ready to begin a trial, the computer randomly chose a picture from a large pool of pictures. After the picture was chosen the subject was shown a blank screen for 5 seconds. This was followed by a three second period where the subject was exposed to the randomly chosen picture, and then another five second blank screen period, and finally a last five second blank screen period called the resting phase. This 18-second procedure was one trial. The next trial started as soon as the subject pressed

the mouse button again and during the whole procedure the electrodermal activity was recorded and stored in the computer. The picture pool consisted of neutral pictures and of emotionally provoking pictures in a ratio of 3:1 (Radin, 1997).

According to the orientating response it is expected that the electrodermal activity of a subject rises slightly before the targets are shown (the first five second period), as they anticipate that something is going to happen. In the beginning of the second period (the 3 second period where the pictures are shown), the activity should rise further if pictures are emotionally provoking and remain constant if they are neutral. In the third part of the experiment (the 5 seconds after the picture were shown), the electrodermal activity should rise very high for the emotional pictures and stagnate for the neutral ones. Finally, everything should stabilize in the resting period. The results were just as described and as predicted by the orienting response theory. However, in the first five-second period, the electrodermal activity was significantly higher for those trials that showed emotionally negative pictures, than for those trials that showed neutral images. In other words, the subjects' electrodermal activity was higher *before* the images were shown (Radin, 1997). Some researchers view this as a phenomenon that is justifiable from an evolutionary perspective. If one can anticipate danger then one would have a better chance at survival (Radin, 1997; Bem, 2003).

This phenomenon known as the presentiment effect has been successfully replicated by Bierman (Bierman & Radin, 1997). The results of these studies are analogous to those made by Klinton in his time-reversed effect studies, in the sense that both seem to provide support for the idea that a response can be elicited in the present by stimuli in the future. A negative side of the presentiment studies is however, that they are difficult to replicate due to the complex procedure and apparatuses necessary for the experiment.

Precognitive Habituation

In order to simplify the experimental procedures used in the presentiment studies a new protocol has been designed by Bem (2003), called precognitive habituation. This process utilizes previously discussed phenomena, namely the mere exposure effect and the habituation hypothesis.

In precognitive habituation (PH) experiments, subjects are asked to view pairs of either negatively arousing (mutilated bodies etc) or positively arousing (for instance erotic) pictures and are instructed to choose the one they prefer. After they have chosen an image a computer randomly selects one of those two images and flashes it to them subliminally.

As described earlier, in mere-exposure studies, it has been shown that subjects prefer images they had previously been exposed to (Kunst-Wilson & Zajonc, 1980). Further, it has also been shown by Dijksterhuis and Smith (2002), that if one is exposed to extremely positive or negative stimuli then the emotional effect of the stimuli lessens due to habituation.

The idea behind PH is based on these two premises in the following way: If the subject can see into the future, then one can assume, that at the time she is shown an image-pair, she has already been exposed to one of those images because she has "seen" it in the future. This would lead to a preference for that image, given that the image is neutral or emotionally negative. To illustrate, first the subject sees the negative image in the future and becomes habituated to it. Then she sees the same image plus another one (negative as well), and is asked to choose between them according to preference. She chooses the image she had been

habituated to (as it seems less negative than the other image) and then she is shown that image, but this time in the present. If the image shown in the future were emotionally positive, then the subject would prefer the *other* emotionally positive image shown to her in the present (Bem, 2003). It is hypothesized by Bem that this would perhaps work even better if the stimuli were shown subliminally, as in that case the whole process would be unconscious like in the Klintman study and in the presentiment studies. Further, it is also the case that mere-exposure effects are more powerful using subliminal stimuli (Bornstein, 1989).

For both negative and positive (erotic) trials, a hit is when the subject chooses the target picture on the preference task. The target picture is of course the picture randomly selected by the computer after the preference task (see figure 1). The precognition hypothesis can be entertained under the condition that the erotic picture preferred by the subject is *not identical* to the one she is exposed to in the future and that the negative picture *is identical* to the one she is exposed to in the future. Due to this fact, there should be a higher (than expected by chance) number of hits on negative trials and a lower (than expected by chance) number of hits on erotic trials in order to support the precognition hypothesis. Another refinement in this design is that before the experiment subjects are given questionnaires designed to explore those psychological variables that, could possibly have an affect on psi performance. This way, in the future one can use subjects based on those psychological “requirements” identified by the questionnaire.

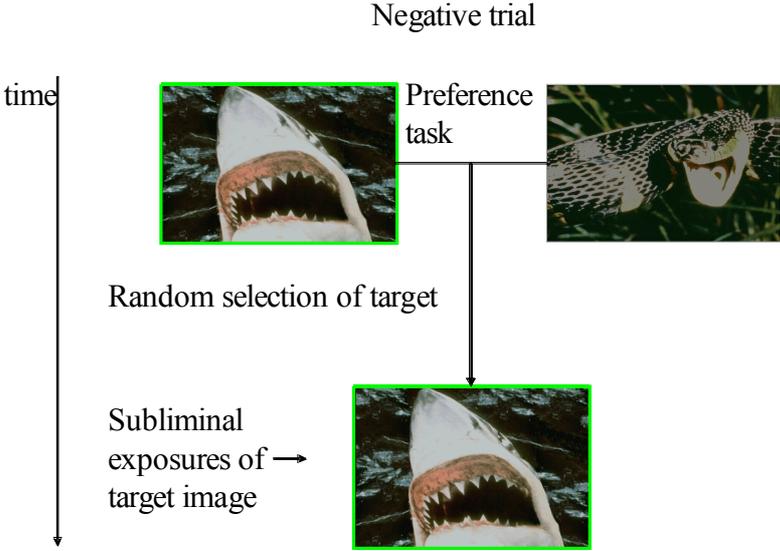


Figure 1. Precognitive habituation protocol for a negative trial.

The results obtained by Bem utilizing this procedure vary slightly, as he has used different versions of this design. In the first series he used picture pairs that were divided into 3 categories of valence and 2 levels of arousal: high/low positive, high/low negative and high/low neutral. There were no erotic pictures in this series. Significance was only obtained for the high negative category, where the overall hit-rate was 55.2% ($p = .010$, two-tailed) (Bem, 2003), meaning that subjects selected those highly negative images that were later on selected by the computer. These results seem theoretically consistent with those achieved in the presentiment studies by Bierman and Radin (Radin, 1997; Bierman & Radin, 1997) in that it seems that subjects can anticipate threatening stimuli. However, there should also be

significant results for the low affect and positive categories according to the mere-exposure effect and habituation hypothesis. Regarding the low-affect stimuli, Bem argues that this is not necessarily so, because in the original studies, mere-exposure effect can only be showed when the time interval between the stimulus and the preference task is several minutes long. In the precognitive habituation study however the time interval is a couple of seconds (Bem, 2003). Unfortunately however, Bem does not comment on the non-significant results on the positive pictures.

The next two experiments conducted were designed to replicate the results of the first study (Bem, 2003). However, the procedure was modified. In one of them only two types of pictures were used (negative and low-affect) while in the other a third category of pictures was introduced (erotic). The collective results of all three studies *together* show a significant psi effect for both negative (53.0%, $p = .002$, one-tailed) and erotic trials (47.1%, $p = .033$, one-tailed), while no significance was found for neutral trials (Bem, 2003). Unfortunately however, the results for each experiment alone are not reported by Bem.

Further changes were made in the next three experimental series. The exposure times, picture pool and the questionnaire were varied with each experiment. The collective results (of *all six* studies) were significant again (negative 52.6%, $p = .0008$, one-tailed and erotic trials 48.0%, $p = .031$, one-tailed) (Bem, 2003). It was also noted that the scores received for the three items measuring “erotic reactivity” and the two measuring “emotional reactivity” on the questionnaire, successfully predicted subjects’ performance on erotic and negative trials. These items were adapted from Zuckerman’s sensation seeking scale (Bem, 2003). Those subjects that were rated emotionally reactive, showed a significant psi effect on the negative trials, and those rated erotically reactive showed significant results on the erotic trials. Further, subjects classified non-reactive showed non-significant results. The deduction is that when making PH studies in the future, one should use subjects that are emotionally and erotically reactive (Bem, 2003). Unfortunately however, neither the overall results for each of these experiments by itself nor the collective results for these three experiments are reported.

At this point, an attempt to replicate the PH-effect was made by a skeptical colleague of Bem (Kenneth Savitsky). However, Bem asked Savitsky to make modifications to this experiment as well. There were no erotic pictures, and the exposures were supraliminal. Collectively the results were insignificant, however if only the emotionally reactive participants were counted, a PH-effect was found (with hit rate of 56.0%, $t_{31} = 2.66$, $p = .006$). Bem states that it seems as though the supraliminal exposures do not eliminate the PH effect for the negative trials, but they do so for the erotic trials (Bem, 2003).

In Bem’s last study in the series, there was a serendipitous finding: when subjects were exposed to the low-affect pictures more than 9 times, a phenomenon Bem named precognitive boredom appeared. This constituted a systematic preference of non-target, low-affect images during trials. In his study, Bem received a 46.8% hit-rate significantly below chance expectation for the low-affect pictures ($t_{39} = -2.12$, $p = .04$, two-tailed) (Bem, 2003).

A final and interesting discovery about the first three studies conducted by Bem is that there were considerable sex differences. In fact, all of the PH effects found in those studies were due to the scores of female participants (Bem, 2003). However, such a difference was not reported in any of the later studies made by Bem (2003), Savitsky (2003) or even, in yet another variation of the precognitive habituation conducted by Savva, Child and Smith (2004).

The goal of the study by Savva et al. (2004) was to attempt a replication of the PH-effect but with an ethically less problematic design. They had not used any erotic images and had replaced all previously used negative images with images of spiders. Then, they asked participants to fill out a questionnaire about fear of spiders and were categorized into two groups according to their results on the questionnaire: spider-fear and no-fear. The hypothesis put forth by Savva et al. was that the spider-fear group would be more likely to choose the target picture when the pictures were of spiders than when they were low-affect images. For the no-fear group, no difference was expected.

For the spider-fear group, there was in fact a significant difference between hit-rates for spider stimuli and hit-rates for low-affect stimuli ($p = .021$) and no such difference was found for the no-fear group. Nevertheless the overall hit-rate was not significantly above or below chance, and neither was it for the no-fear group alone. The hit-rates produced by the spider-fear group did not significantly deviate from the expected 50% either, although it was not far (54%, $p = .051$, one tailed) (Savva, Child and Smith 2004). This means the spider-fear group did not anticipate the spider pictures often enough to gain significance, but they did so significantly more often than with the low-affect pictures.

The purpose of the present study was to replicate the PH-effects produced by Bem using the PH-protocol. However, due to the number of different designs used, the definition of the PH-protocol is somewhat ambiguous. From the several different versions utilized up to date, the one in the present study was chosen because it has had most success and seemed to be the most promising candidate. It includes both erotic and negative images. The software and questionnaire used were also adopted from the experiments carried out by Bem.

The hypotheses are as follows:

1. There will be a significantly higher overall (for erotic and negative trials together) hit-rate than expected by chance. Because the PH hypothesis predicts target misses on the erotic trials, the hits for erotic trials are converted to target hits (so that e.g. 40% becomes 60%) when testing this hypothesis.
2. There will be a significantly lower hit rate than expected by chance for erotic trials for erotically reactive participants (“erotically reactive” defined as subjects whose scores are higher than three on the erotic screening questions).
3. There will be a significantly higher hit rate than expected by chance for negative trials for emotionally reactive participants (“emotionally reactive” defined as subjects whose scores are higher than three on the negative screening questions).

Method

Participants

Forty-seven participants (24 women and 23 men) ranging from ages 19-64 years ($M = 29$ years, $SD = 9.9$ years) participated in the experiment. Amongst the participants there were 32 undergraduate students (who received course credits in return for their services) and 2

lecturers from the psychology section of the University of Stockholm. Of the remaining participants, 10 were students enrolled in other courses and 3 were employed in various professions. These participants were acquaintances of the experimenter.

Apparatus and Materials

A Dell Latitude notebook computer attached to an external CRT monitor (Samsung SyncMaster 17 GLi) with a screen resolution of 1024 x 768 pixels was used for the study. The external CRT monitor was used to avoid inconvenience that could have been caused by the notebooks LCD display. A “regular” (non-touchpad) mouse and the internal speakers of the notebook were utilized.

The software and images were the same as used by Bem (2003) in experimental series 100 and 200 and by Savva et al. (2004). Most of the images were taken from the International Affective Picture System, however as the erotic images were deemed quite mild they were supplemented with more graphic erotic images from the Internet (Bem, 2003).

As the target pictures were to be exposed subliminally, backward masking and parafoveal exposure procedures were used in combination to counter the difficulties of subliminal exposure due to the slow refresh rates of computer screens. Backward masking constitutes a procedure where a neutral image is flashed onto the target image right after exposure. This erases the target image from the retina. In parafoveal exposure, the subjects focus on a crosshair in the centre of the screen while the pictures are flashed on either left or right side of the crosshair resulting in that the picture appears on the side of the fovea. Combining these two procedures an exposure lasted 17ms.

Further the software also contained a 20-item questionnaire, measuring the psychological traits thought to have been capable of predicting PH-effects in subjects. The two items designed to measure erotic reactivity were adopted from the Sensation Seeking Scale (Zuckerman, 1974) and the origins of the other items are not stated in Bem’s report. The items measuring emotional and erotic reactivity can be found in Appendix 1.

Procedure

Upon entering the laboratory the participants were warned that during the experiment they would be exposed to very unpleasant and to erotic images. They were given a consent form and were prompted to read through and sign it if they agreed to participate in the experiment. After they had signed the form they were told that the experiment dealt with Extrasensory Perception. The subjects were then given instructions and left alone in the lab to start the experiment.

After answering the 20-item questionnaire on the computer, the subjects took part in a 5 minute cool-down exercise. This consisted of listening to ocean waves with closed eyes or while looking at a picture of the starry sky taken by the Hubble telescope. Subjects were then exposed to pairs of pictures (erotic, neutral or negative pairs) side by side and asked to indicate which one they preferred by clicking on it with the mouse. After a picture was selected, the computer recorded the selection, then randomly chose one picture of the same image-pair and subliminally exposed it to the subject 12 times in a row. This appeared as a series of flashes to most subjects, which they were prompted to passively observe. This

procedure was then repeated 48 times with 12 erotic trials, 12 negative trials, 12 low-affect trials and 12 sets of filler trials that were not scored for psi.

The sequence of the picture pairs was also randomly selected for each trial, as was the left/right placement of each picture during the preference task and during the subliminal exposure. The randomization was done by using a pseudo random number generator, in the programming language True BASIC.

When the experiment was finished the results of that specific subject was shown on the screen. The experimenter explained in detail how the design was used to measure precognition and answered any questions the participant had.

The PH-program supplied by Bem contains an automatic data analysis feature that was used. However, as it is also possible to export the data, the presented results were analysed using SPSS.

Results

An alpha of 5% was used in all analyses. No correction has been made for multiple analyses.

Hypothesis 1

The hit rate for the overall study was 50.8% was not significantly above chance expectation: $t_{46} = 0.59$, $p = .279$ (one tailed). This constituted a one-sample t-test for all of the negative and erotic trials. As mentioned earlier, due to that the PH hypothesis predicts target misses on the erotic trials, the hits for erotic trials have been converted to target hits for these calculations (so that e.g. 40% becomes 60%).

Hypothesis 2

Subjects that received a mean greater than 3 on their scores on the erotic questions were classified as “erotically reactive”. The hit-rate for these subjects on the erotic trials was 47.2% which is in the right direction, however, not significantly below chance expectation: $t_{20} = -1.07$, $p = .149$.

Hypothesis 3

Subjects that received a mean greater than 3 on their scores on the questions measuring emotional reactivity were classified “emotionally reactive”. The hit-rate for these subjects on the negative trials was exactly 50.0% which is exactly at chance expectation

Exploratory analyses

A one sample t-test was made that took all of the trials into consideration: negative, (converted) erotic and low-affect, however this yielded non-significant results as well with a hit-rate of 50.8%: $t_{46} = .592$, $p = .279$.

In order to explore the finding that Bem termed boredom effect, the low-affect trials were also tested in this study. There was a 48.2% hit-rate on the low affect trials, and although this result is in the right direction, it is not significantly below chance expectation: $t_{46} = -.636$, $p = .264$.

The other interesting finding in Bem’s experiment, namely that women performed significantly better than men, was also further explored. For this study, this was only true for the negative trials. The hit-rate of women (53.1%) was in fact significantly higher than the hit-rates of men (43.8%): $t_{45} = -2.420$, $p = 0.02$ (two-tailed). The strange thing about this result is that the significant difference is not due to that women got so much higher scores but to that the men got so much lower! In fact, the 44% hit-rate produced by the men on the negative trials is significantly below chance expectation: $t_{22} = -2.17$, $p = .02$ (two-tailed).

Further, the hit-rates of subjects rated erotically reactive (47.2%) were compared to those that were not reactive (48.0%) for the erotic trials. There was no significant difference between these two groups: $t_{45} = .296$, $p = .384$.

The hit-rates of subjects rated emotionally reactive (50.0%) were compared to those that were not reactive (49.8%) for the negative trials. There was no significant difference between these two groups: $t_{45} = -1.281$, $p = .10$.

A 3-item scale measured erotic reactivity and a 2-item scale measured emotional reactivity. A reliability analysis was run on each of the scales: the Cronbach's alpha of the emotional reactivity scale was .64 indicating a moderate internal consistency and the erotic reactivity scale had an alpha of .29 indicating very low reliability.

Finally, the data were analyzed for correlations between session length and the different trials: overall ($r_{45} = -.10$, $p = .50$), negative ($r_{45} = -.11$, $p = .46$), erotic ($r_{45} = -.05$, $p = .71$) and low affect ($r_{45} = -.11$, $p = .47$).

Discussion

The hypotheses

The results provide no further support for the first hypothesis. It cannot be concluded however that precognition itself does not exist. This is partially due to the complicated nature of the design. Even if we assume that precognition does exist, it would be possible that no PH effect could be demonstrated. For instance, under the condition that it is not possible to habituate someone in the future, or simply if mere-exposure effects do not work in a time-reversed paradigm then the experiment would show no significance, despite the fact that precognition does exist. Nevertheless, it could be argued that merely because the first hypothesis did not gain support, the possibility that emotionally and erotically reactive people show PH-effects should not be rule out.

However, as the non-significant results showed no support for the second and third hypotheses, it is safe to state that no support was found for precognitive habituation for subjects that were characterized emotionally or erotically reactive either. The most obvious reason for this is of course, that precognition does not exist. However, the above explanation is still valid from the perspective that precognition does exist.

The second deals with the operational definitions of the constructs of emotional and erotic reactivity. In the present study as well as in Bem's study, two respectively three, items were adopted from the Zuckerman's sensation seeking scale (Bem, 2003). The answers to these items gave a score from which it was determined whether a subject was emotionally and erotically reactive or not. In the case of this study the reliability of both scales were rather low. The reasons for the low reliability of the scales of emotional and erotic reactivity could be several. One explanation might be that the questionnaires were in the English language and most of the subjects had a non-English mother tongue. This could have lead to a misinterpretation of the questions, thereby leaving faulty and unreliable scores. On the other-hand all subjects were instructed to indicate if they were uncomfortable with their English and were told that if they had any problems comprehending the questions they would get help. In the cases where this happened (two items for the same participant) the item in question was translated into Swedish.

Unfortunately there is no information in Bem's report on the reliability of these scales, and the author has not yet received the reply to an e-mail regarding this issue. Nevertheless, assuming that the scales used in Bem's study were reliable, there could be another

explanation for the low reliability of the scales in this study. It is possible that they are “more reliable” in the United States, where Bem conducted his study, than in Sweden (where this study was conducted) due to cultural differences.

Returning to the original discussion, it is possible to say that if precognition does exist and PH effects can be shown with erotically and emotionally reactive people, then the non-significant results in this study could be due to the fact that the items measuring the above constructs did not fulfil their function.

Explorative results

This study also failed to replicate Bem’s precognitive boredom effect. A possible explanation for this result is that due to an undiscovered difference in the execution or analysis of this experiment, the effects were eradicated. These results however, are corroborated by that no precognitive boredom effect was found in the study of Savva et al either (2004).

The significant PH-effects from the female population of Bem’s study (2003) were not replicated either. There was no significant difference between men and women in the overall study. There was a significant difference between the males’ and females’ hit-rates for the negative trials. However, these results have to be handled with extreme care. For starters, due to the large number of significance tests presented in the study, even if all of the null hypotheses were true the probability of finding statistical significance in one of the hypotheses is above 30%. Secondly, these results are not supported by Bem’s findings. However, it would be interesting to see if they are replicable.

As it has already been established that the indicators of emotional and erotic reactivity had poor reliability in this study, it is difficult to further analyze data as functions of these categories. Nevertheless, it could be possible to argue that the emotional reactivity items that had a moderate reliability could be used for establishing an emotionally reactive category amongst the participants that would be reliable enough for analysis. If this were true, then it would be possible to examine Bem’s hypothesis that emotionally reactive people perform better than emotionally non-reactive people on the negative trials by comparing their mean hit-rates on these trials. The results of this analysis were also non-significant; never the less, even if they had been significant they would still have to be handled with care.

Finally, a naive assumption from the author, that perhaps when subjects concentrate more and take their time they would perform better, was investigated. There were no correlations that would show any kind of relationship between time taken to complete a session and scores achieved.

Future research

For this design to be able to show precognition, several assumptions have to be made. Firstly, that precognition exists. Secondly, that time reversed effects can be achieved using the mere-exposure paradigm with highly affective stimuli. This second assumption has no base however, if it is not possible to achieve regular mere-exposure effects using highly affective stimuli. Unfortunately, as of yet there have been no studies investigating this, and therefore the validity of the second crucial assumption of the PH-design is vulnerable.

Further, the PH design is not an exact copy of a mere-exposure design. Despite the main difference that it is run backwards, there are other dissimilarities like the number of exposures, the time between exposure and selection task etc. These dissimilarities could possibly lead to the conclusion that a PH-study is not a mere-exposure study run backwards at all but simply a new design, which is only slightly similar to a mere-exposure study run backwards.

The positive side of using the mere-exposure studies, as a starting point is that it has been shown that mere-exposure effects exist and from this we can investigate whether they exist in a time-reversed paradigm. However, if the PH-design employs highly affective stimuli, which have not been shown to produce mere-exposure effects, using a new design that is only slightly similar to a reversed mere-exposure study, then the validity of the underlying reasons for using this method in the first place become questionable.

Therefore in order to validate the use of the PH-design perhaps one could run a PH-study “forwards”. Sjöden and Parker (2004) have in fact done something along these lines. They used the design of Dijksterhuis and Smith (2002) in order to produce “regular” cognitive habituation effects using negative stimuli. However it would be better to use exactly the same design as Bem, first with regular stimuli that have been known to produce mere-exposure effects. Then, if the results become positive, with highly affective stimuli (both negative and erotic). This way, it could be shown that the effect we are trying to reverse, exist to begin with.

Then it could be argued that if this method can be used to produce mere-exposure effects using highly affective stimuli, then it should also be a valid method for studying precognition. However if there are no mere-exposure effects, then the design should perhaps be changed to an exact copy of an original mere-exposure design and then run backwards.

Further, the process for screening emotionally reactive subjects might require improvement in this protocol. According to Bem’s results, if someone is “emotionally reactive”, then he or she should show a greater PH-effect for the negative trials. In Bem’s study there are only two items measuring the entire concept of “emotional reactivity” and it could be hypothesized that this too small an amount to measure such a vast construct. Never the less, his positive results (unless they are caused by an artifact) could confirm the opposite.

However, if the results were truly positive due to “emotional reactivity” then a more precise measure of this construct would probably yield subjects that produce even better PH-results. In the opinion of the author it is exactly this, which is achieved in the design created by Savva et al. (2004). People with fear of spiders (possibly a narrower construct measured by 6 items) are exposed to the one and only stimulus that they are *all* emotionally reactive to: spiders. Therefore this is probably a more valid measure of “emotional reactivity” or to be more precise a better way to find subjects that have strong emotional reactions to certain images. The fact that this should have yielded even more positive results but did not, could have been due to that positive effects were canceled out by artifacts, if the precognition hypothesis is true.

It could be said that a more precise variation of the present questionnaire should be used to determine emotional and erotic reactivity. Another alternative is to adopt the method utilized by Savva et al. (2004) using spider stimuli.

Despite the fact that there are probably elements in the PH-protocol that could use some improvements, in the opinion of the author, it has several advantages over other experimental procedures measuring psi. To begin with its simplicity enables quick and reliable replication craving only one experimenter. Also, since the only apparatus necessary for its execution is a computer, it is also very cost efficient. Further, in the opinion of the author, a great advantage is that it measures psi on an unconscious level. This is because of two reasons at least. The first is that according to experiments by amongst others Radin (1997) and Klintmann (1984), it is possible that precognition is a phenomenon that is more likely to be observed through unconscious reactions to stimuli.

The second reason is more complicated. As an example let us say, that subjects are told that a computer will randomly pick one of two colors (Red and Yellow) and show it to them. Before they see the color however, they have to guess which one will be shown to them. In such a situation, when the random generating process chooses a sequence like RYRYYR and a sequence like YYYYYY then subjects tend to see the former sequence as more random than the latter, and the more likely to be the outcome of a random generation process (Griffiths & Tenenbaum, 2001). This however is merely an illusion, because both outcomes are equally likely to be generated by a random generator and only difference between them is that one of them is perceived as more remarkable. This leads to that during a color guessing task, subjects might reason the following way: “hmm, it has been red 3 times in a row; therefore the next one has got to be blue”. Due to this phenomenon known as “gamblers fallacy” (Tversky Kahneman, 1974), it could be possible that even if precognition existed in a conscious form, despite that one knew the next color is red, one would be inclined to say “blue” because it is common sense that it cannot be red again.

Due to the unconscious nature of the PH-protocol however, ones choice is not affected by rational thinking and common sense, the problem described above is therefore evaded (regardless of whether the reasoning is correct or not).

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Appendix 1.

Emotional and erotic reactivity questionnaire

Emotional reactivity items:

In general, how intense are your emotional reactions to movies, videos, or photographs that are violent, scary, or gruesome?

Not at all Intense	Slightly Intense	Moderately Intense	Fairly Intense	Very Intense
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In general, to what degree are you aware of, attuned to, or in touch with your emotional reactions to images that are violent, scary, or gruesome?

Not at all Aware	Slightly Aware	Moderately Aware	Fairly Aware	Very Aware
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Erotic reactivity items:

I prefer to date people who are physically exciting rather than people who share my values.

Very Untrue	Untrue	Between True and Untrue	Fairly True	Very True
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In general, how much do you enjoy watching erotic scenes in movies?

Not at all	Slightly	Moderately	Fairly	Very
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How much do you like earthy body smells?

Not at all	Slightly	Moderately	Fairly	Very
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