Journal of Scientific Exploration, Vol. *11*, ***No.*** 2, pp. 163-180, 1997 0892-3310197

Unconscious Perception of Future Emotions: An Experiment in Presentiment

DEAN I. RADIN

Consciousness Research Laboratory, Box 454009
4505 Maryland Pkwy, Harry Reid Centerfor Environmental Studies
University of Nevada, Las Vegas, NV 89154-4009

Abstract — Is consciousness limited to perception of the sensory present and memory of the past, or does it also have access to future information? In an experiment designed to explore this question, a computer was used to randomly select and present target photos from a pool of digitized photographs. Some targets labeled "calm" included landscapes and cheerful people; other targets labeled "extreme" included violent and erotic topics. Heart rate, blood volume, and electrodermal activity were recorded before, during and after presentation of the target photo to see whether the body would unconsciously respond differentially to the two types of future targets. Extreme targets were expected to produce classical orienting responses ***after*** the targets were displayed, and a "presentiment" (future feeling) effect was predicted to produce orienting pre-sponses ***before*** the pictures were displayed. Calm targets were expected to cause no unusual responses before or after the target was displayed. Four experiments, involving 31 participants who viewed a total of 1,060 target photos, showed the expected orienting response after the target photo was displayed. In accordance with a presentiment hypothesis, there was a clear orienting pre-sponse that peaked with a four standard error difference in physiological measures between extreme and calm targets one second ***before*** the target photo was displayed.

Keywords: consciousness – precognition – parapsychology – presentiment – psychophysiology – unconscious

Introduction

Freedom stretches only as far as the limits of our consciousness. — Carl Jung, 1942

If consciousness is an epiphenomenon of the physical brain (Grush & Churchland, 1995), or as Francis Crick (1994) put it, "nothing but a pack of neurons," then presumably all aspects of consciousness are inextricably bound to the physical, sensory present, intermingled with fading memories of the past. In arguing against consciousness as a mere epiphenomenon, Beloff (1994) asks:

"If it is the case that a mind can, on occasion, extract information from an object other than its own brain... it would be futile to doubt that a mind can interact with its own brain in the ordinary course of life. [This] is precisely what interactionism or radical dualism asserts and what epiphenomenalism denies." (p. 36).

If the mind does indeed extract information unfettered by known physical constraints, this would immediately anneal the so-called "hard" problem of consciousness. The mystery would no longer be limited to "the question of how physical processes in the brain give rise to subjective experience," as the hard problem is described by Chalmers (1995), instead the mystery would be compounded with the additional question of how information can arise in the physical brain even when the origin of the information is beyond the reach of the physical senses.

Now consider an extension of Beloff's question, and ask whether mind may also extract information about events in the future, suggesting some sort of "transtemporal" aspect to consciousness. Such an extraction would be a form of perception called precognition, the non-inferential prediction of future events.

To explore the possibility that the mind can access its future brain state, a series of experiments was conducted. In particular, unconscious physiological responses to future events were studied. Strictly speaking, such responses would be a subset of precognition known as "presentiment," a vague sense or feeling of something about to occur without conscious awareness of a particular event. Unconscious physiological measures were employed mainly because the relevant experimental literature suggests that precognitive perception, like the majority of sensory information, only rarely reaches the level of conscious awareness (Schmeidler, 1988).

Physiological Responses

The effect used in this study to detect transtemporal consciousness is a well-known psychophysical reflex known as the orienting response (OR), first described by Pavlov in the 1920's. The OR is associated with enhancing an organism's ability to analyze the content and meaning of novel or unexpected stimuli. It is characterized by a host of simultaneous, physiological changes, including pupillary dilation, EEG blockage, a rise in phasic electrodermal activity, a deceleration-acceleration pattern in heart rate, and vasoconstriction in the finger (Andreassi, 1989, Bouscein, 1992).

It is relatively straightforward to produce an OR in an experiment by presenting a participant with an emotionally provocative stimulus. Pictures were used in the present experiment, although sounds, meaningful words, electrical shocks, and sudden tactile stimuli are also effective. Because an organism's general level of arousal is affected cumulatively by such stimuli, the strength of an OR tends to diminish after 3 to 5 sequential presentations. In this study, to avoid such habituation, the novel or "extreme" stimuli used to produce the ORs were randomly interspersed with a larger number of control or "calm" stimuli.

Previous Research

The use of physiological measures in psi research can be traced back at least 40 years (*e.g.,* Otani, 1955), but this general approach to studying psi gained popularity in the 1960s (*e.g.,* Beloff, 1974; Morris, 1977; Schouten, 1976). The literature reveals two general types of physiological psi experiments: Investigations of physiological correlates of conscious psi perception, and use of physiological measures as unconscious detectors of psi.

The majority of the previous studies employed physiological measures in an agent-receiver paradigm to examine the autonomic or central nervous system of a percipient while a remote agent attempted to send emotional or other meaningful information (Delanoy, 1989; Delanoy and Sah (1994). Tart (1963), for example, measured electrodermal activity, blood volume, heart rate, and verbal reports in an agent-receiver study where he as agent received random electrical shocks to see if the percipients would detect those events. Tart reported that the percipients' physiology reacted significantly to the remote shocks, but there was no evidence that they were consciously aware of the events.

Later, Dean (1966), Barry (1967), and Haraldsson (1972) all independently found significant changes in blood volume when an agent sent emotional thoughts towards a percipient, located sometimes thousands of miles away. Duane and Behrendt (1965) studied correlated EEG between identical twins, and Grinberg-Zylberbaum et al (1992), Targ and Puthoff (1974) and May, Targ and Puthoff (1979) studied EEG event-related potentials between pairs of participants. More recently, Warren, McDonough and Don (1992) have been studying event-related brain potential changes in participants who are involved in psi perception tasks.

The largest single body of psi experiments using physiological measures has been reported by William Braud and colleagues (*e.g.,* Braud, 1981; Braud & Schlitz, 1989, 1991). Braud's highly successful series of experiments, like the majority of studies on the psychophysiology of psi, have generally focused on agents attempting to influence autonomic or CNS responses in remote people. Overall, these studies all support the idea that people can unconsciously respond to information beyond the reach of the normal senses.

Present Research

The present experiment differs from most previous physiological studies in that it examines psi performance in one person in the same place but at different times. This is in contrast to the more common design, where psi is studied among two people in different places at the same time. If psi is space-time equivalent, as most of the empirical and anecdotal data suggests, then these two forms of experiments should be equivalent.

Moreover, we speculated that a time-separated design may be more efficient than space-separated designs because it may be easier for a person to detect or "resonate" with their own future thoughts than for a person to resonate with another person's thoughts. In addition, the present technique offers a significant pragmatic advantage over experiments studying distant mental influence of human physiology — it does not require expensively shielded laboratory rooms or extensive security methods to prevent sensory leakage from one person to the other. Sensory leakage is completely avoided by using time to "shield" the target.

The Basic Experimental Method

In a series of four experiments, participants sat in a comfortable, reclining chair approximately two feet in front of a color computer monitor. On the pads of the first and second fingers of the left hand, electrodes were attached to record electrodermal activity (EDA). On the pad of the third finger of the left hand, a photoplethysmograph was attached to record both heart rate (HR) and blood volume pulse (BVP). Signals from these electrodes were monitored by an electrically isolated, computer-controlled physiological data acquisition system (J & J Engineering, Model 1-330).

After all electrodes were attached, the participant rested her wired-up left hand comfortably in her lap. In her right hand, she held a computer mouse with her right index finger resting on the left mouse button. When ready to begin, she pressed the mouse button and prepared to look at a picture about to be displayed on the computer monitor in front of her. After the button press, the computer randomly selected a target photo, there was a 5 second delay during which the screen remained blank, then the selected picture was displayed for 3 seconds (as shown in Figure 1).

This was followed by a blank screen for 5 seconds, and this was followed by a 5 second rest period. After the rest period, a message indicated that when the participant was ready to begin the next trial, the button could be pressed again (in practice, participants waited from less than one second to more than 30 seconds between trials). The three physiological responses were continuously monitored during the 13 second recording epoch. The participant viewed 41 pictures in a single session, one picture at a time. The experimenter watched the participant on the first trial to make sure that the procedure was followed correctly, and the remaining 40 trials were conducted by the participant alone. Only the last 40 trials were used for subsequent analysis.

On each trial, the computer selected (uniformly at random, with replacement) one target photo from a pool of 120 digitized high-quality color photographs (later experiments used a pool of 150 targets). The target photos were divided into two subjective categories, ***calm*** and ***emotional.*** Calm targets included pleasant pictures of landscapes, nature scenes, and cheerful people; emotional targets included arousing, disturbing or shocking pictures, including photos of explicit sexual activity, genital piercings, and mutilated bodies. The original target pool consisted of 79 calm and 41 emotional photos (the later

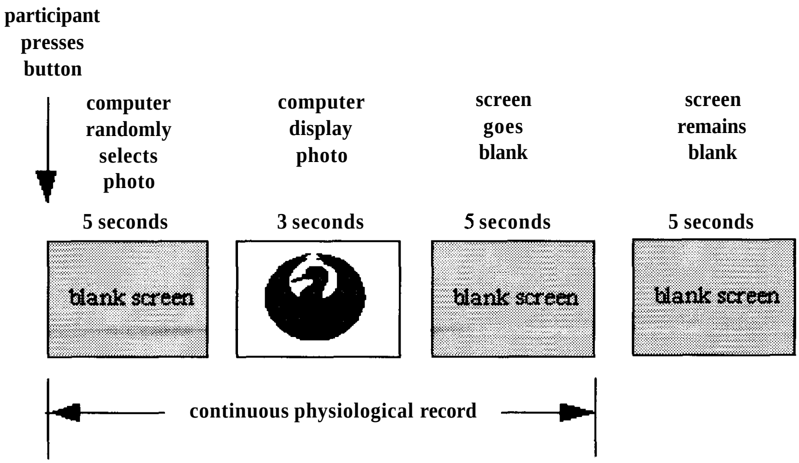

Fig. 1. Illustration of experimental procedure.

pool consisted of 100 calm and 50 emotional photos). These pictures were displayed by the computer in 256 colors, with 600×800 resolution.

Due to the nature of this experiment, in which it was necessary to occasionally display emotionally shocking pictures, the participant population was restricted to mature adult volunteers. All of the participants were asked to read an informed consent form explaining that some disturbing pictures might be shown, and to provide their verbal consent before the experiment began.

Method of Analysis

The basic analytic technique applied to the data was a superposed epoch analysis. Data on each trial is a 13-second epoch of continuous physiological measurements consisting of 5 seconds in a "before" period, 3 seconds in a "during" period, and 5 seconds in an "after" period. The sampling rate was 5 samples per second, thus a single trial epoch consisted of 65 contiguous physiological measurements (of EDA, HR, and BVP). Figure 2 illustrates the raw EDA values collected in a sequence of 40 trials for one participant.

The analysis was designed to take into account the fact that physiological measurements drift over time within individuals, and people have different baseline or tonic levels (Andreassi, 1989). Therefore, instead of examining the absolute values returned by the physiological monitor for a given trial epoch, for each 65-sample epoch the different underlying baselines were taken into account by taking the differences between the mean value of a given epoch, per physiological measure, versus all of the individual samples in that epoch. The baseline mean per epoch was based upon the physiological values of the first 5 seconds of the epoch — the before-display period — rather than the entire 13-second epoch, because after display of the target photo it was expected

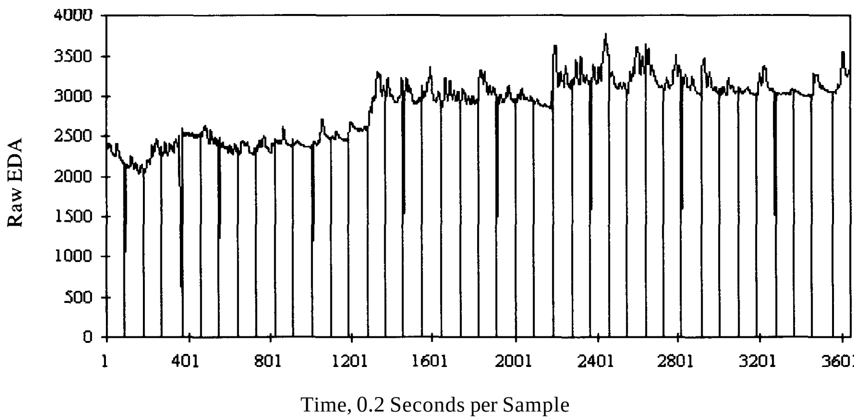

Fig. 2. EDA data record for one participant. The vertical lines are the boundaries of each recording epoch. The ordinate is the raw EDA value (with 12-bit resolution) returned by the physiology monitor.

(by design, for emotional targets) that phasic responses would significantly shift the baseline.

Thus, for trial epoch i, sample **j**, and target category c (*i.e.*, emotional or calm), the raw physiological measure e„, was transformed into A, = $e_{ijc} - e'_{ic}$, where e'_{ic} was the mean of trial epoch i, target category c, over samples **j** = 1 to 25 (*i.e.*, the first five seconds of the epoch). This transform created 65 "mean-difference" A, samples per epoch, per target category.

Next, the grand mean and standard errors for the 65 Δ_{ijc} were separately determined for calm and emotional target categories. That is, the grand mean A), and standard error $\sigma(e_{jc})$were determined across all i epochs, separately per target category c, for each of the 65 mean-difference samples. We called these 65 A), values "average mean-differences."

Finally, because this study was interested in how physiology changed from the moment the button was pressed, the first average mean-difference calm sample A), (*i.e.*, A'$_{calm}$) was independently clamped to zero, and the *differences* were determined between A'$_{calm}$ and the rest of the $\Delta'_{j\,calm}$ samples. The same procedure was followed for the $\Delta'_{j\,emotional}$ samples. The result is illustrated in Figure **3** for the participant's data shown in Figure 2. It is important to emphasize that these data transformations were identically applied to the calm and emotional target epochs for data collected before, during and after display conditions.

Predictions

This experimental procedure creates one of two types of events five seconds after pressing a button: a calm event or an emotional event. The emotional event was expected to produce a classical orienting response which we would

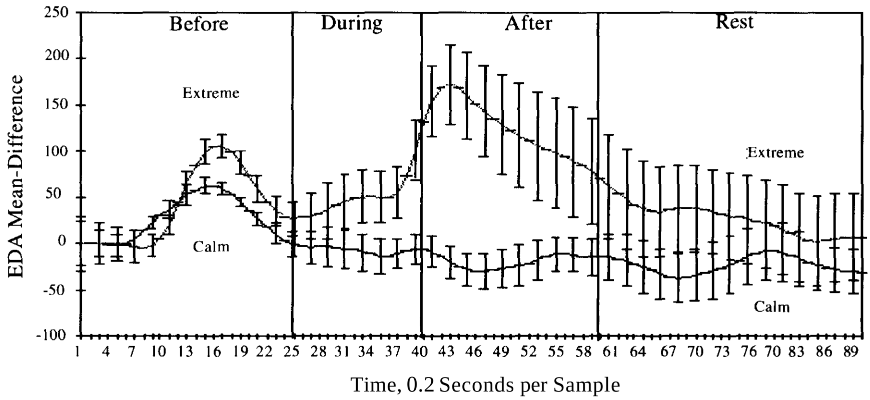

Fig. 3. Superposed epoch analysis for one participant's EDA data (based on the raw data shown in Figure 2). The error bars are one standard error. The four sections correspond to Before the target was displayed, During, After, and a Rest. Presentiment is seen as a higher EDA response for extreme targets in the Before period.

detect, typically, as a rise in skin conductance, a drop in heart rate, and a drop in finger blood volume (Andreassi, 1989; McNaughton, 1989; Thayer, 1989). By contrast, a calm picture was expected to show little or no orienting response.

The presentiment hypothesis predicts that the emotional shock caused by viewing an emotional picture in the future causes an unconscious physiological "pre-action" in the present. Specifically, the emotional targets were predicted to show orienting "pre-sponses" just before display of the target photos. These pre-sponses were expected to mimic the future orienting responses. No

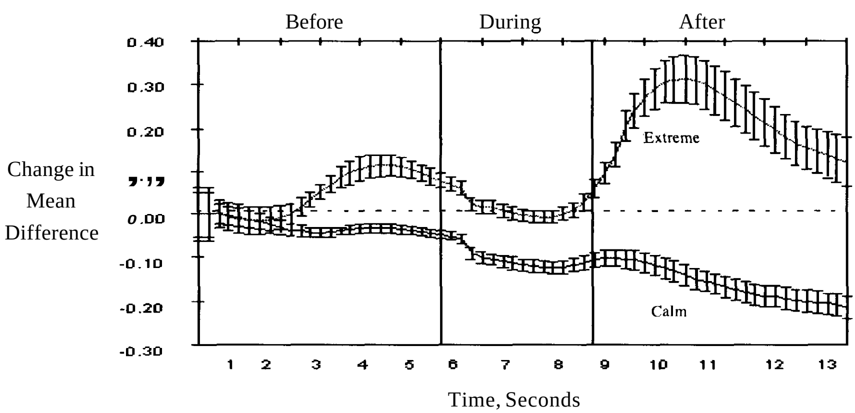

Fig. 4. As expected by the classical orienting response. EDA after display of the target photos was higher for Extreme targets than for Calm targets. As predicted by the presentiment hypothesis, EDA was also higher before display of Extreme targets, but not for Calm targets. Errors bars are one standard error.

unusual responses were expected in the calm target category, either before, during or after the target is displayed.

Results: Experiment I

Eight participants (3 women, 5 men) participated in a total of 260 trials: 104 were randomly selected by the computer as emotional, 156 as calm. The first three people ran 20 trials in a single session; the remaining five ran 40 trials in a single session. Result of the superposed epoch analysis for EDA is shown in Figure 4. The Figure shows a statistically clean separation of EDA between calm and emotional targets in accordance with the presentiment hypothesis.

Notice that this experimental design has a built-in control: The physiological results observed in the during and after-display condition ***must*** reflect what is expected according to the orienting response, otherwise something would be wrong with the analysis technique. We see in Figure 4 that the expected responses did occur, and because the identical analysis technique was applied to data recorded in the before-display period, we know then that the separation observed in EDA in Figure 4 reflects a genuine presentiment effect.

Figure 5 shows the result of a superposed epoch analysis for changes in finger blood volume. This shows the expected drop in blood volume for emotional targets in the after-display period, and as predicted by the presentiment hypothesis, there is also a significant drop in blood volume in the before-display period. The heart rate epoch analysis did not reveal a significant drop in heart rate in the before-display period.

Results: Experiment 2

Three participants contributed a total of 40 trials. A one-second target display period was used rather than the 3 seconds used in Experiment 1. Because the primary results of interest were obtained with EDA in the first experiment, this replication concentrated only on EDA. Figure 6 shows the result of a su-

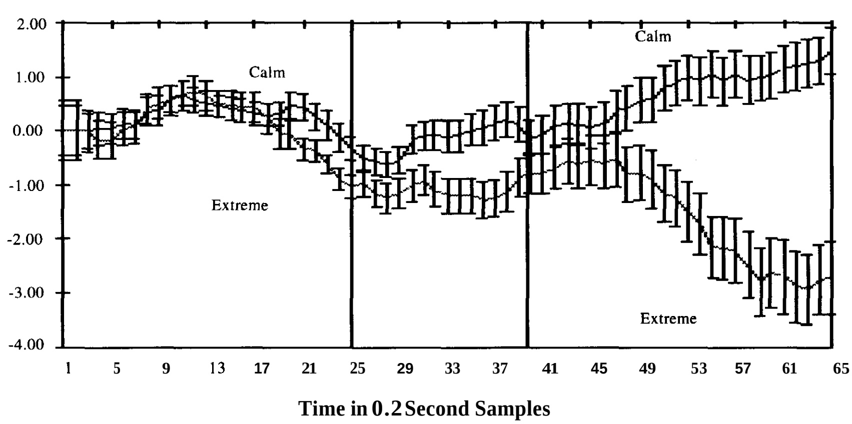

Fig. 5. Changes in mean difference blood volume in Experiment 1.

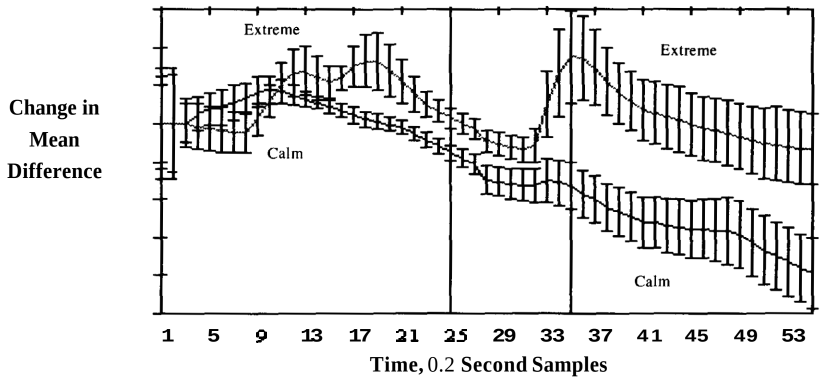

Fig. 6. Change in mean difference EDA for Experiment 2.

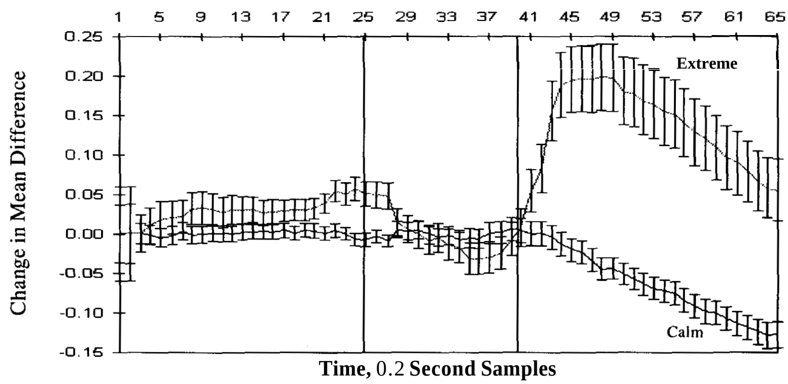

Fig. 7. Change in mean difference EDA in Experiment 3.

perposed epoch analysis, revealing results similar to those obtained in Experiment 1.

Results: Experiment 3

Sixteen participants (8 men, 8 women) contributed a total of **640** trials. The experimental method was identical to that used in Experiment 1, with the exception that the entire experiment was controlled, and the target photos displayed, on a portable notebook computer (Toshiba 75 Mhz **80486** ***vs.*** a Dell Optiplex **66** Mhz **80486** used in Experiments 1 and 2). Figure 7 shows the result of a superposed epoch analysis for EDA, revealing results similar to those obtained in Experiments 1 and 2.

Redundancy Analysis

We then pooled EDA, HR, and **BVP** data from Experiments 1 and 3 (because the methods were virtually identical) into a single measure consistent with what is expected for an operating response. That is, because we know that for most people EDA would rise and HR and **BVP** would drop after exposure to emotional targets, we can form a single score to reflect this expectation by taking the following steps: (1) form a z-score of the difference between the average mean-difference EDA for emotional and calm target categories, for all samples 1 - 65. (2) Do the same for average mean-different HR and **BVP.** (3) Create a single Stouffer z-score using the formula $Sz = [zd_{EDA} - zd_{HR} - zd_{BVP}]/\sqrt{(3)}$, where "$zd$" refers to "$z$ of the difference."

We could predict that this Sz-score should rise to very high levels after display of the targets, because we know how the autonomic nervous system responds according to the nature of the target. In fact, this Sz-score must rise to high levels, otherwise something would be wrong with either the experimental or analytic methods. We see in Figure 8 that this rise does indeed occur, peaking at nearly 9 standard normal deviates.

Now we can predict, based on the presentiment hypothesis, that there should be a significant rise in *Sz* both before and after the target is displayed. Figure 8 shows that the Sz-score indeed rises to a peak of nearly 5 standard normal deviates. This suggests that use of redundant autonomic measures may provide a more efficient method of detecting presentiment, especially if these measures are customized to take into account individual, idiosyncratic responses.

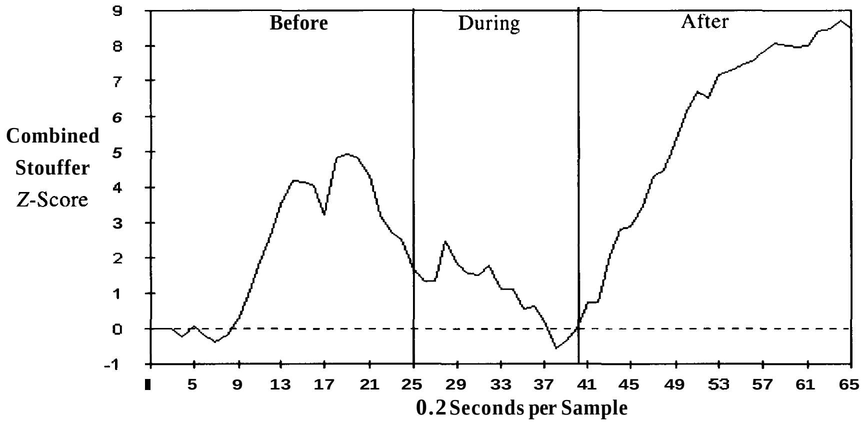

Fig. 8. Combined Stouffer z-scores for the differences in EDA, BVP, and HR for Extreme and Calm targets in Experiments 1 and 3. As expected, the orienting response after display of the target photos rises to extremely high levels, peaking at nearly 9 normal standard deviates. Also evident is an orienting presponse that peaks at nearly 5 normal standard deviates about one second before the target photos are displayed.

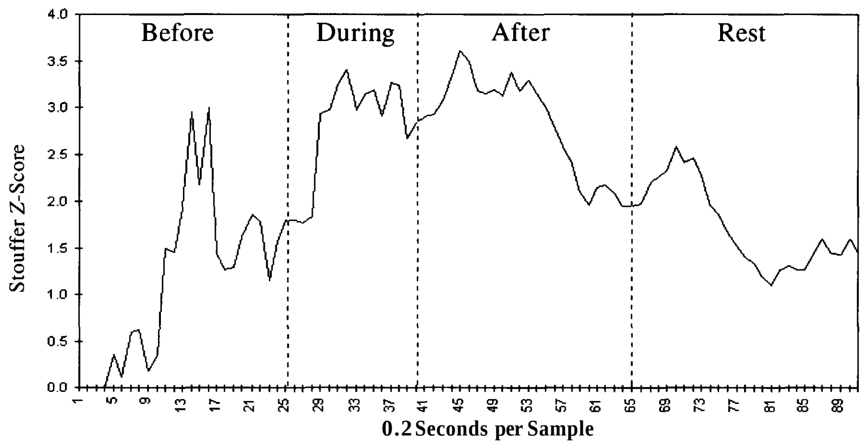

Fig. 9. Combined Stouffer z-scores for the differences in EDA, BVP, and HR for Extreme and Calm targets in Experiment 4.

Experiment 4

Figure 9 shows the result of combining EDA, HR, and BVP data in another experiment involving four people who contributed 40 trials each. The method here differed from the previous three experiments because the target photo was selected ***immediately before*** it was displayed — *i.e.,* after sample 25 — rather than as soon as the participant pressed the button to begin the trial. Thus, this was a "true" presentiment experiment (*i.e.,* excluded real-time clairvoyance as a possibility) in the sense that the target identity did not exist in any form, not even as a software variable, until just before it was displayed.

Discussion

Let anyone try, I will not say to arrest, but to notice or attend to, the present moment of time. One of the most baffling experiences occurs. Where is it, this present? It has melted in our grasp, fled ere we could touch it, gone in the instant of becoming.
— William James, *The Principles of Psychology (1890)*

William James may have been on to something. The present may not be where — or when — we thought it was. The experiments described here suggest that under certain circumstances we unconsciously respond to emotional events in our immediate future, events that we have no normal way of predicting. In informal post-interviews, none of the participants reported conscious awareness of the targets that they were about to see, and no one systematically noticed any physiological differences before presentation of the targets. As noted by previous researchers (*e.g.,* Schmeidler, 1988), if precognitive and other forms of so-called "extra-sensory" perception are largely unconscious, this may be why such phenomena are so difficult to detect using experimental designs that rely solely upon conscious reports.

Effects of Physiological Arousal

Figures 4, 6, and 7 show clear operating presponse (OP) separations between Extreme and Calm EDA in Experiments 1, 2 and **3.** But what these graphs do not reveal is whether the magnitude of the OP corresponds to expected differences in generalized physiological arousal. We know, for instance, that higher tonic levels of electrodermal activity are associated with increased attention and better vigilance on perceptual tasks (Prokasy & Raskin, 1973). Persons with widely varying EDA, called "labiles," are better than so-called "stabiles" at keeping their attention focused on an ongoing task. Labiles also manifest larger electrodermal responses to emotionally significant stimuli.

This allows us to predict that the higher the tonic level of EDA, which is associated with higher lability, the larger the EDA OP should be. To test this, a correlation was determined between the tonic EDA per trial epoch (*i.e.,* the average skin conductance level for the first 5 seconds of each trial) versus the mean-difference EDA (called Δ_{ijc} above) for sample 10, which corresponds to second 2 of the 5-second before-display period. Then the correlation was calculated between the tonic EDA per epoch vs. sample 11, and so on up to sample 40, or 8 seconds into the epoch.

If the present results are consistent with the physiological effects of arousal, if the OP is a genuine effect linked to a future OR, and if the OP increases with enhanced attention and perceptual ability, then there should be positive corre-

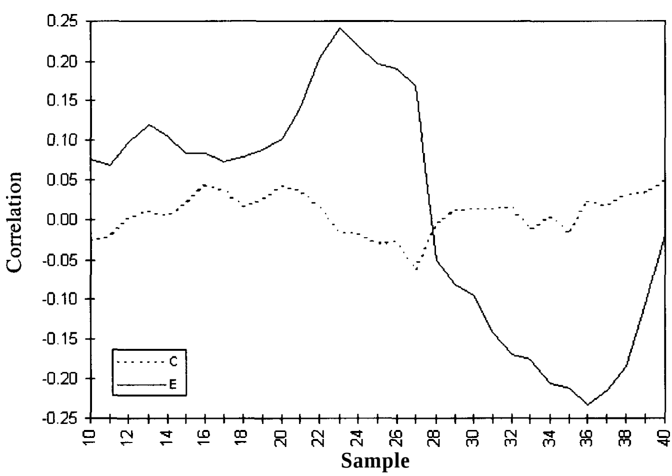

Fig. 10. Correlation between tonic EDA level per trial epoch vs. mean difference EDA at different points in the epoch. This shows that at highter levels of nervous system arousal, the orienting presponse for Extreme targets is larger, peaking just before the target is displayed, at sample 24 ($r = 0.241, t = 4.368, p = 1.7 \times 10^{-5}$). At no point is the same correlation significant for Calm targets.

lations between tonic level and OP for Extreme targets, but not for Calm targets. Results, shown in Figure 10, confirm this prediction.

Alternative Hypotheses

Results are Due to Chance. To determine a probability of the difference between data in the two target conditions in the before-display period, we must take into account (a) autocorrelations between successive samples, (b) within-subject repeated measures, and (c) assumptions about the underlying distributions. To do this, we pooled all EDA data for Experiments 1 and 3, then calculated a t-score of the difference in EDA for calm and emotional targets for each of the first 25 samples (the before-display condition). The maximum t-score in this group of 25 was $t = 2.92$. Next, the assignment of calm and emotional conditions in this dataset were scrambled, maintaining the same number of calm and emotional targets as in the original dataset, but randomly reassigning the labels. From this new dataset, a maximum t-score was determined as before. This procedure was repeated 1,000 times to form an empirical distribution of maximum t-scores. The original maximum t-score was then compared to this distribution, and the result showed that there were 8 maximum t-scores greater than 2.92 out of 1,000. In other words, differences larger than those observed in the actual data would be unlikely with $p = .008$. This suggests that chance is not a viable explanation for the observed results.

Results are Due to a Cueing Artifact. In the first three experiments, after the participant presses a button the computer evaluates a pseudorandom algorithm based on a seed-number set to the current value of the computer system clock. The result, a number pointing to a particular picture, is stored in software, and the screen remains blank with no external indication of its value. The computer does not access its hard drive to read the picture until it is time to display the picture, and thus there are no disk access sounds or other computer hardware actions that might conceivably provide a hint as to the identity of the target. Thus, there is no way a participant can know which target is about to be shown on any given trial. In addition, in Experiment 4, the target is not even selected until immediately (about 10 milliseconds) before it is displayed.

Results are Due to an Analysis Artifact. This is unlikely because the identical analysis procedure was employed for all EDA, HR and BVP data uniformly across each epoch, and the analyses revealed the expected OR in the after-display condition. Given this, we can infer that the analysis of results before the target was displayed should also be valid.

Results are Due to Targets Being Presented in a Nun-random Order. After combining the 260 targets selected in Experiment 1 and the 656 targets (16 people $\times$ 41 target selections per person) from Experiment 3, the distribution of the total of 916 targets was examined to see how often each of the 120 target pictures were selected. The distribution was tested by chi-square, with the resulting $\chi^2(119\text{df}) = 104.52$, $p = 0.825$. Thus, targets were selected uniformly at

TABLE 1
Distribution of Sequential Pairs of Targets

	EE	EC	CE	CC
Observed	58	101	103	196
Expected	51	102	102	204

random, so it should not have been possible to successfully guess the identity of a target on any given trial.

Next, the distribution of pairs of sequential targets was examined, *i.e.*, the number of times an Extreme target was followed by another Extreme target (EE), Extreme was followed by Calm (EC), and so on. The observed and expected counts are shown in Table 1, and the resulting $\chi^2(3df) = 1.29$, $p = 0.73$. Thus, the identity of a given target did not provide a hint about the nature of the succeeding target.

The distribution of target types was also examined. Of 916 targets (all targets used in the first three experiments), 320 were Extreme and 596 were Calm. Compared against the expected number of Extreme targets (assuming *p*(Extreme) = 401120, or 1/3), this results in $z = 1.03$, $p = .303$ (two-tailed). Thus, the two types of target categories were distributed as expected, and there should not have been any way for a participant to guess the category of successive targets.

How do we know that extreme targets were as provocative as they were intended to be?

By inspection, the physiological results demonstrated that the pool of Extreme targets produced the expected OR and the Calm targets did not. However, to confirm that the target categories were also subjectively separable, 6 people (3 men, 3 women) were asked to look at each of the 120 pictures used in the third experiment (in a new random order for each person), and rate each

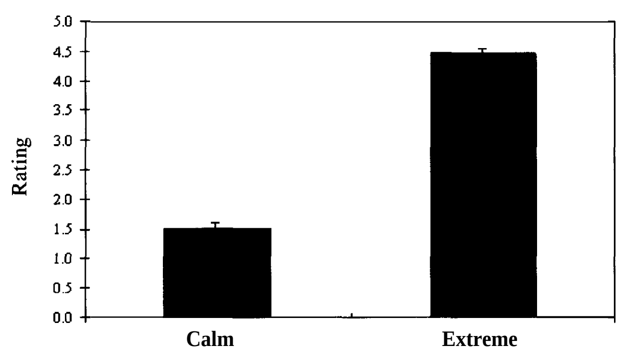

Fig. 11. Subjective ratings for Calm and Extreme target pools for Experiment 3, with one standard error bar.

picture from 1 (calm) to 5 (extreme). Results, shown in Figure 11, leave little doubt that the pool of Extreme pictures was subjectively more arousing than the Calm pictures.

While it is clear that the two target pools were subjectively different, it is not possible to tell from a purely dichotomous analysis whether the magnitude of the postulated OP was associated with the degree of subjective arousal, which seems like a reasonable assumption. To test this question, a correlation was determined for all trials in Experiment 3 between EDA mean difference for samples 10 through 40 in a given epoch, versus the subjective rating for the target used in that epoch. A positive correlation was predicted that would peak around the time the OP was expected to crest. Figure 12 shows the result, which confirms the prediction with a peak correlation at sample 24, $r = 0.096$, $t = 2.365$, $p = 0.018$.

The Effect is Due to Anticipatory Effects. This is the suggestion that participants' arousal levels progressively increased on each successive trial until an extreme target occurred, then it reset back to a baseline level. Such an "anticipatory strategy" might create a difference between the average physiological measures obtained on calm and extreme trials, in favor of slightly higher arousal levels for extreme trials. This was tested through Monte Carlo tests where a simulated participant used an optimal anticipatory strategy to raise arousal levels uniformly on each successive calm trial until a extreme trial randomly occurred. The simulation resulted in statistically non-significant differences in average arousal levels, far too small to account for the observed physiological effects. In addition, in a recent replication of this experiment by an independent researcher (Bierman & Radin, 1997), internal consistencies within the data related to differences in stimulus display time were discovered (shorter display times were associated with larger presponse effects than

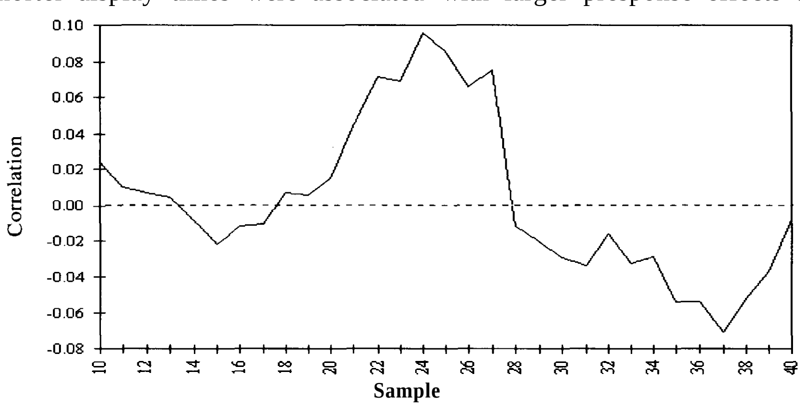

Fig. 12. Correlation for all trials in Experiment 3 between EDA mean difference in a given epoch versus the subjective rating for the target used in that epoch. This shows that the more subjectively extreme the target photo, the larger the orienting presponse. The presponse peaks just before the target is actually displayed ($r = 0.096$, $t = 2.365$, $N = 600$, $p = 0.018$, two-tailed).

longer display times). This again argues against simple anticipatory strategies as an adequate explanation of the presponse effect.

Conclusion

The quote at the beginning of this article is preceded by the following few sentences:

No one can flatter himself that he is immune to the spirit of his own epoch, or even that he possesses a full understanding of it. Irrespective of our conscious convictions, each one of us, without exception, being a particle of the general mass, is somewhere attached to, colored by, or even undermined by the spirit which goes through the mass. Freedom stretches only as far as the limits of our consciousness. — **Carl Jung**, 1942

In exploring the limits of consciousness, especially when confronting experimental results suggesting the existence of unconscious precognition, we are indeed challenged by the spirit of our own epoch. In spite of the persuasiveness of conventional wisdom, consciousness may in fact have transtemporal aspects, and if so, the hard problem of consciousness takes on a mysterious new gleam.

However, before adopting Beloff's (1994) contention that a transtemporal or transpatial consciousness argues against epiphenomenalism, it is worthwhile to consider an alternative. It may be, for example, that consciousness does indeed emerge from the workings of the physical brain, but our notion of "physical" must be significantly expanded. After all, the mechanistic, Newtonian model of physical reality has radically changed over the past century through developments in quantum theory, chaos theory, and non-linear dynamics, and we now know that the world is not simply a deterministic mechanism. Reality must be non-local. Non-locality in this sense means that physical matter is influenced not only by events local to that matter, but by events at arbitrary distances, including events outside the light cone (Herbert, 1985). Given the properties of this strange new view of the world, a phenomenon like transtemporal perception is not only possible, but likely.

In fact, from the post-Newtonian viewpoint, the supposed intractable gulf between epiphenomenalism and interactionism is revealed as an illusion. The former promises to tell us much about how the brain processes information, but it says little about where all the information comes from. The latter promises to tell us about strange ways that information can impinge upon the brain, but not much about how the brain processes that information. Any model of consciousness which aspires to be comprehensive must judiciously combine theories and evidence from both the former and the latter views.

Acknowledgments

The Consciousness Research Division of the Harry Reid Center for Environmental Studies, UNLV, gratefully acknowledges past and present grant support from the Parapsychology Foundation (USA); Institut für Grenzgebiete der Psychologie und Psychohygiene (Germany); Bigelow Foundation (USA); Society for Psychical Research (England); Bial Foundation (Portugal); and the John Björkhem Memorial Foundation (Sweden).

References

Andreassi, J. L. (1989). ***Psychophysiology: Human Behavior and Physiological Response.*** Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Barry, J. (1967). Telepathy and plethysmography. ***Revue Metapsychique,*** 56.

Beloff, J. (1974). ESP: The search for a physiological index. ***Journal of the Society for Psychical Research,*** 47, 401.

Beloff, J. (1994). Minds and machines: A radical dualist perspective. ***Journal of Consciousness Studies,*** 1, 32.

Bierman, D. J. and Radin, D. I. (1997). Anomalous anticipatory response on randomized future conditions. ***Perceptual and Motor Skills,*** 84, 689.

Bouscein, W. (1992). ***Electrodermal Activity.*** New York: Plenum Press.

Braud, W. G. (1981). ***Psi*** performance and autonomic nervous system activity. ***Journal of the American Societyfor Psychical Research,*** 75, 1, 1.

Braud, W. and Schlitz, M. J. (1989). A methodology for the objective study of transpersonal imager. ***Journal of Scientific Exploration,*** 3, 1, 43.

Braud, W. G. and Schlitz, M. J. (1991). Consciousness interactions with remote biological systems: Anomalous intentionality effects. ***Subtle Energies,*** 2, 1, 1.

Chalmers, D. J. (1995). The puzzle of conscious experience, ***Scientific American,*** Dec., 80.

Crick, F. H. C. (1994). ***The Astonishing Hypothesis: The Scientific Search for the Soul.*** London: Simon and Simon.

Dean, D. (1966). Plethysmograph recordings as ESP responses. ***International Journal of Neuropsychiatry,*** 2,439.

Delanoy, D. and Sha, S. (1994). Cognitive and physiological ***psi*** responses to remote positive and neutral emotional states. In D. Bierman (Ed.) ***Proceedings of Presented Papers*** of the 37th Annual Convention of the Parapsychological Association, 128.

Delanoy, D. (1989). Characteristics of successful free-response targets: Experimental findings and observations. In L. A. Henkel and R. E. Berger (Eds.) ***Research in Parapsychology,*** 1988, Metuchen, New Jersey: Scarecrow Press.

Duane, T. D. and Behrendt, R. (1965). Extrasensory electroencephalographic induction between identical twins. ***Science,*** 150,3694,367.

Grinberg-Zylberbaum, J., Delaflor, M., Arellano, M. E. S., Guevara, M. A. and Perez, M. (1992). Human communication and the electrophysiological activity of the brain. ***Subtle Energies,*** 3, 3, 25.

Grush, R. and Churchland, P. S. (1995). Gaps in Penrose's tilings. ***Journal of Consciousness Studies,*** 2, 10.

Haraldsson, E. (1972). ***Vasomotor reactions*** as ***indicators of extrasensory perception.*** Ph ***D.*** Dissertation, University of Freiburg, Germany.

Herbert, N. (1985). ***Quantum Reality.*** New York: Anchor Books, Doubleday.

Jung, C. G. (1942). ***Psychological Reflections: A Jung Anthology,*** 15, 143.

May, E. C., Targ, R. and Puthoff, H. E. (1979). EEG correlates to remote light flashes under conditions of sensory shielding. In C. T. Tart, H. E. Puthoff and R. Targ (Eds.), ***Mind at Large.*** New York: Prager, 127.

McNaughton, N. (1989). ***Biology and Emotion.*** Cambridge: Cambridge University Press.

Morris, R. L. (1977). Parapsychology, biology and ***psi.*** In B. ***B.*** Wolman (Ed.), ***Handbook of Parapsychology.*** New York: Van Nostrand Reinhold Company, 687.

Otani, S. (1955). Relations of mental set and change of skin resistance to ESP score. ***Journal of Parapsychology,*** 19, 3, 164.

Prokasy, W. F. and Raskin, D. C. (Eds.) (1973). ***Electrodermal Activity in Psychological Research.*** New York: Academic Press.

Schmeidler, G. R. (1988). *Parapsychology and Psychology: Matches and Mismatches.* Jefferson, NC: McFarland and Company, Inc.

Schouten, S. A. (1976). Autonomic psychophysiological reactions to sensory and emotive stimuli in apsi experiment. *European Journal of Parapsychology,* 1, 72.

Targ, R. and Puthoff, H. E. (1974). Information transmission under conditions of sensory shielding. *Nature,* 251,5476,602.

Tart, C. T. (1963). Physiological correlates of *psi* cognition. *International Journal of Parapsychology,* 5,375.

Thayer, *R.* E. (1989). *The Biopsychology of Mood and Arousal.* New York: Oxford University Press.

Warren, C., McDonough, B. E. and Don, N. S. (1992). Event-related brain potential changes in a *psi* task, *Journal of Parapsychology,* 56, 1.