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Title: Evidence for Subconscious but not Conscious Psi in Remote Stare Detection and Precognition Tasks

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Abstract

To more completely examine the relationship between conscious and subconscious psi performance, data for both kinds of performance would ideally be collected simultaneously. However, studies examining two replicable forms of subconscious psi perception, remote stare detection and presentiment, are generally performed in the absence of a concurrent behavioral task. This choice is probably based on the conviction that physiological evidence for these phenomena is most easily obtainable when participants are not being asked to engage conscious psi abilities. The few studies that have simultaneously gathered both behavioral and physiological data have generally found null results for both conscious and subconscious psi.

To address this gap in knowledge, we set out to test three hypotheses: 1) conscious remote stare detection is possible and evidence for it can be obtained via the performance of a two-interval forced-choice (2IFC) task during the concurrent measurement of physiological data, 2) remote staring produces physiological changes in the individual being stared at, these changes are apparent as tonic and/or phasic effects in pulse periods and/or skin conductance across individuals, and they are present even when individuals are simultaneously asked to consciously determine when they are being stared at, and 3) stimuli that produce different levels of arousal after their occurrence also produce different levels of arousal before their occurrence, these differences are apparent as tonic and/or phasic effects in pulse periods and/or skin conductance across individuals, and they can be measured even when individuals are simultaneously asked to consciously predict the identity of a future stimulus.

To test these hypotheses, we collected behavioral and physiological data from a group of 20 Northwestern University undergraduates who each participated in a 1.5 to 2-hour session in which they performed three conditions. We referred to these conditions as the remote stare-detection (RSD), precognition, and remote-stare-detection control (RSD control) conditions; these were

performed in the order listed. The *RSD condition* consisted of 30 two-interval forced-choice (2IFC) trials in which the participant was asked to distinguish the 10-s interval during which s/he had been remotely stared at through a video camera (the staring period) from the 10-s interval in which s/he had been unobserved (the non-staring period). The *precognition condition* consisted of 25 single-interval trials in which the participant was asked to guess which of four images would later be revealed as the "target" image on that trial. The *RSD control condition* was the same as the RSD condition, except the subject was unobserved throughout the entire condition. Intervals in the RSD control condition are referred to as "staring" vs. "non-staring" periods (in quotes), to indicate that although the computer software marked the intervals as such, there was no actual observation of the participant during this condition. Note that in this condition, participants received false feedback so that to the participant, in all respects this condition was the same as the RSD condition. Electrodermal activity (skin conductance or SC) data and pulse period (inter-beat interval or IBI) data were recorded throughout all three conditions. All analyses used planned two-tailed comparisons at α=0.05.

Confirmatory and exploratory analyses supported only the two hypotheses regarding physiological or subconscious effects. Neither individual nor group data revealed behavioral or conscious performance above chance on any of the three conditions.

In terms of confirmatory analyses of physiological data, an examination of tonic effects in the *RSD condition* revealed that inter-beat intervals were, on average, significantly higher during staring than non-staring periods in the first interval ($t_{1,16}$=2.96, p=0.009, d=0.72) and significantly lower during staring than non-staring periods in the second interval ($t_{1,16}$=-2.27, p=0.037, d=0.55). Examination of tonic effects in skin conductance data revealed no significant differences between average skin conductance in staring vs. non-staring periods in either the first or second intervals (both p-values >0.244) on this condition. Analysis of phasic effects in the RSD condition revealed that average difference traces based on IBI traces from staring vs. non-staring periods showed

several contiguous regions of statistical significance including the region between about 6 and 8.5 s in the first interval (stare IBI > non-stare IBI) and two regions in the second interval: between about 0 and 1 s and between about 9 and 10 s (stare IBI < non-stare IBI). Difference traces derived from skin conductance data revealed no significant regions.

Supporting that these results may arise from a true staring effect, confirmatory analyses of data from the *RSD control condition* revealed no significant physiological tonic or phasic effects. Averaged IBI and SC data did not differ between staring and non-staring periods in either the first (IBI: p=0.995; SC: p=0.686) or second (IBI: p=0.194; SC: p=0.656) intervals. Further, no regions of statistical significance were found in the average difference traces derived from either pulse period or skin conductance data recorded in the RSD control condition.

In a follow-up exploratory analysis, an algorithm based on the differences observed in physiological data in the RSD condition was applied to the pulse period and electrodermal data for each participant on a trial-by-trial basis. Suggesting that the physiological differences observed between staring and non-staring periods were consistent across individuals, this algorithm predicted which interval was most likely to be the staring interval at a rate that was, across participants, better than chance on the RSD condition, but not on the RSD control condition (RSD condition: t_{16}=3.89, p=0.001, d=0.94; RSD control condition: p=0.536; paired $t_{1,15}$=3.69; p=0.002; d = 0.92).

Regarding the *precognition condition*, confirmatory analyses revealed no evidence of tonic pre-feedback effects in either pulse period or skin conductance data; paired t-tests between collapsed averages across pre-stimulus periods from correct vs. incorrect trials were not significant for either measure (both ps > 0.272). However, confirmatory analyses of phasic pre-feedback effects revealed a > 500 ms region in which IBI values were significantly higher on correct trials than on incorrect trials; this region was temporally centered around 5.5 seconds preceding feedback. Supporting the validity of this result, no regions of significance were found in the control analyses

of the same pulse period data sorted by correctness of the previous trial. No regions of significance were found via phasic analysis of skin conductance data.

We used exploratory analyses to examine whether such presentiment-like responses might also have occurred on correct vs. incorrect trials of the RSD and RSD control conditions, and found no evidence for such responses in the RSD condition. However, exploratory analyses of phasic pre-feedback effects in the RSD control condition revealed two regions during which skin conductance values were significantly higher preceding feedback on correct vs. incorrect trials (~7.75-8.25 and ~6.25-6.75 ms before feedback). Again suggesting a genuine presentiment-like effect, albeit different from that found in the precognition condition, there were no pre-feedback differences when the same data were re-analyzed after sorting according to correctness on the previous trial.

Overall, the results do not provide evidence for conscious behavioral performance of remote-stare detection or precognition, but they do support the existence of subconscious psi effects that occur during the performance of remote-stare detection and precognition tasks. The present experiments, performed in an independent perceptual neuroscience laboratory in a mainstream scientific context, provide replications of a subset of data focusing on remote staring and presentiment and offer novel avenues for the investigation of the mechanisms underlying these and other psi phenomena. A replication attempt is currently underway.

Introduction

Several forms of apparent psi perception are consistently demonstrable at the physiological (subconscious) level, if not at the behavioral (conscious) level. For example, on average, individuals seem to have different physiological responses when they are being remotely observed through a video camera as compared to when they are not being observed (W. Braud et al., 1993a; W. Braud et al., 1993b; M. Schlitz and S. LaBerge, 1997; R. Wiseman and M. Schlitz, 1997), although some experimenters have not been able to replicate this effect (see R. Wiseman and M. Schlitz, 1997). A meta-analysis of 15 such studies of *remote stare detection*, including these and other studies with negative results, revealed a small but significant average effect size [d=0.13, p=0.01 (S. Schmidt et al., 2004)]. Another relatively well-replicated subconscious perceptual phenomenon is *presentiment*, demonstrated by statistically significant physiological responses to arousing stimuli arriving 3-7 seconds in the future. Such responses have been described in peer-review journals using five different physiological measures (skin conductance, heart rate, blood volume, EEG, fMRI) in at least five different laboratories (D. Radin, 1997; D. Bierman and H. Scholte, 2002; B. McDonough et al., 2002; S. Spottiswoode and E. May, 2003; R. McCraty et al., 2004b, a; D. Radin, 2004; E. C. May et al., 2005).

In order to more completely examine the relationship between conscious and subconscious psi performance, data for both kinds of performance would ideally be collected simultaneously. However, most commonly, studies examining remote stare detection and presentiment are performed without a behavioral context. This methodological choice is probably based on the conviction that physiological evidence for these phenomena is most easily obtainable when participants are not being asked to engage conscious psi abilities. When physiological data can successfully be obtained during concurrent behavioral task performance, examination of the link between physiological and behavioral psi phenomena is simplified and enhanced. Unfortunately, this goal has been difficult to obtain. A recent attempt to simultaneously demonstrate both

behavioral and physiological measures of both precognition and telepathy failed on all counts (S. T. Moulton and S. M. Kosslyn, 2008; see Discussion for analysis), and an attempted replication of the staring effect which employed both conscious and subconscious measures also produced null effects (S. Muller et al., 2006). In our laboratory, an unpublished preliminary study examining conscious stare detection during mock gathering of physiology data resulted in a statistically significant behavioral effect ($n=10$, $p=0.03$), but these data were obtained when participants were not using ear plugs to block out potential auditory cues, so sensory leakage was a possible explanation for the effect.

In the present experiment, we set out to test three hypotheses: 1) conscious remote stare detection is possible and evidence for it can be obtained via the performance of a two-interval forced-choice (2IFC) task during the concurrent measurement of physiological data, 2) remote staring produces physiological changes in the individual being stared at, these changes are apparent as tonic and/or phasic effects in pulse periods and/or skin conductance across individuals, and they are present even when individuals are simultaneously asked to consciously determine when they are being stared at, and 3) stimuli that produce different levels of arousal after their occurrence also produce different levels of arousal before their occurrence, these differences are apparent as tonic and/or phasic effects in pulse periods and/or skin conductance across individuals, and they can be measured even when individuals are simultaneously asked to consciously predict the identity of a future stimulus.

For the remote stare-detection task, the selection of a two-interval forced-choice (2IFC) procedure (see Methods) was based on previous results showing that single-interval procedures ("were you stared at just now?") reveal a clear bias towards choosing "staring" as a response (J. Colwell et al., 2000); such bias is reduced with the use of multiple-interval procedures (D. Green and J. Swets 1974; L. Marshall and W. Jesteadt, 1986). In our examination of presentiment, rather than asking participants to rate the arousal level of an upcoming stimulus (which would be the

direct behavioral analogue of the physiological presentiment phenomenon) we used a less directly related visual precognition task in which trial-by-trial feedback was given (see Methods). On this condition, we could then compare physiological responses between correct (uncommon and arguably more arousing) and incorrect (much more common and arguably less arousing) trials to determine whether presentiment occurs in this behavioral context. We took this indirect approach because we are running a concurrent study examining learning on this condition, and we wanted to understand more about its physiological underpinnings.

Confirmatory and exploratory analyses supported only the two hypotheses regarding physiological or subconscious effects. No analysis revealed behavioral or conscious performance beyond chance on any condition, thus the first hypothesis was not supported. In contrast, confirmatory analyses found consistent differences in IBI between contrasting periods for the remote stare detection and precognition conditions (hypotheses 2 and 3). Exploratory analyses strengthened these findings and extended them to presentiment-like skin conductance differences found in one of the conditions (RSD control), lending further support to hypothesis 3.

Methods

Experimental Design

Between January and March 2009, we collected behavioral and physiological data from a group of 20 Northwestern University undergraduates who each participated in a 1.5 to 2-hour session in which they performed three conditions. We referred to these conditions as the remote stare-detection (RSD), precognition, and remote-stare-detection control (RSD control) conditions; these were performed in the order listed. The number of trials in each condition were pre-planned. The *RSD condition* consisted of 30 two-interval forced-choice (2IFC) trials in which the participant was asked to distinguish the 10-s interval during which s/he had been stared at (the staring period) from the 10-s interval in which s/he had been unobserved (the non-staring period). The

precognition condition consisted of 25 single-interval trials in which the participant was asked to guess which of four images would later be revealed as the "target" image on that trial. The *RSD control condition* was the same as the RSD condition, except the subject was unobserved throughout the entire condition. Intervals in the RSD control condition are referred to as "staring" vs. "non-staring" periods (in quotes), to indicate that although the computer software marked the intervals as such, there was no actual observation of the participant during this condition. Note that in this condition participants received false feedback; to the participant, this condition was the same as the RSD condition in all respects. Participants were told that they were performing the RSD condition twice to determine if their performance would improve after experience with the precognition condition. Electrodermal activity (skin conductance or SC) data and pulse period (inter-beat interval or IBI) data were recorded throughout all three conditions. All conditions used software that drew upon a hardware-based true random-number generator that has passed many tests for statistical randomness.

No formal protocol was written before the experiment began, although a general outline of the conditions was written in a laboratory notebook, and the protocol was discussed and agreed upon orally among the authors, two of whom are skeptics (MG and SS). To prevent opportunistic data gathering and optional stopping, behavioral and physiological data were not examined until all data acquisition was complete. The number of participants was determined by the number of undergraduates who registered for the experiment in the Winter quarter of 2009.

Participants

Twenty participants (15 females) between the ages of 18 and 21 years received course credit for their participation in these experiments. Participants were pre-screened for a high level of belief in the existence and scientific verifiability of anomalous phenomena via a written question: "How would you rate your confidence that psychic phenomena, including telepathy and precognition, are

real and scientifically verifiable? Please answer on a scale from 0 to 5, with 0 rated as "No Confidence" and 5 as "Complete Confidence." This question was included in a packet of other questions used for pre-screening the psychology department subject pool at Northwestern University. To avoid participants who would put little or no effort into the behavioral portion of these experiments, we selected only individuals who rated their confidence as either "4" or "5" on this scale. All participants performed all three conditions, but due to hardware and/or operator errors, physiological data was only available on all three conditions for 16 of the 20 participants.

Conditions

Prior to the first trial in each of the three conditions, there was a 135-second relaxation period to allow the participant's skin conductance and pulse periods to settle to baseline values. Before leaving the room, the experimenter told the participant to use this time to relax and get ready for the first trial.

In each trial of the *RSD condition*, we used a computer monitor to present participants with two visually marked 10-second intervals separated by an inter-stimulus interval of 6 seconds. Before presenting these intervals, the software randomly selected either the first or second interval as the staring interval (with equal probability). After these two intervals, the participant clicked a mouse on one of two buttons (marked "1" and "2") to indicate during which of the two intervals s/he had felt "stared at." The participant then received sustained (3-second duration) visual feedback showing the actual interval during which the experimenter (JM) had been staring at his/her image in a remote video monitor. This feedback was followed by an 8-second inter-trial interval.

From the participants' point of view, each trial of the *RSD control condition* was exactly the same as those in the *RSD condition*. However, during each this entire condition, the experimenter's remote video monitor was turned off, and the experimenter herself was engaged in other work. As

in the *RSD condition*, the trial-by-trial feedback received by the participant during this condition corresponded to the intervals labeled "staring" and "non-staring" by the computer software.

In each trial of the *precognition condition*, participants were presented with four photographs in each of the four corners of the computer monitor. These photographs were selected without replacement from a set of 100 images consisting of the 100 least arousing photos in the International Affective Picture System database (P. J. Lang et al., 2005), as ranked by adult female observers. Four novel photographs were presented on each trial. Each participant was asked to use the mouse to click on the image that they felt would be the one later selected by the computer as the "target" image. Immediately after the participant clicked on an image, all images disappeared from the screen. The software then randomly selected one of the four photographs as the target image (with an equal probability for any of the four targets), and a full-screen version of this target image was displayed for 8 seconds, followed by an inter-trial interval of 8 seconds before the next four images were displayed.

Procedure

Each participant first completed consent forms, then discussed the purpose of the study with the experimenter (JM). The experimenter told each participant that they were selected for this study due to their conviction that psi phenomena could be verified scientifically, and that the experimenter shared this conviction. They were told that the purpose of this study was to replicate previous findings from other laboratories, and to shed light on the perceptual learning of psi tasks. Each condition was described just before the participant performed that condition.

Before the RSD condition, the experimenter told the participant that she would be in the room next door, observing a computer monitor which would tell her in which of two observation intervals she should look at a video monitor displaying the participant's real-time image. The experimenter explained that the computer software's random-number generator was responsible for choosing which of the two intervals would be the staring interval, and that the experimenter would

have no knowledge of the correctness or incorrectness of the participant's guess on each trial until the end of the experiment. The experimenter also reassured the participant that when she looked at the monitor, she would be thinking "positive, caring thoughts" about the participant. She explained that when she looked away, the experimenter would cover the monitor and think about other things. The experimenter encouraged the participant to "play" with using different techniques to determine which interval was the staring interval. Some examples: positioning his/her body so that the video camera showed a profile or a back-only view, choosing a part of the body in which tingling would signify staring or non-staring intervals or simply going with "intuition" or "gut" feelings.

During the RSD condition, the participant was seated in a concrete-block room next door to the room in which the experimenter was seated. The experimenter sat on a chair facing a computer monitor and a video monitor. All of her movements were designed to make little or no noise. The experimenter used her cardboard-bound lab notebook to block her view of the video monitor until signaled by the computer software to stare. When she saw this signal, the experimenter moved the lab notebook aside by moving her arm but not her elbow (which rested on the desk), and stared at the image of the participant in the video monitor. During the 10-second staring interval, the experimenter both thought compassionate thoughts and silently intended the participant to sense that she was staring. By observing the participant's computer monitor through the experimenter's video monitor, the experimenter knew when the observation interval had ended. At this point, she moved her arm to cover the video monitor with the lab notebook, and returned her gaze to the computer monitor so that she would be ready for the next staring interval. Through the entire condition, the experimenter took care not to create noise that could differentiate the staring from the non-staring intervals. The door to the participant's room was closed, and the participant wore sound-attenuating earplugs during the entire condition as an extra precaution. Once the 30 trials had been completed, the experimenter walked into the testing room, signaled for the participant to remove the earplugs, and asked the participant to describe his/her experience.

Before the *precognition condition*, the experimenter briefly described the task and explained that some people may be able to sense information before it's available to the five senses. The experimenter covered the video camera with a piece of paper, and mentioned that the participant would not be observed during this task. The experimenter encouraged the participant to choose the image that "felt" right, and left the room after thanking the participant. During the precognition condition, the experimenter answered emails, read, or analyzed data until the computer monitor displayed a statement that all trials were complete. After the condition was complete, the experimenter returned to the testing room and asked the participant to describe his/her experience.

Before the *RSD control* condition, the experimenter explained that the next condition would be the same as the first (the RSD condition), and that the goal of repeating this condition was to determine whether performance on the precognition would result in improved performance on the next condition. This goal was, in fact, true: the experimenter was curious about whether experience on a precognition task could allow the participants to perform the RSD control condition based on precognition of the feedback, rather than on experiencing (non-existent) staring. The experimenter uncovered the video camera and helped the participant re-insert the sound-attenuating earplugs, then she left the room. During the RSD control condition, the video monitor was turned off. The experimenter performed other work on her laptop while the computer software still displayed cues for the "staring" and "non-staring" interval on her desktop screen, which was not connected to the video monitor. She did not attend to the desktop screen, except for brief glances to determine if all trials were complete. When the condition was finished, the experimenter returned to the testing room, signaled the participant to remove the earplugs, and asked about his/her experience.

Apparatus for Gathering Behavioral Data

Software for the RSD and precognition conditions was written by the experimenter (JM) in Matlab 7.4 (2007a, The Mathworks, MA); both programs are available upon request. The RSD program was used for both the RSD and the RSD control conditions. To avoid the patterns that can

arise from the use of pseudo-random number generators, the RSD and the precognition software used independent calls to an Alea 1 True Random Number Generator (Araneus, Finland) for each selection of a staring interval (RSD and RSD control conditions) or target image (precognition condition). This hardware-based USB random number generator has passed many tests of statistical randomness, including the Die Hard series of tests. Further testing for randomness is described in the Results section.

The RSD and precognition software programs were run on a Dell PC (Intel Core 2 Duo processor) running the Microsoft Windows XP operating system that was sitting on the floor in the experimenter's room. This PC was attached to a flat screen computer monitor in the experimenter's room as well as a secondary flat screen monitor in the participant's testing room (both monitors from Acer). The mouse used by the participant for behavioral responding was connected to this same PC. For remote viewing of the participant during the RSD condition, we used a Swann video transmitter paired with a 2.4 GHz receiver connected to a Spectra video monitor.

Apparatus for Gathering Physiological Data

We used Biograph Infiniti software Version 3.1.5 (Thought Technology Ltd., NY) to gather skin conductance and inter-beat interval data. This software was run on an HP laptop with an Intel Celera M processor, using the Microsoft Windows XP operating system. This laptop remained in the room with the subject at all times, but when the software had started to gather data, the top of the laptop was closed almost entirely, so the participant would not be distracted the screen. If the participant did for some reason see the screen, no information about the behavioral aspects of any condition would have been available.

Adhesive single-use Ag/AgCl electrodes (11 mm in diameter) were snapped to leads from a skin conductance sensor (SC-Flex/Pro, Thought Technology, Ltd.) and attached to the second and third fingers of the non-dominant hand. The sensor used a constant voltage of 0.5V between the electrodes to measure the conductance. No electrode gel was used (see Discussion for commentary

on this and other EDA-related issues). A blood volume pulse sensor (BVP-Flex/Pro, Thought Technology, Ltd.) was attached to the fourth finger of the non-dominant hand; this BVP sensor provided peak-to-peak amplitude data from which pulse periods or inter-beat intervals were calculated. All attachments were reinforced with breathable medical tape. The skin conductance and blood volume pulse sensors were connected to a Procomp Infiniti Encoder (Thought Technology, Ltd.), which was connected via a USB port to the HP laptop running the physiology software. The encoder applied a 5^{th} order Butterworth anti-aliasing filter (64Hz) to all incoming signals. Skin conductance and inter-beat interval data were gathered only during each of the three conditions, and not during breaks. Unless the participant had to use the washroom, the skin conductance electrodes and blood volume monitor was attached to the participant during the entire experiment. Room temperature was kept at approximately 70° F throughout the experiment.

To mark the timing of behavioral events for later physiological analysis, the RSD and precognition software both used the same strategy. Each program sent an auditory click to a voltage isolator (Thought Technology, Ltd.). This pulse was interpreted as a voltage deviation, which was communicated via a lead attached to the Procomp Encoder, and recorded by the Biograph Infiniti software. In the RSD and RSD control conditions, one event-marking pulse was sent at the beginning and end of each observation interval. There was no difference between the pulses surrounding staring and non-staring periods. In the precognition condition, one event-marking pulse was sent immediately prior to the display of the target image.

Continuous skin conductance and inter-beat interval data for each listener on each condition were sampled at 256 Hz, re-sampled at 32 Hz, and saved on a USB flash drive for later analysis on a MacBook laptop. The experimenter (JM) wrote physiology data analysis software in Matlab 7.6.0 (R2008a, The Mathworks, MA); this software is available upon request. When analyzing inter-beat interval data, the software removed instances of inter-beat intervals longer than 1400 ms and shorter

than 400 ms, and replaced these values with dummy ('NaN') values. To avoid "data picking" due to experimenter bias, no other artifact-removal process was performed.

Data Analysis

The independent variable in the RSD condition was the presence or absence of staring in the first and second intervals. The independent variable in the precognition condition was correct vs. incorrect performance on each trial. The independent variable in the RSD control condition was the first and second interval periods marked "staring" and "non-staring" by the RSD software. The calculation and analysis of all dependent variables are described below.

All confirmatory and exploratory analyses used two-tailed comparisons at α=0.05; all t-tests were preceded by Shapiro-Wilk and Kolmogorov-Smirnov tests of normality, and all dependent variables passed these tests at α=0.05. *To test hypothesis 1*, we used a planned t-test to compare behavioral performance on the RSD condition with performance predicted by the null hypothesis (chance), and a paired t-test to compare behavioral performance between the RSD and RSD control conditions. *To test hypothesis 2*, we planned to avoid potential order effects by comparing physiological data from the RSD and RSD control conditions only within each of the two intervals in the 2IFC condition, and not across these two intervals. Within each of these intervals, two planned analyses were used to examine tonic vs. phasic effects. *To examine tonic effects within each interval of the RSD and RSD control conditions*, we would calculate the average of all traces recorded during staring vs. non-staring (or "staring" vs. "non-staring") periods, giving for each participant one mean staring IBI trace, one mean staring SC trace, one mean non-staring IBI trace and one mean non-staring SC trace for both the first and second intervals (Figure 1, left). Then we would collapse each of these traces into a single mean value by averaging the trace over time. Paired t-tests across these collapsed averages from staring and non-staring periods would result in four paired t-tests comparing IBI and SC collapsed averages between staring and non-staring periods in the first and second intervals in the RSD condition, and four similar paired t-tests in the

RSD control condition. *To examine phasic effects within each interval of the RSD and RSD control conditions*, for each participant two difference traces per interval would be calculated by subtracting the mean non-staring IBI trace from the mean staring IBI trace (resulting in an IBI difference trace), and by subtracting the mean non-staring SC trace from the mean staring SC trace (resulting in an SC difference trace; Figure 1, right). Across-participant averages of these two difference traces would be calculated for each interval, and a 95% confidence interval would be computed for each time point. Note that briefly contiguous and non-contiguous regions in which the confidence intervals do not include zero are predicted by chance performance; with α=0.05 and 320 total points in each trace, purely by chance 16 difference values in each trace should have confidence intervals that do not overlap with zero. Thus, to be conservative, only regions for which confidence intervals do not overlap with zero for 16 or more difference values are discussed here as significantly different from zero. Hypothesis 2 would be considered to be supported only if any tonic and/or phasic effects found in either IBI or SC data from the RSD condition were not found in data from the RSD control condition. *To test hypothesis 3*, we planned similar analyses on IBI and SC data recorded during the pre-stimulus period, which we considered to be the 10 seconds preceding the display of trial-by-trial feedback. To examine tonic effects, we planned paired t-tests on collapsed averages of traces from the pre-stimulus periods of correct vs. incorrect trials. To examine phasic effects, we would calculate average difference traces between data from pre-stimulus periods in correct and incorrect trials for each participant and, as in the RSD and RSD control analysis, compute an average difference curve across participants using 95% confidence intervals at each timepoint to find regions of significance longer than 16 contiguous data points. Further, as a control for potential arousal effects resulting from previous "correct" feedback, we planned to use the same two analyses to examine the same physiology data grouped according to the correctness of the previous trial. Hypothesis 3 would only be supported if any tonic and/or phasic effects found in IBI

or SC data from the precognition condition were not found when the same data were sorted according to the correctness of the previous trial.

Group analyses of behavioral data included all twenty subjects. However, due to experimenter error (forgetting to turn on the physiology recording software) and/or hardware malfunction (battery failure in the voltage isolator), physiology data was only available for 17 participants in the RSD condition, 19 participants in the precognition condition, and 18 participants in the RSD control condition. To avoid concerns about "data picking," we analyzed all available physiology data, except when making paired comparisons across physiology data from the RSD and RSD control conditions. In such cases, we only analyzed physiology data from the 16 participants for whom physiology data were available in both conditions. SPSS 13.0 for Windows was used for all statistical analyses.

One of the several exploratory analyses we performed consisted of a *computational analysis*, an algorithm applied to inter-beat interval and skin conductance data from the RSD and RSD control conditions. Input to the algorithm consisted of the IBI and SC traces recorded during the first and second intervals of each trial (trial-specific IBI and SC traces) as well as the collapsed averages of IBI and SC data in the first interval and the second interval across all 30 trials (across-trial IBI and SC averages). The algorithm was run in two modes, mirroring the tonic and phasic confirmatory analyses. In the "tonic" mode, when examining data from each trial, the algorithm collapsed trial-specific IBI and SC traces to obtain an average IBI and SC value across each of the two 10-second intervals. In the "phasic" mode, when examining data from each trial, the algorithm collapsed trial-specific IBI and SC traces to obtain an average IBI and SC value for each interval, derived only from the temporal regions of interest found during confirmatory analyses of phasic effects. Regardless of the mode used by the algorithm, once the trial-specific data were collapsed into either whole averages or regions of interest for the first and second intervals, the functioning of the algorithm was the same. For each trial, it compared the collapsed trial-specific IBI and SC

values from the first interval with the across-trial first interval IBI and SC values, and the collapsed trial-specific IBI and SC values from the second interval with the across-trial second interval IBI and SC values. Based on these comparisons, the algorithm determined whether the first or second interval was more likely to contain the staring period. Each of the four comparisons produced tentative predictions that were stored until all four comparisons were complete. The comparisons were as follows.

1) If the collapsed trial-specific IBI value from the first interval was greater or equal to the across-trial first interval IBI value, the first interval was predicted as the staring interval on that trial. Otherwise, the second interval was tentatively predicted as the staring interval.
2) If the collapsed trial-specific IBI value from the second interval was greater than the across-trial second interval IBI value, the first interval was predicted as the staring interval on that trial. Otherwise, the second interval was tentatively predicted as the staring interval.
3) If the collapsed trial-specific SC value from the first interval was less than the across-trial first interval SC value, the first interval was predicted as the staring interval on that trial. Otherwise, the second interval was tentatively predicted as the staring interval.
4) If the collapsed trial-specific SC value from the second interval was less than or equal to the across-trial second interval SC value, the first interval was predicted as the staring interval on that trial. Otherwise, the second interval was tentatively predicted as the staring interval.

If three or more of these four tentative predictions were in agreement, the staring interval selected by the majority of the predictions became the final predicted staring interval for that trial. If the tentative predictions were split equally between the first and second interval, the prediction of the second comparison (IBI comparison in the first interval) was selected as the final predicted staring interval for that trial. This tie-breaker was chosen because the IBI data from the first interval produced the strongest effect size in the confirmatory analyses. The final predicted staring interval for each trial was then stored in an array, and once all 30 trials had been analyzed, this array was

compared with the array of actual staring intervals (or "staring" intervals in the RSD control condition). For each participant, the number of predicted staring intervals that correctly matched the actual staring intervals was calculated and used as the dependent variable to assess the success of the computational analysis.

Results

Behavioral Results: Confirmatory Analyses

The behavioral data from the RSD and RSD control conditions revealed no statistically significant results. On both conditions, chance performance was 50% correct. The group mean for the RSD condition was 48.2% correct (SD 8.6%) and for the RSD control condition was 50.5% correct (SD 8.3%). T-tests on both conditions were not significant (RSD: t_{19}=-0.9, p=0.4; RSD Control t_{19}=0.27, p=0.79), and a paired t-test revealed no difference in performance between conditions ($t_{1,19}$=-0.97, p=0.34).

Behavioral Results: Exploratory Analyses

Exploratory analyses also revealed no statistically significant results. Although none of the hypotheses addressed behavioral performance on the precognition condition, we assessed performance on this condition as well. The group mean on the precognition condition was 24.6% correct (chance was 25%), and a t-test was not significant (precognition t_{19}=0.27, p=0.8). There were also no significant correlations between behavioral performance on any two of the three conditions (Pearson, all $ps > 0.117$). Exploratory analyses at the individual level revealed that only one individual achieved significant behavioral performance on any of the three conditions. This subject (W02) scored 67% correct on the RSD control condition (binomial test, p=0.04); this subject had comparably poor performance on both the RSD condition (40% correct) and the precognition condition (16% correct). Thus, this result is more than likely due to chance; given that the binomial test was effectively repeated 60 times to look for significant results at the individual

level (20 participants x 3 conditions), one would expect 3 seemingly significant results purely by chance when using an alpha at 0.05.

Anecdotally, three participants noted that they felt disconnected or unable to distinguish "staring" intervals during the RSD control condition, when they were never actually being observed. However, these participants did not score any better than the group average on the RSD condition (participants W09, W10, W12; average score of these participants on RSD: 48% correct), suggesting that whatever strategy they were using to distinguish intervals in the RSD condition was no more effective than chance responding.

Physiological Detection of Staring vs. Non-Staring Intervals: Confirmatory Analyses

The physiological data from the RSD condition revealed statistically significant differences in pulse period data recorded during staring versus non-staring intervals, at both the tonic and phasic levels of analysis. These differences did not occur in the RSD control condition (results summarized in Table 1). In terms of tonic effects, collapsed averages of inter-beat intervals (IBI) recorded during the RSD condition were, on average, longer during staring periods than non-staring periods in the first interval (staring mean: 758 ms; non-staring mean: 748 ms), and the reverse was true in the second interval (staring mean: 760 ms; non-staring mean: 766 ms). This difference was either not present or not as apparent in the RSD control condition (1st interval staring mean: 792 ms; 1st interval non-staring mean: 794 ms; 2nd interval staring mean: 811 ms; 2nd interval non-staring mean: 807 ms). Paired t-tests across collapsed averages of IBI data from staring and non-staring periods were significant for data from both the first ($t_{1,16}$=2.96, p=0.009, d=0.72) and second ($t_{1,16}$=-2.27, p=0.037, d=0.55) intervals of the RSD condition, but not for the same dependent variables from the RSD control condition (both ps > 0.443). Skin conductance (SC) data recorded during the RSD condition showed a trend mirroring the IBI data from this condition: collapsed averages of SC values were lower during staring than non-staring periods in the first interval (staring mean: 7.20 uS; non-staring mean: 7.30 uS), and collapsed averages of SC values were higher during staring

than non-staring periods in the second interval (staring mean: 7.07 uS; non-staring mean: 6.98 uS). This was not the case for SC data in the RSD control condition (1st interval staring mean: 9.05 uS; 1st interval non-staring mean: 9.01 uS; 2nd interval staring mean: 8.86 uS; 2nd interval non-staring mean: 8.82 uS). However, this trend did not reach significance in either interval of either the RSD or RSD control conditions (all *ps* > 0.245).

In terms of phasic effects, average staring minus non-staring difference traces for pulse period data from the RSD condition in first intervals (Figure 2, TOP) and the same difference traces for second intervals (Figure 2, BOTTOM) show several regions of statistical significance, for which 95% confidence intervals (bars) do not overlap with zero for more contiguous values than predicted by chance (see Methods). These include the region between 6 and 8.5 s in the first interval (stare IBI > non-stare IBI) and two regions in the second interval: between about 0 and 1 s and between about 9 and 10 s (stare IBI < non-stare IBI). No such regions were apparent in the electrodermal data from either interval (Figure 2). Examination of IBI and SC data from the RSD control condition (Figure 3) reveals difference values that do not overlap with zero except for a few regions that would be predicted by chance (fewer than 16 values). Thus, the effects observed in the RSD condition appear to relate specifically to the presence of staring periods, as no similar effects were observed in the RSD control condition.

Physiological Detection of Staring vs. Non-Staring Intervals: Exploratory Analyses

An exploratory computational analysis used to further examine the physiological data supported the conclusion that the physiological differences between staring and non-staring intervals in the RSD condition were relatively consistent across individuals (results summarized in Table 2). Mean differences in physiological data can result from several individuals showing large and consistent deviations in the recorded variables. Thus, we set out to determine whether such differences were consistent enough across individuals that if individuals had used a physiologically informed approach, they would have been better able to distinguish staring from non-staring

intervals. To address this issue, we developed an algorithm that was applied to the individual pulse period and electrodermal data recorded during both intervals on each trial of the RSD condition, for each participant (see Methods). Based solely on either tonic or phasic variables calculated from the physiological data, this algorithm predicted which interval was most likely to be the staring interval on each trial. Then we tabulated, for each participant, the number of times the algorithm predicted a staring interval that coincided with the actual staring interval on each of all 30 trials. We repeated this process for the RSD control condition, using the pulse period and electrodermal data from that condition as input to the algorithm. When the algorithm was run in "tonic" mode using collapsed averages in each interval as input (see Methods), the group mean of the number of staring intervals predicted correctly (out of 30 trials) was 16.4 for the RSD condition and 15.5 for the RSD control condition. T-tests indicated the algorithm performed better than chance on data from the RSD condition (t_{16}=2.16, p=0.046, d=0.52) but not on data from the RSD control condition (t_{17}=0.65, p=0.524) although the difference in performance between the two conditions was not significant ($t_{1,15}$=1.45, p=0.169). Performance improved when the algorithm was operated in "phasic" mode, using statistically significant regions of interest rather than collapsed averages as input (see Methods). In phasic mode, the average of correct predictions was 16.9 for data from the RSD condition and 14.6 for data from the RSD control condition. These values were significantly greater than chance on the RSD condition, but not on the RSD control condition (RSD: t_{16}=389; p<0.001; d = 0.94; RSD Control condition: t_{17}=-0.63; p=0.536), and the performance of the algorithm in phasic mode was significantly better in the RSD than the RSD control condition ($t_{1,15}$=3.69; p=0.002; d = 0.92). Thus, individuals using a physiologically informed strategy for solving the task in the RSD condition would have been able to differentiate staring from non-staring intervals at a level significantly higher than chance. That the same strategy does not work for the RSD control condition, in which participants were unobserved throughout the condition, suggests that this result stems from an actual physiological effect of staring vs. nonstaring periods.

Physiological Pre-Feedback Effects on Correct vs. Incorrect Trials: Confirmatory Analyses

On the precognition condition, a significant phasic difference between pulse period data from correct vs. incorrect trials revealed a presentiment-like response; this difference *preceded* the display of the feedback (Table 3, "Current Trials" column). These differences were not apparent in analyses of tonic effects. Collapsed averages of pulse period data recorded during the 10-second pre-feedback period on correct trials were longer than those on incorrect trials (mean IBI correct: 783 ms, mean IBI incorrect: 776 ms), although these values were not significantly different ($t_{1,18}$=1.13 p=0.273). Electrodermal data recorded during this period was not strikingly dependent on the correctness of the trial (SC correct: 9.27 uS, SC incorrect: 9.29 uS), and these values were also not significantly different from one another ($t_{1,18}$=-0.29, p=0.776). In terms of phasic analyses, average pulse period difference traces from the precognition condition revealed a brief region of significance spanning >16 values, between 5.5 and 5.25 seconds before the display of feedback; another region of significance between 4 and 3 seconds pre-feedback may also be of interest, but it only spanned 12 values (Figure 4, Top). In this first region (5.5 to 5.25 seconds before feedback), IBI values were significantly longer on correct trials than incorrect trials. There were no regions of significance in the electrodermal difference data.

Because the feedback on previous trials could reasonably be expected to affect physiological responses to current trials, our confirmatory analyses included re-examination of the same data, this time sorted by whether the previous trial had been correct or incorrect (Table 3, "Previous Trials" column). For this control analysis based on the correctness of previous trials, paired t-tests on average pulse period and electrodermal data from the 10-second pre-feedback period were again not significant (both ps > 0.664). In addition, there were also no regions of significance in either the IBI or SC difference data when the trials were sorted by the correctness of the previous trial (Figure 4, Bottom). Thus the small but significant difference observed in IBI data on correct vs. incorrect trials may in fact reflect some sort of presentiment-like response.

Physiological Pre-Feedback Effects on Correct vs. Incorrect Trials: Exploratory Analyses

Because the RSD and RSD control conditions also provided trial-by-trial feedback, we used exploratory analyses of physiological data to examine whether pre-feedback responses might also have occurred during these conditions (results summarized in Table 4). For the RSD condition, which was the first condition performed by each participant, the correctness or incorrectness of the previous trial dominated both pulse period and electrodermal responses. This effect was demonstrated both by the lack of pre-feedback responses when the data were sorted by correctness of the current trial, and the presence of pre-feedback responses when the data were sorted by correctness on the previous trial. Specifically, in regards to tonic effects, collapsed averages of IBI and SC data recorded in the 10 seconds prior to feedback did not differ between correct vs. incorrect trials (mean IBI correct: 760 ms, mean IBI incorrect: 761 ms; mean SC correct: 7.00 uS, mean SC incorrect: 7.00 uS; both *p*s > 0.769), but when the same data sorted by correctness of the previous trial, IBI values were significantly lower on trials preceded by correct trials ($t_{1,16}$=-3.20; p=0.006, d=0.78). There was no parallel significant difference for skin conductance data from the RSD condition when the data were sorted by the correctness of the previous trial ($t_{1,16}$=1.38; p > 0.186). Phasic effects in the RSD condition were also found only when data were sorted by correctness on the previous trial (Figure 5). IBI values on trials preceded by correct trials were significantly lower than those preceded by incorrect trials during a 1-second period from 4.5 to 5.5 seconds before feedback. No phasic effects were found for SC values. These results indicate that on the first condition, after receiving feedback indicating that their behavioral choice was correct, participants were still affected by this occurrence well into the following trial.

The RSD control condition, which was the last condition, revealed phasic pre-feedback responses that differed between correct and incorrect trials, but unlike the precognition condition, these responses were apparent in skin conductance but not pulse period data. In terms of tonic effects, pulse period and electrodermal data averaged across the 10 seconds prior to feedback did

not differ between current correct and incorrect trials, or when sorted according to the correctness of previous trials (current: both *ps* > 0.120; previous: both *ps* > 0.701). Analysis of phasic effects revealed no regions of significance in IBI data when sorted either by current or previous correctness (Figure 6). However, when skin conductance data were sorted according to correctness of the current trial, there were two regions of significance in skin conductance difference traces from correct vs. incorrect trials, both > 500 ms long, centered around 8 seconds (26 values) and 6.5 seconds (22 values) before feedback was received (Figure 6, Top). On correct trials skin conductance was significantly higher in these two temporal regions than on incorrect trials. Supporting the interpretation that these skin conductance effects are not attributable to arousal from feedback in the previous trial, average difference traces sorted according to correctness on the previous trial did not reveal any such regions in the pre-feedback period (Figure 6, Bottom).

Deviation from Balanced Order and Correlations with Effects on the RSD Condition

The strongest effects presently reported are the IBI differences found in the RSD condition. However, because this condition used an unbalanced, truly randomized selection of the staring interval on each trial, it is possible that the effects described here were caused by physiological drifts that corresponded to the interval order. Although balanced orders are recommended for experiments testing the effect of remote intention or observation on physiological systems (M. Schlitz et al., 2003), we chose to avoid using a balanced order for two reasons: 1) although unlikely, it is possible that participants could learn the balanced order in the RSD condition and use it as a cue for their behavioral responses in the RSD control condition, and 2) this set of experiments serves to provide a baseline for a set of learning studies already underway in our laboratory, and it was necessary that the software used during these experiments both exactly match the software used for the long-term study, and did not contain any patterns that could be discovered over time. But because the order was unbalanced in the RSD and RSD control conditions, it is especially important to assess the quality of the random-number generator (RNG) used. Although the RNG used in all

conditions has passed many batteries of tests for statistical randomness and meets the highest standards for RNGs put forth in earlier guidelines for remote influence studies (M. Schlitz et al., 2003) it is still possible that the particular interval orders selected by the RNG was not sufficiently balanced. Thus, we used the method outlined in Schlitz et al. (2003) to determine the deviation from a balanced order for each of the RSD and RSD control sessions. For both conditions the across-participant deviations were not significantly different from zero (RSD condition: staring periods in the first and second intervals, respectively: 15.4, 14.6; t_{19}= 0.59, p=0.562; RSD control condition: staring periods in the first and second intervals: 14.4, 15.6; t_{19}=0.95, p=0.352). Within the RSD condition, three sessions showed deviations that were significantly different from zero according to the binomial test, two with 12 more first-interval staring trials than second-interval staring trials, and one in the opposite direction but of the same magnitude. Within the RSD control condition, two sessions showed deviations that were significantly different from zero, one with 10 and the other with 12 more second-interval staring trials than first-interval staring trials.

Given the small number of trials per session some highly unbalanced sequences are expected, however it is possible that the physiological effects observed in the RSD condition could be explained by these imbalances. To determine whether this could have been the case, we calculated difference scores from IBI and SC collapsed averages in the first and second intervals of the RSD condition (mirroring the four paired t-tests; e.g., collapsed average of IBI (SC) staring values in first (second) interval minus collapsed average of non-staring values of the same measure in the same interval). We then performed correlations between these difference scores and deviations from balanced sequences calculated for each participant. None of these four correlations were significant, regardless of whether raw differences or absolute values of the differences were used (Pearson, all ps > 0.363). To determine whether deviations from balanced sequences could explain phasic effects in the RSD condition, we calculated difference scores based on statistically significant regions of interest by collapsing averages of IBI staring values only across significant

regions of each interval and subtracting the collapsed averages of IBI non-staring values in the same regions of the corresponding interval (e.g. average differences between staring and non-staring periods across 6 to 8.5 seconds only in the first interval, and 0-1 seconds only in the second interval). Correlations between these difference scores versus deviations from balanced sequences also produced no significant results, again regardless of whether raw or absolute values were used (Pearson, $ps > 0.425$). Finally, no correlation between the performance of the computational analysis algorithm and deviations from balanced sequences in the RSD condition were significant (Pearson, $ps > 0.240$). These results suggest that although the RNG produced some sequences that were severely unbalanced, these imbalances cannot explain the effects observed in the RSD condition.

Discussion

The results of confirmatory and exploratory analyses did not support hypothesis 1 but did support hypotheses 2 and 3, suggesting that while conscious psi performance on remote stare detection and precognition may be difficult to observe during the simultaneous recording of physiological data, evidence of subconscious psi performance can be obtained while participants perform concurrent remote stare detection and precognition tasks.

Behavioral results were not significant on any condition, adding to the mounting evidence that conscious psi perceptual performance is at most a very subtle skill that is not evenly distributed in the untrained population. A previous examination of conscious remote stare detection under conditions of sensory shielding came to a similar conclusion, based on null effects (E. Lobach and D. Bierman, 2004).

In contrast to the behavioral data, the physiological data presented here may offer some insight into the mechanisms of remote stare detection and presentiment. In the case of the remote stare detection (RSD) condition, the physiological data help explain why participants were unable

to solve the task consistently: arousal differences between staring and non-staring intervals depended on whether staring occurred in the first or second interval, making the intuitive first-to-second interval comparison an inconsistent measure to use over time. This effect masking also suggests another explanation, beyond the several excellent analyses already provided, of why a previous fMRI study of conscious and subconscious telepathy and precognition produced no significant findings (S. T. Moulton and S. M. Kosslyn, 2008). Namely, in that study, participants also performed a two-interval forced choice task, but the results were not sorted according to the interval in which the stimuli were presented. In the current study, because a computational algorithm could relatively successfully use the existing physiological data to select the staring interval, it is possible that participants could be trained to attend to the same measures in order to make the behavioral determination in a two-interval forced-choice context. Studies exploring such a possibility are underway in our laboratory.

We are not aware of any previous remote stare detection study published in a peer-reviewed journal that has used any other physiological measure than electrodermal activity. Here, the effect of staring on pulse periods was much stronger than on electrodermal activity. However, the current study used some unusual methods to record electrodermal data. First, although several rigorous analyses of electrodermal recording methodology have suggested that electrode gel is necessary during the recording of SC data (S. Schmidt and H. Walach, 2000; S. Schmidt et al., 2001), the manufacturer of the equipment used in this study suggests that it should not be used unless necessary (e.g. to increase low skin conductance values). We did not find it necessary in any case; the skin conductance values obtained in the three conditions were reasonable without the use of electrode gel; SC averages collapsed across 10-second intervals ranged from 1.34 to 17.6 uS in the first condition and SC values generally increased from the first to last condition. Second, athough the electrodes were surrounded by an adhesive collar, breathable tape was used to further secure electrodes to the fingers, and some authors have suggested that the use of such tape could introduce

mechanical artifacts into the SC signal (S. Schmidt and H. Walach, 2000; S. Schmidt et al., 2001). To guard against such artifacts, participants were instructed not to move their hand during recording, and the electrode leads were taped to the table. If some artifacts did occur, however, they would have been randomly distributed throughout the recording, and therefore would not have contributed to any consistent across-participant effects. On the other hand, many elements of the electrodermal measurement methodology were conventional. The electrode type and size used here (Ag/AgCl electrodes 11 mm in diameter), the finger placement, and the constant voltage of 0.5V used here are methodological choices that are either considered adequate or recommended by most authors (D. C. Fowles et al.; S. Schmidt and H. Walach, 2000; S. Schmidt et al., 2001). Further, the analytical approaches we used, including the analysis of both phasic and tonic components of skin conductance data as well as the use of t-tests in statistical analyses, are also recommended above several other common methods of analysis (S. Schmidt et al., 2001). For these reasons and those cited above, we consider the present skin conductance data to be sound.

Replication of the remote staring effect in pulse period data lends further support to the subconscious aspect of the remote staring phenomenon, and also helps elucidate the mechanisms underlying it. For instance, in the current experiment, the pulse period data suggest that staring had an equilibrating effect on participants. In the first interval, staring was associated with longer inter-beat intervals than when participants were not observed; in the second interval, staring was associated with shorter inter-beat intervals than when they were unobserved (Table 1 and Figure 2). It seems as if staring maintained the pulse period within a narrow range, reducing both extremes. In order to understand this effect, it might be important to note that in the current study, the experimenter (JM) told each that she would be looking at them with "love" and "compassion" rather than in the negative sense that is more often implied by the word "staring." The felt experience of the staring periods, rather than simply the act of being observed, may be critical to the physiological impact of staring. Supporting this idea, a previous report on remote staring in trained

subjects indicated that before training staring increased electrodermal activity relative to unobserved periods, while after training staring had the opposite effect (W. Braud et al., 1993a). When describing this effect, the authors concluded that, over time, participants and starers had both become more positive and relaxed in their relationship, perhaps creating an electrodermal response to match. In the current study, it is possible that this kind of relaxed, caring relationship was created in advance by the experimenter's frank and open discussion of observing the participants with love and compassion.

The presentiment-like responses on the precognition and RSD control conditions are intriguing to us for two reasons: 1) their existence suggests that such responses can be obtained during the performance of different behavioral tasks, and 2) the presentiment-like responses on the precognition condition seemingly opposed those on the RSD Control condition. To the first point, the current presentiment-like responses, evoked not by future arousing vs. non-arousing stimuli but instead by upcoming feedback about task performance, should be replicable in other behavioral tasks offering trial-by-trial feedback, assuming that participants are motivated enough to be aroused when trials are correct and that participants perform enough trials to extinguish the arousal arising from correct performance on a previous trial (see Figure 5, RSD condition). To the second point, the presentiment-like responses observed in the precognition condition indicated seemingly lower arousal (longer IBI values) in the pre-feedback periods preceding feedback on correct trials (Figure 4, TOP), but in the RSD control condition the presentiment-like responses indicated higher arousal (higher SC values) during the same period (Figure 6, TOP). This seeming difference may be clarified when post-feedback responses are taken into account. Post-feedback responses were similar between the two conditions: participants had higher skin conductance after feedback on correct versus incorrect trials on both conditions, and higher inter-beat intervals after feedback during the same time period on both conditions (significantly so for the RSD condition; see Figure 6). Thus, IBI pre-feedback responses in the precognition condition and SC pre-feedback responses

in the RSD control condition both mirrored the post-feedback responses in the same physiological system.

One potential explanation for the finding that presentiment-like responses in the precognition and RSD control conditions differ in the physiological system in which they are apparent is that these responses are not foreshadowing the feedback, but instead reflect physiological conditions under which performance is affected. The precognition condition presented a behavioral task that could be solved either using precognition or psychokinesis (influencing the random number generator), but in the RSD control condition, precognition was the only possible method available because there was no staring contrast that could have been made, and the random number generator determined the staring vs. non-staring intervals before each trial began. Thus, this difference in presentiment responses could indicate differing physiological states that support psychokinesis (on the precognition condition) versus precognition (on the RSD control condition). This type of analysis is reminiscent of that provided by mainstream vision perception researchers reporting significant differences in EEG signals from the pre-stimulus period of trials on which participants detected stimuli vs. trials on which stimuli were not detected (T. Ergenoglu et al., 2004; K. E. Mathewson et al., 2009). Their explanation of the results is that the differences reflect attention or readiness potentials that facilitate accurate detection. Because these reports do not discuss whether these potentials are also present before false alarms (in which participants experience a stimulus when there is no stimulus present), it is of course entirely possible that such EEG pre-stimulus responses could in fact be foreshadowing the experience of detecting the stimulus. In our laboratory, experiments are underway to determine whether the current presentiment responses are reflections of feedback foreshadowing or task performance.

These data join other physiological demonstrations consistent with telepathy and precognition that have been published in both mainstream and non-mainstream peer-reviewed journals over the past five decades (T. Duane and T. Behrendt, 1965; R. Targ and H. Puthoff, 1974;

D. Orme-Johnson et al., 1982; W. Braud et al., 1993a; W. Braud et al., 1993b; D. Radin et al., 1995; D. Radin, 1997; M. Schlitz and S. LaBerge, 1997; R. Wiseman and M. Schlitz, 1997; B. McDonough et al., 2002; S. Spottiswoode and E. May, 2003; J. Wackermann, 2003; J. Wackermann et al., 2003; R. McCraty et al., 2004b, a; D. Radin, 2004; L. J. Standish et al., 2004; E. C. May et al., 2005; T. L. Richards et al., 2005). The present experiments, performed in an independent perceptual neuroscience laboratory in a mainstream scientific context, provide replications of a subset of these data focusing on remote stare detection and presentiment, and offer novel avenues for the investigation of the mechanisms underlying these phenomena. If replicated, they could help form the basis of understanding of two forms of putative psi perception.

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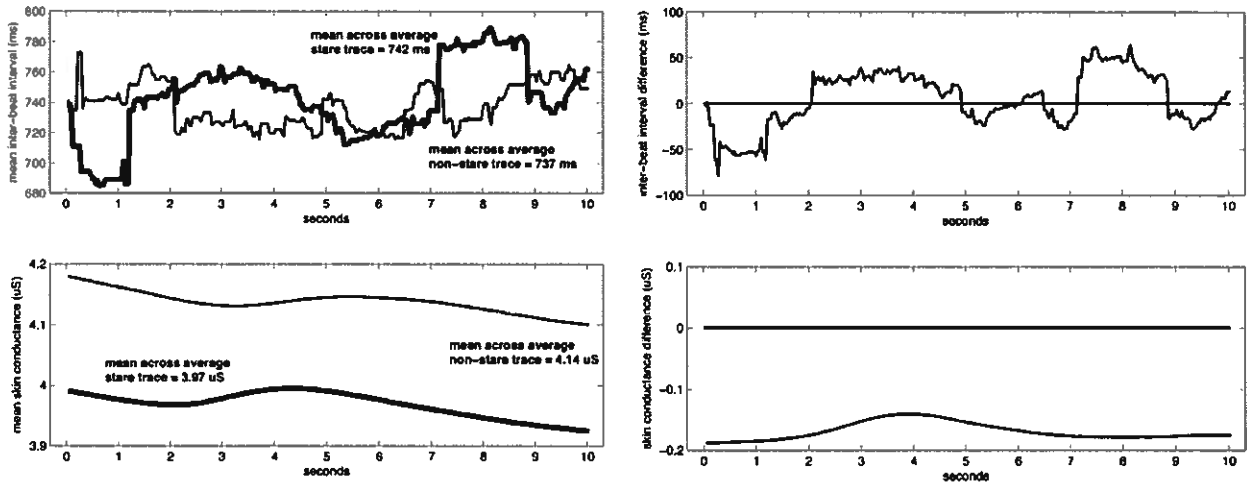

Figure 1: Example Calculation of Tonic and Phasic Physiology Dependent Variables in the RSD and RSD Control Conditions

For each participant, physiology traces were first averaged over all first-interval stare periods and all first-interval non-stare periods in all 30 trials to obtain four mean physiology traces. Top Left: mean inter-beat interval traces for staring (darker line) vs. non-staring (lighter line) periods. Bottom Left: mean skin conductance traces for staring (darker line) vs. non-staring (lighter line) periods. To obtain dependent variables used for examining tonic differences, these four traces were collapsed over time by averaging across each trace, resulting in four collapsed means. To obtain dependent variables used for examining phasic differences, each non-stare trace was subtracted from each stare trace to provide two difference traces. Top Right: difference trace for IBI, Bottom Right: difference trace for SC.

For data from the RSD and RSD control conditions, both methods were repeated for all traces in the second interval. Similar methods were applied to data from the precognition condition (see Methods). Data shown are actual first-interval data from participant W08 in the RSD condition.

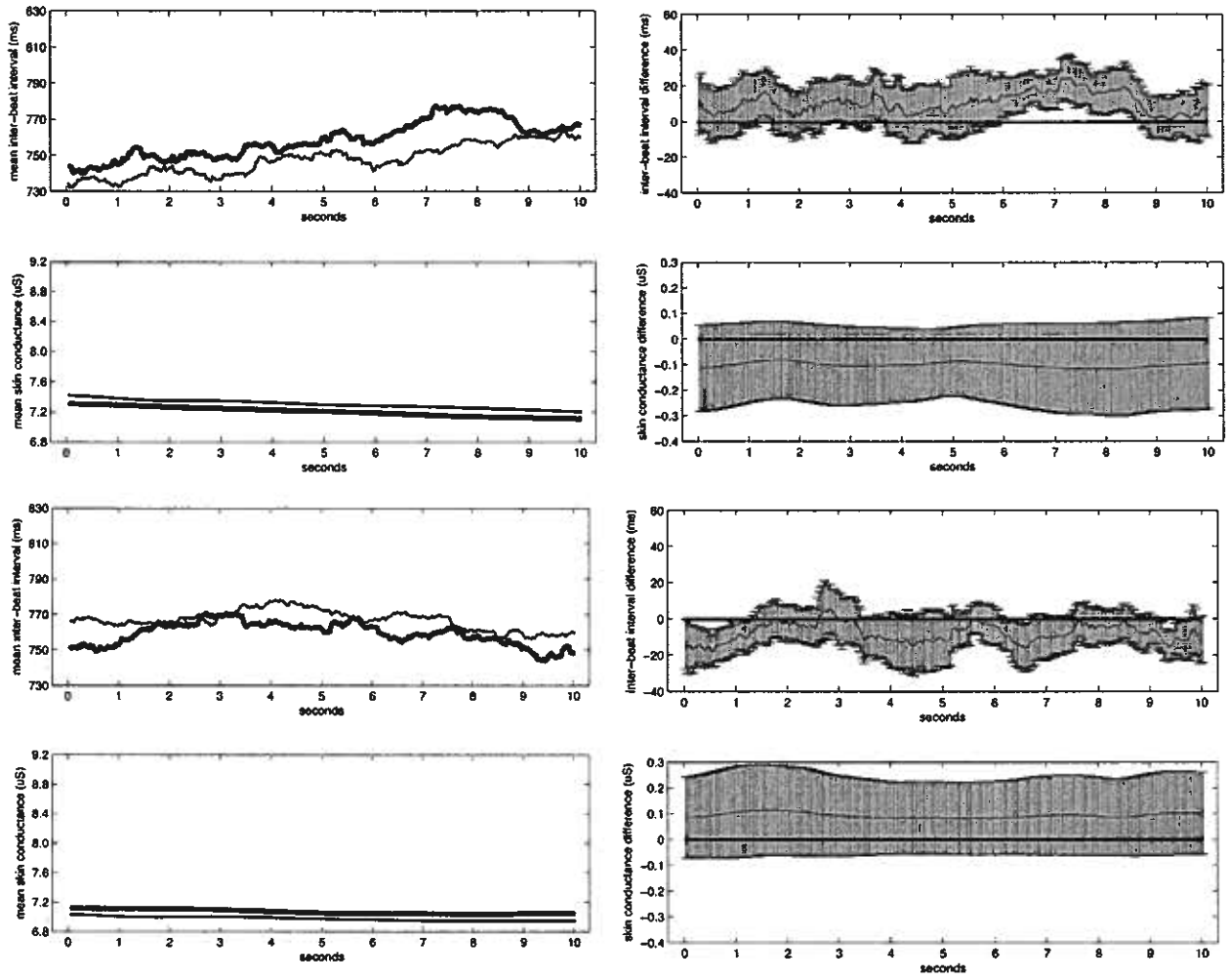

Figure 2: Average Traces During Staring vs. Non-Staring Periods, RSD Condition
LEFT: Group averages of the mean pulse period and electrodermal traces recorded during staring and non-staring periods in interval 1 (TOP) vs. interval 2 (BOTTOM) in the RSD condition. Error bars removed for clarity. Heavy line indicates mean trace for staring periods; lighter line indicates mean trace for non-staring periods.
RIGHT: Average difference traces in interval 1 (TOP) vs. interval 2 (BOTTOM) in the RSD condition. For each participant, for both the first and second interval, the mean of the traces recorded during non-staring periods was subtracted from the mean of the traces recorded during staring periods (staring minus non-staring). These difference traces were then averaged across participants; error bars show 95% confidence intervals.

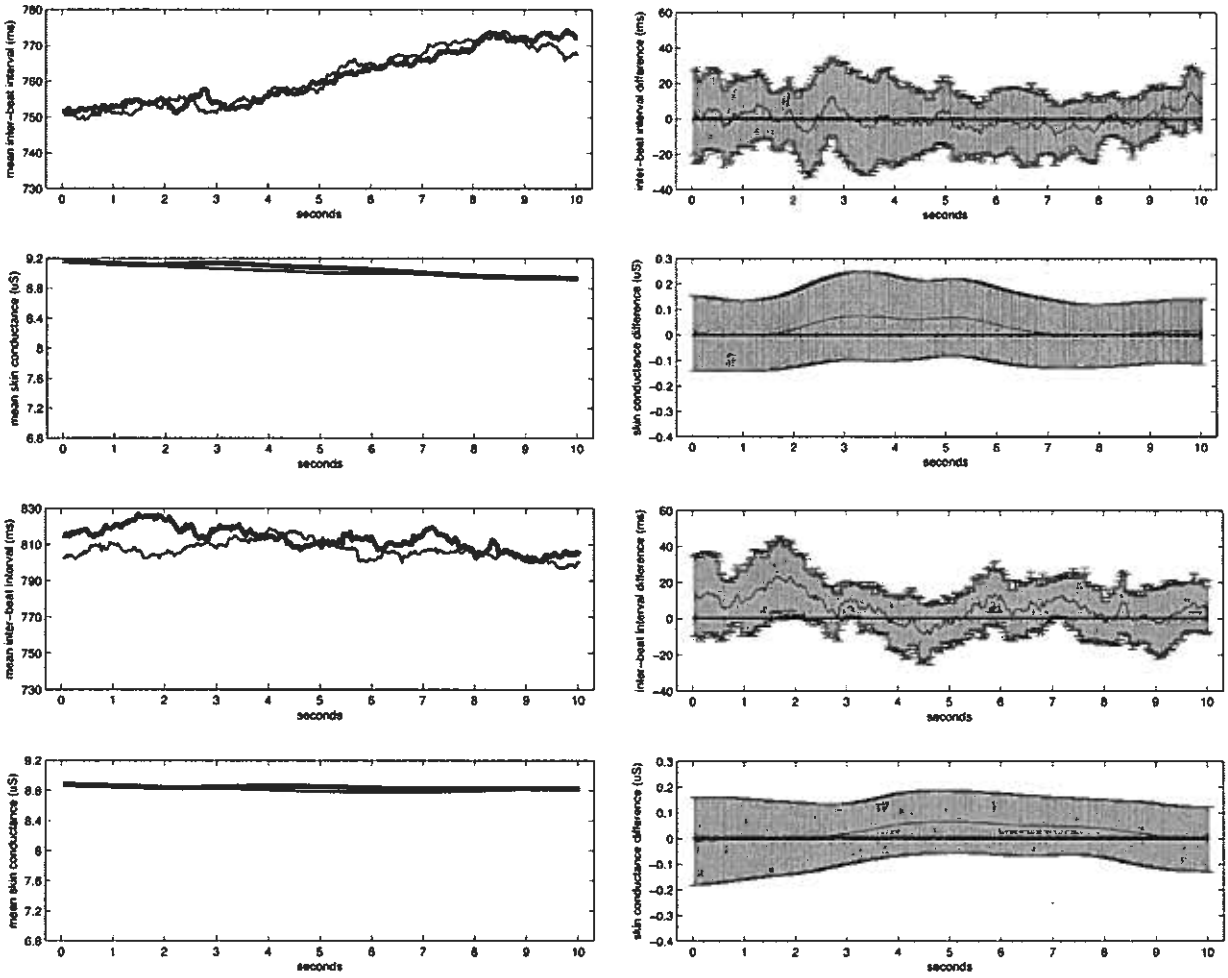

Figure 3: Average Traces During "Staring" vs. "Non-Staring" Periods, RSD Control Condition

LEFT: Group averages of the mean pulse period and electrodermal traces recorded during "staring" and "non-staring" periods in interval 1 (TOP) vs. interval 2 (BOTTOM) in the RSD control condition. Error bars removed for clarity. Heavy line indicates mean trace for "staring" periods; lighter line indicates mean trace for "non-staring" periods.

RIGHT: Average difference traces in interval 1 (TOP) vs. interval 2 (BOTTOM) in the RSD control condition. For each participant, for both the first and second interval, the mean of the traces recorded during "non-staring" periods was subtracted from the mean of the traces recorded during "staring" periods ("staring" minus "non-staring"). These difference traces were then averaged across participants; error bars show 95% confidence intervals.

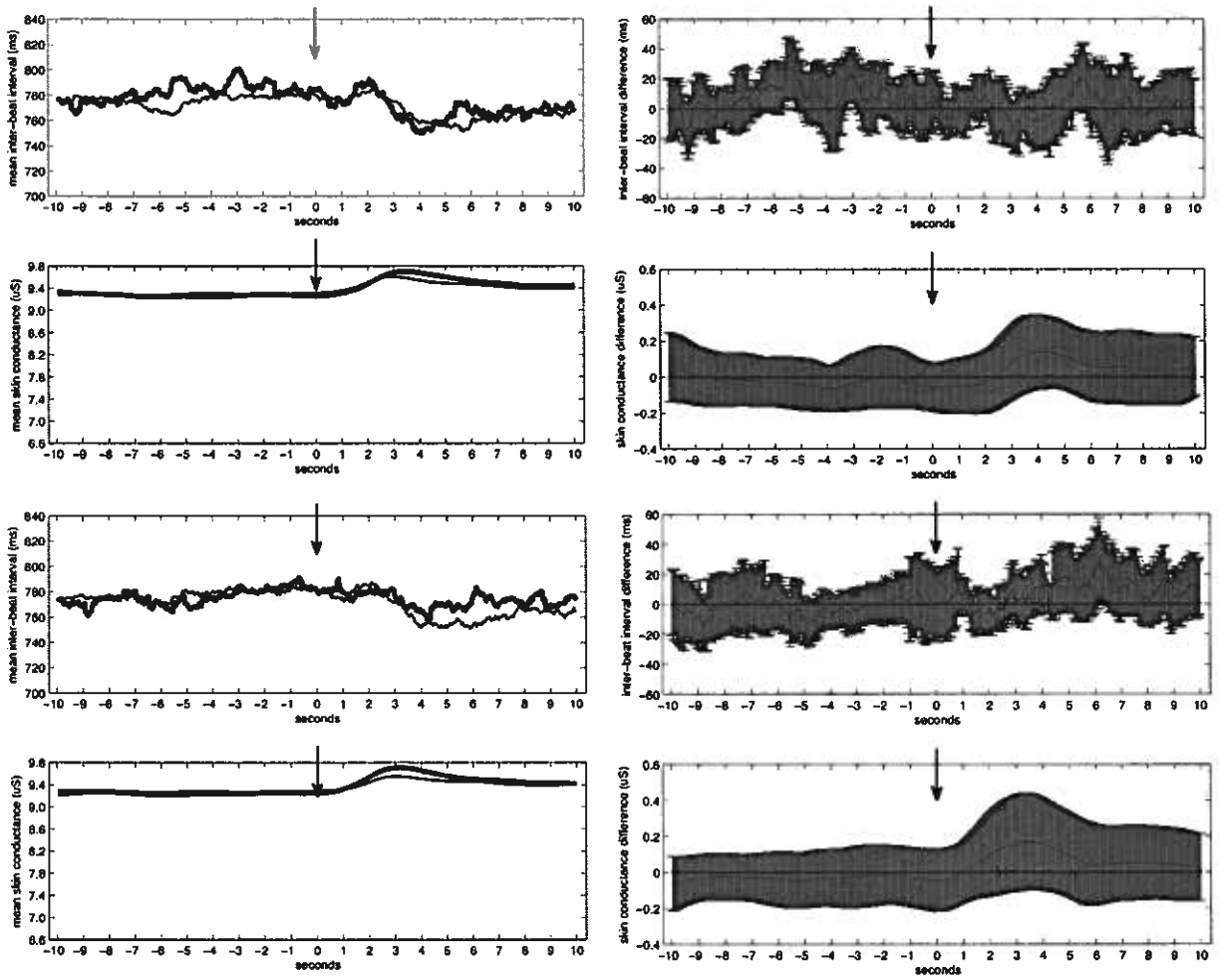

Figure 4: Average Traces During Pre- and Post-Feedback Periods, Precognition Condition
LEFT: Group averages of the mean pulse period and electrodermal traces recorded pre- and post-feedback in the precognition condition. Arrow indicates the beginning of feedback display (at 0 seconds). Error bars removed for clarity. Heavy line indicates mean trace for correct performance on current (TOP) or on previous (BOTTOM) trial; lighter line indicates mean trace for incorrect performance on current (TOP) or on previous (BOTTOM) trial.
RIGHT: Average difference traces in the precognition condition. For each participant, the mean of the traces recorded on incorrect trials was subtracted from the mean of the traces recorded during correct trials (correct minus incorrect; TOP). As a control, the mean of the traces recorded on trials preceded by incorrect trials was subtracted from the mean of the traced recorded on trials preceded by correct trials (previous correct minus previous incorrect; BOTTOM). These difference traces were then averaged across participants; error bars show 95% confidence intervals.

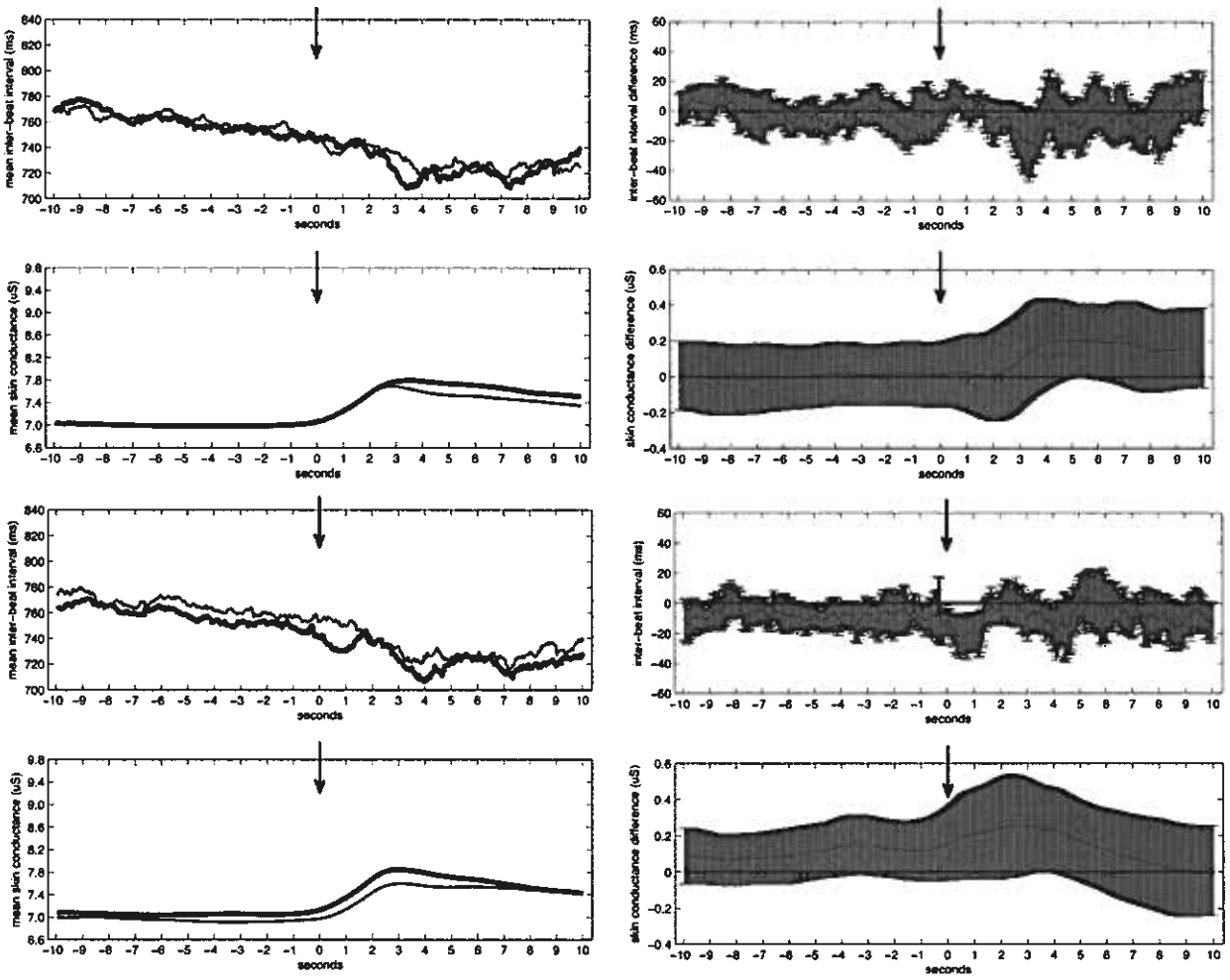

Figure 5: Average Traces During Pre- and Post-Feedback Periods, RSD Condition
LEFT: Group averages of the mean pulse period and electrodermal traces recorded pre- and post-feedback during the RSD condition. Arrow indicates the beginning of feedback display (at 0 seconds). Error bars removed for clarity. Heavy line indicates mean trace for correct performance on current (TOP) or on previous (BOTTOM) trial; lighter line indicates mean trace for incorrect performance on current (TOP) or on previous (BOTTOM) trial.
RIGHT: Average difference traces in the RSD condition. For each participant, the mean of the traces recorded on incorrect trials was subtracted from the mean of the traces recorded during correct trials (correct minus incorrect; TOP). As a control, the mean of the traces recorded on trials preceded by incorrect trials was subtracted from the mean of the traced recorded on trials preceded by correct trials (previous correct minus previous incorrect; BOTTOM). These difference traces were then averaged across participants; error bars show 95% confidence intervals.

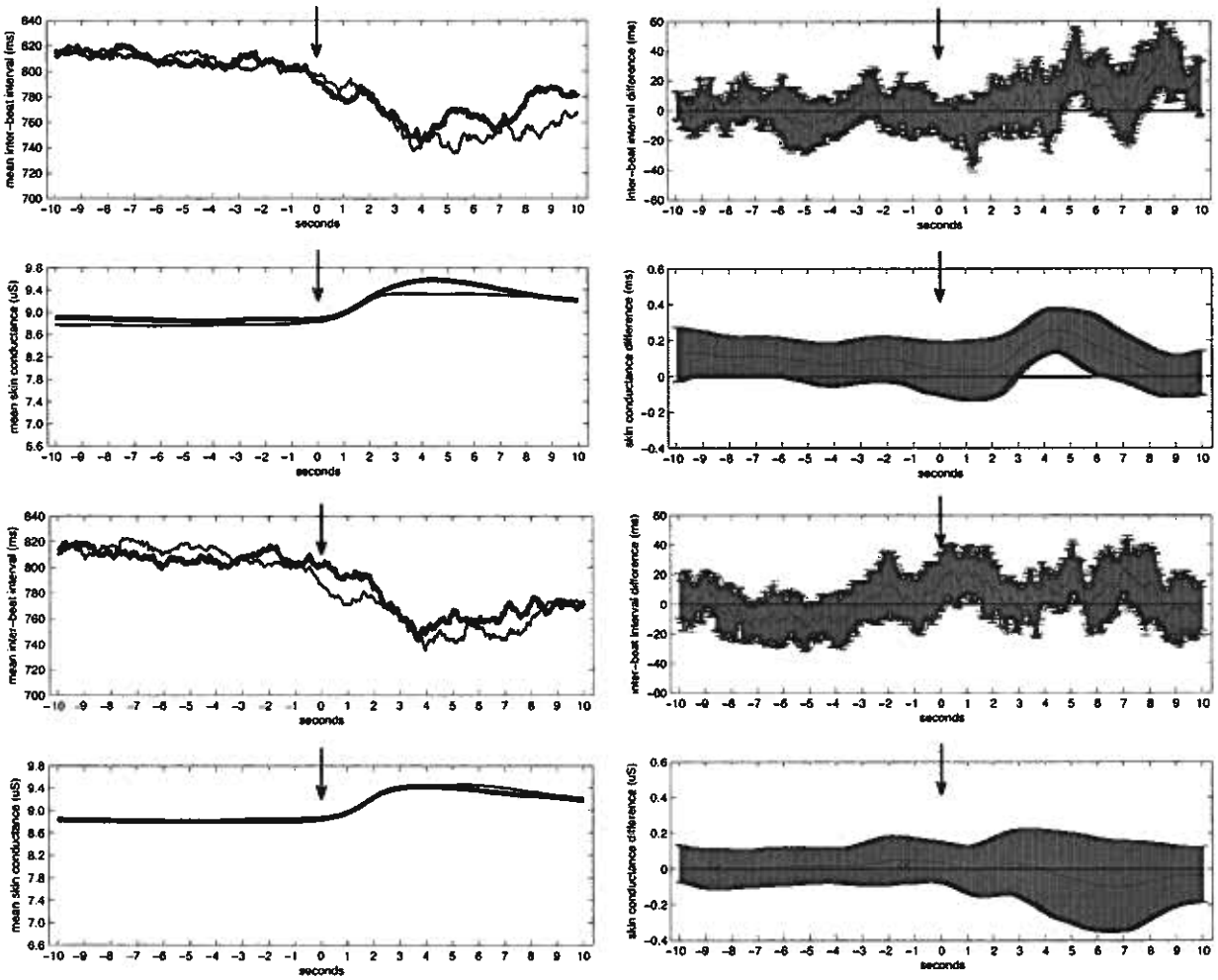

Figure 6: Average Traces During Pre- and Post-Feedback Periods, RSD Control Condition
LEFT: Group averages of the mean pulse period and electrodermal traces recorded pre- and post-feedback during the RSD control condition. Arrow indicates the beginning of feedback display (at 0 seconds). Error bars removed for clarity. Heavy line indicates mean trace for correct performance on current (TOP) or on previous (BOTTOM) trial; lighter line indicates mean trace for incorrect performance on current (TOP) or on previous (BOTTOM) trial.
RIGHT: Average difference traces in the RSD control condition. For each participant, the mean of the traces recorded on incorrect trials was subtracted from the mean of the traces recorded during correct trials (correct minus incorrect; TOP). As a control, the mean of the traces recorded on trials preceded by incorrect trials was subtracted from the mean of the traced recorded on trials preceded by correct trials (previous correct minus previous incorrect; BOTTOM). These difference traces were then averaged across participants; error bars show 95% confidence intervals.

Table 1: Confirmatory Analyses, RSD and RSD Control Conditions, Staring vs. Non-Staring

	RSD Condition (n=17)	**RSD Control Condition (n=18)**
Mean Interval 1 (SD) Staring vs. Non-staring; paired t-test	IBI staring: 754 ms (75 ms) non-staring: 744 ms (70ms) **t=2.87, p=0.011, d=0.70** SC staring: 7.20 uS (4.79 uS) non-staring: 7.30 uS (4.98 uS) t=-1.27, p=0.224	IBI staring: 792 ms (92 ms) non-staring: 792 ms (87 ms) t=0.01, p=0.995 SC staring: 9.05 uS (5.99 uS) non-staring: 9.03 uS (5.87 uS) t=0.41, p=0.686
Mean Interval 2 (SD) Staring vs. Non-staring; paired t-test	IBI staring: 756 ms (72 ms) non-staring: 765 ms (75ms) **t=-2.99 p=0.009, d=0.73** SC staring: 7.07 uS (4.83 uS) non-staring: 6.98 uS (4.67 uS) t=1.21, p=0.243	IBI staring: 813 ms (103 ms) non-staring: 807 ms (101 ms) t=1.35, p=0.194 SC staring: 8.84 uS (5.80 uS) non-staring: 8.82 uS (5.89 uS) t=0.45, p=0.656
Mean Difference Trace Interval 1 Staring vs. Non-staring; 95% confidence interval	**IBI: ~6-8.5 seconds** **stare > non-stare** SC: No regions of significance.	IBI: No regions of significance. SC: No regions of significance.
Mean Difference Trace Interval 2 Staring vs. Non-staring; 95% confidence interval	**IBI: ~0-1 seconds** **stare < non-stare** SC: No regions of significance.	IBI: No regions of significance. SC: No regions of significance.

Table 2: Exploratory Analyses, RSD and RSD Control Conditions, Staring vs. Non-Staring

	RSD Condition (n=17)	**RSD Control Condition (n=18)**
Physiology-Based Algorithm (tonic mode) Number Correct of 30 Trials (SD) Staring vs. Nonstaring; t-test	group mean: 16.4 (2.7) **t=2.16, p=0.046, d=0.52**	group mean: 15.5 (3.1) t=0.65, p=0.524
Physiology-Based Algorithm (tonic mode) Number Correct of 30 trials Staring vs. Nonstaring; paired t-test (n=16)	t=1.45, p=0.169	
Physiology-Based Algorithm (phasic mode) Number Correct of 30 trials (SD) Staring vs. Nonstaring; t-test	group mean: 16.9 (2.0) **t=3.89, p=0.001, d=0.94**	group mean: 14.6 (2.8) t=-0.632, p=0.536
Physiology-Based Algorithm (phasic mode) Number Correct of 30 trials Staring vs. Nonstaring; paired t-test (n=16)	**t=3.69, p=0.002, d=0.92**	

Table 3: Confirmatory Analyses, Precognition Condition, Pre-Feedback Responses

	Current Trials (n=19)	**Previous Trials (n=19)**
Mean Collapsed Across Pre-Feedback Period (SD) Correct vs. Incorrect; paired t-test	IBI correct: 783 ms (80 ms) incorrect: 776 ms (71 ms) t=1.13, p=0.273 SC correct: 9.27 uS (5.84 uS) incorrect: 9.29 uS (5.66 uS) t=-0.29, p=0.776	IBI correct: 776 ms (71 ms) incorrect: 778 ms (74 ms) t=-0.31, p=0.763 SC correct: 9.25 uS (5.67 uS) incorrect: 9.28 uS (5.68 uS) t=-0.44, p=0.665
Mean Difference Trace Pre-Feedback Period Correct vs. Incorrect; 95% confidence interval	**IBI: ~5.25-5.5 seconds before feedback correct > incorrect** SC: No regions of significance.	IBI: No regions of significance. SC: No regions of significance.

Table 4: Exploratory Analyses, RSD and RSD Control Conditions, Pre-Feedback Responses

	Current Trials	**Previous Trials**
Mean Collapsed Across Pre-Feedback Period (SD) Correct vs. Incorrect; paired t-test	**RSD Condition (n=17)** **IBI** correct: 760 ms (75 ms) incorrect: 761 ms (72 ms) t=-0.30, p=0.770 SC correct: 7.00 uS (4.77 uS) incorrect: 7.00 uS (4.67 uS) t=0.04, p=0.965	**RSD Condition (n=17)** IBI correct: 757 ms (73 ms) incorrect: 765 ms (74 ms) **t=-3.20; p=0.006, d=0.78** SC correct: 7.06 uS (4.78 uS) incorrect: 6.95 uS (4.68 uS) SC: t=1.38, p=0.187
	RSD Control Condition (n=18) **IBI** correct: 809 ms (102 ms) incorrect: 809 ms (102 ms) t=0.05, p=0.963 SC correct: 8.86 uS (5.89 uS) incorrect: 8.77 uS (5.82 uS) t=1.63, p=0.121	**RSD Control Condition (n=18)** **IBI** correct: 808 ms (104 ms) incorrect: 810 ms (102 ms) t=-0.39, p=0.704 SC correct: 8.82 uS (5.87 uS) incorrect: 8.80 uS (5.85 uS) t=0.39, p=0.702
Mean Difference Trace Pre-Feedback Period Correct vs. Incorrect; 95% confidence interval	**RSD Condition (n=17)** IBI: No regions of significance. SC: No regions of significance.	**RSD Condition (n=17)** **IBI: ~4.5-5.5 seconds before feedback correct < incorrect** SC: No regions of significance.
	RSD Control Condition (n=18) IBI: No regions of significance. **SC: ~7.75-8.25 and ~6.25-6.75 seconds before feedback correct > incorrect**	**RSD Control Condition (n=18)** IBI: No regions of significance. SC: No regions of significance.