AN ANOMALY OF AN ANOMALY: INVESTIGATING THE CORTICAL ELECTROPHYSIOLOGY OF REMOTE STARING DETECTION

By Ian S. Baker and Paul Stevens*

ABSTRACT: If there is evidence of an overall effect of remote staring detection, then theoretically there should also be evidence of electrophysiological processing of this information in the brain. A series of three experiments examining the potential electrophysiological correlates of remote staring detection were presented, followed by a fourth experiment to examine a potential artifact. The first experiment provided an initial exploration of this effect, finding primarily that “remote staring detection” has no evident time-locked processing associated with it on its own but rather acts upon other processes occurring at the same time. The second experiment provided evidence that this effect is not related specifically to face processing but can impact on other forms of processing as well. The third experiment uncovered evidence of a potential artifact that could explain the “remote staring effect,” which is verified in the final experiment. The overall results are discussed in light of an interesting and subtle psychophysical luminance effect that could potentially have an impact upon a wide variety of experiments that employ event-related measures of electrophysiological processing.

Keywords: remote staring detection, electroencephalography, global field power, psychophysics, luminance artifact

Remote staring detection has been defined as “…the purported ability to detect when one is being watched or stared at by someone situated beyond the range of the conventional senses.” (Braud, Shafer, & Andrews, 1993a, p. 301). Remote staring detection involves the measurement of behavioral or physiological reactions to staring by someone who is not physically present. Even though it should be impossible for the starrer to know through any conventional sensory means that the starrer is staring at them at any particular moment. Belief in this phenomenon as an everyday experience is considerably widespread, with incidences of belief ranging from approximately 70% to 94% of the populations sampled (Braud et al., 1993a; Braud, Shafer, & Andrews, 1993b; Cooper, 1913; Cotrell, Winer, & Smith, 1996; Rosenthal, Soper, & Tabony, 1994; Sheldrake, 2005; Thalbourne & Evans, 1992). Over the past 100 years there have been several attempts to examine these anecdotal experiences and beliefs under controlled conditions. The earliest research in this area used relatively simple and direct behavioral measures that demonstrated an evolution of methodological sophistication over time as greater controls over extraneous variables were introduced (Cooper, 1913; Poortman, 1959; Titchener, 1898; Williams, 1988). The introduction of the use of electrodermal activity (EDA) as a measure of autonomic nervous system (ANS) activity and as a potential indicator of a “fight-or-flight” response to being stared at remotely was a significant methodological development. This was particularly the case when the EDA method was combined with the use of CCTV systems to separate the starrer and starrer (Braud et al., 1993a, 1993b). Collectively referred to as the “EDA-CCTV” studies (Baker, 2005), several researchers found interesting results utilizing this method, including potential skeptic-believer experience effects (Schulz & LaBerge, 1994; Schulz, Wiseman, Watt, & Radin, 2006; Watt, Schlitz, Wiseman, & Radin, 2005; Watt, Wiseman, & Schlitz, 2002; Wiseman & Schlitz, 1997, 1999; Wiseman & Smith, 1994, 1994). A meta-analysis (Schmidt, Schneider, Utu, & Walach, 2004) of the 15 EDA-CCTV experiments that had been conducted at that time found a small but significant effect (d = .13, p = .01), suggesting evidence that requires further investigation. This was the primary objective of the research presented in this paper. Firstly, previous EDA-CCTV methods were expanded to include central nervous system (CNS) activity. It would be expected that, if this phenomenon is genuine, then any stimulus processing or awareness of a remote stare should result in corresponding activity in the brain. Secondly, it was important to embed the potential effect within a wider theoretical framework. Assuming that remote staring detection is producing brain activity as the information is processed, does this processing follow similar systems to those that have already been identified in cognitive neuroscience; for example, the processing of faces and/or the gaze of others? 
Our results showed that the facial expression was an effective way to elicit empathy in participants, with a clear preference for positive facial expressions. This effect was observed across different age groups and cultural backgrounds, indicating a universal response to facial expressions. Future research could explore the neural mechanisms underlying this empathy response and how it can be applied in clinical settings to improve social interactions.
The Journal of Parapsychology

Method

Participants. Twenty participants (7 males and 13 females) took part in this experiment with an average age of 25.3 years (range: 20–38 years). The participants were paid for taking part and were all staff or students at the University of Edinburgh. All but one of the participants were right-handed.

Materials, equipment, and procedure. Apart from relatively minor equipment upgrades, all of the equipment was identical to that used in Experiment 1. The relevant EEG and skin conductance electrodes were attached in the same manner. The same personality questionnaires were administered.

The overall procedure was the same as that used in Experiment 1, except that the conditions that the participant was exposed to were different. Each condition was repeated 60 times in a pseudo-randomised and counterbalanced order. Apart from the rest periods, the participants were presented with either a static picture of the starer on the screen in front of them or by a picture of a chair from the International Affective Picture Set (IAPS) database. A chair was used in order to reflect the maximum degree of processing differences between faces and objects (Filer & Taylor, 2004). In addition, during these times the starer may also have been stared at remotely by the starer via the computer-controlled CCTV system, depending upon the condition. These four conditions are summarised in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Stares' screen</th>
<th>Face displayed</th>
<th>Object displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action of starer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Remote Stare</td>
<td>Face condition</td>
<td>Object condition</td>
</tr>
<tr>
<td>Face + Remote Stare cond.</td>
<td>Face condition</td>
<td>Object condition</td>
</tr>
<tr>
<td></td>
<td>Face + Remote Stare cond.</td>
<td>Object condition</td>
</tr>
</tbody>
</table>

The participants’ EEG was recorded at 500 Hz (32-bit) sample rate, with a high-pass filter at 0.5 Hz and no low-pass filter (system maximum range was 29.2 Hz) and no notch filter. Each condition lasted for 5,000 ms followed by a 5,000-ms rest period.

Results and Discussion

Again, the EEG data were preprocessed to remove muscle and ocular artifacts, epoched, and averaged into event-related potential (ERP) data for each condition. These epochs were slightly longer than in Experiment 1 in order to encompass any potentially later effects (-100 ms to 800 ms). Global field power was the main measure used, and two temporal peaks were identified as being of interest: 150 ms and 208 ms. The ERP data for all participants and for all four conditions can be seen in Figure 3. Shapiro-Wilk analyses revealed that the data did not violate any assumptions of normality and so parametric analyses were conducted.

Separate 2 × 2 (image type × remote staring manipulation) repeated measures ANOVAs were conducted on the two peaks of interest. The initial 150-ms component demonstrated a significant effect for remote staring processing, F(1,19) = 6.95, p = 0.02, but no significant difference between face and object processing, F(1,19) = 18, p = .005, and no significant interaction effect, F(1,19) = .92, p = .46. The second (208-ms) component mirror these findings, with a significant effect for remote staring processing, F(1,19) = 11.23, p < .001, no significant difference between face and object processing, F(1,19) = .051, and no significant interaction effect, F(1,19) = .92, p = .38.

Additional analyses (See Baker, 2007, for more details) revealed that the differences in face and object processing were broadly localised to the right temporal lobe region (i.e., P7/T7) as expected (Eimer, 2000; Iler, & Taylor, 2004).

One potential issue with the ERP/ERP analyses is that they examine only a small part of the data; only the first 800 ms of a 5,000-ms epoch. As the phenomenon under investigation has not been examined in this way previously, it was possible that a "remote staring effect" may be noted over a longer duration. However, ERP/ERP analyses are not suited for this. In order to examine (a) the relationship with alpha activity, and (b) a longer time duration, a post hoc analysis of global alpha activity (using fast-Fourier transforms) for all four conditions over the 5-s stimulus period (divided into the averaged activity for each second) was examined. A 4 × 5 (conditions × time [seconds]) repeated measures ANOVA with Greenhouse-Geisser correction revealed no significant differences between the alpha activity of the different conditions, F(1,19) = 1.07, p = .38, and no significant effect of time, F(1,19) = 1.75, p = .20, and no significant interactions, F(1,19) = 0.96, p = .35. This indicated that for the most dominant frequency band in the evoked domain there was no remote staring detection effect over a longer duration; it was only evident in the peak elements of the GPF (see Baker, 2007 for additional post hoc analyses).

Finally, the skin conductance data for each of the 60 administrations of each stimulus for each person was averaged and compared for each condition. Analysis indicated no significant differences in skin conductance between the Face condition and Face and Remote Stare condition (z = -0.58, p = .56) or between the Object condition and the Object and Remote Stare condition (z = -1.85, p = .07). However, skin conductance responses to stimuli can rapidly habituate in as little as 2 to 8 stimulus administrations (Dawson et al., 1990). In order to investigate this, two post hoc analyses examined the averaged skin conductance responses to the first 16 similar to previous skin conductance studies into remote staring detection: e.g., Schilz & LaBerger, 1997), then first 8 administrations of each stimulus, similar to above. However, none of these comparisons approached significance (see Baker, 2007, for more details).

The results suggest that remote staring detection has an effect upon the global processing of both faces and objects—increasing the GPF in both cases—and does not appear to be a facespecific effect. In conjunction with the results of the first study, it suggests that remote staring detection apparently does not have an electrocortical processing in its own right, but rather acts upon any concurrent processing.

The lack of any processing of remote staring detection on its own and the fact that the impact of remote staring detection on faces reversed between the two studies (in the first study it reduced the peak GPF, in the second study it increased the peak GPF) was concerning. This reversal might be due to the subtle
methodological differences between the two studies. In the first experiment, the randomisation sequence resulted in participants effectively being presented with an image at fairly random intervals, whereas in the second experiment the image presentation was very regular. This may have altered alpha activity generation between the experiments and produced different effects (Stare, 2003). Alternatively, it may have revealed a potential artifact that caused the significant "remote staring effect." The third experiment was designed to replicate the previous effects and test for the possibility of an artifact.

**Experiment 3**

The third experiment replicated the conventional face processing condition and the face and remote stare condition used in the two previous experiments in order to examine the reversal of the effects between experiments one and two in more detail. In addition to this, the third experiment also examined the possibility that the effect of the remote staring detection was an artifact. This was done by simply removing the remote staring stimulus altogether for half of the experiment, but otherwise conducting the experiment as before. The rationale behind this was simple: remove the remote stare, and—if it was a genuine effect—this should remove the effect itself.

**Method**

**Participants.** Twenty participants (10 males and 10 females) took part in this experiment with an average age of 27.8 years (range: 18-50 years). The participants were paid £5 for taking part and were all staff or students at the University of Edinburgh. All but two of the participants were right-handed.

**Materials, equipment, and procedure.** All of the EEG and skin conductance equipment, the other experimental hardware, and the questionnaires were the same as for the last experiment. The overall procedure was the same as for the last two experiments, apart from some minor alterations due to the type of conditions that the participants were exposed to in this experiment. In order to examine the effect of the removal of the stare on the remote staring effect, a pseudorandomised and counterbalanced split-session and absent for the second half of the session. For the other 50% of the sessions, the stare was physically present for the first half of the session and absent for the second half of the session. For the other 50% of the sessions, this was reversed. The order in which this occurred was randomised (without replacement) by an independent party (the second author), and the experimenter (first author) was not aware of the order of any session prior to the session beginning. Within each half of the session, the order of the Face or the Face + Remote STare conditions was also pseudorandomised and counterbalanced. This resulted in four conditions that are summarised in Table 3.

**Table 3**

<table>
<thead>
<tr>
<th>2 × 2 Table of the Independent Variable Manipulation for Experiment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stare’s screen</strong></td>
</tr>
<tr>
<td>Face Only displayed</td>
</tr>
<tr>
<td><strong>Action of starrer</strong></td>
</tr>
<tr>
<td>Stare Present</td>
</tr>
<tr>
<td>Stare Absent</td>
</tr>
</tbody>
</table>

The participants’ EEG was recorded using the same parameters as the second experiment.

**Results and Discussion**

As in the two previous experiments, the EEG data were preprocessed to remove muscle and ocular artifacts, then epoched and averaged into event-related potential (ERP) data for each condition (epochs of 100 ms to 800 ms duration). Once again, global field power was the main measure used, and two temporal peaks were identified as being of interest: 120 ms and 174 ms. The GFP data for all participants and for all four conditions can be seen in Figure 4. Shapiro-Wilk analyses revealed that the data did not violate any assumptions of normality and so parametric analyses were conducted.

Separate 2 × 2 (presence of starrer x remote staring manipulation) repeated measures ANOVAs were conducted on the two peaks of interest. The initial 120 ms component demonstrated a significant effect for both remote staring processing, F(1,19) = 10.18, p = .005, and for the presence of a starrer, F(1,19) = 12.01, p = .003, but no significant interaction effects, F(1,19) = .01, p = .92. The second (174 ms) also suggested a significant effect for remote staring processing, F(1,19) = 54.89, p < .001, but no significant effect for the presence of a starrer, F(1,19) = .09, p = .76, and no significant interaction effects, F(1,19) = 1.72, p = .21.

Figure 4. Global field power (GFP) results from all 20 participants for all conditions in Experiment 3.

However, these results can only be understood to their fullest extent by examining them with paired-sample t tests. Two comparisons for each peak of interest were conducted. The first compared the Face (Stare Present) and the Face + Remote Stare (Stare Present) conditions. As the starrer was physically present during each of these conditions, this test is equivalent to the Face and the Face + Remote Stare comparisons that were conducted in the first two experiments, and therefore ostensibly tests for the impact of remote staring detection on the global processing of faces. The second comparison examined the differences between the Face + Remote Stare (Stare Present) and the Face + Remote Stare (Stare Absent) conditions. The test between these two conditions more carefully examines the impact of physically removing the remote starrer from the experiment than the analyses above. Significant results here would suggest the remote starrer is important to this effect, nonsignificance would support the existence of a potential artifact.

The initial 120 ms peak demonstrated a significant difference between the Face (Stare Present) and the Face + Remote Stare (Stare Present) conditions, t(19) = -2.16, p = .04, but it did not suggest a significant difference between the Face + Remote Stare (Stare Present) and the Face + Remote Stare (Stare Absent) conditions, t(19) = -1.21, p = .24. The findings for the second peak (174 ms) mirror these findings, with a significant difference between the Face (Stare Present) and the Face + Remote Stare...
The Journal of Parapsychology

Anomalous Anomalies: The Cortical Electrophysiology of Remote Staring Detection

These results suggest that, although there was no difference between the luminance levels of the images on the ssee's screen once the image reached its full luminance level, a small difference between the images when they were being initially presented on the screen. This may have, in turn, had an impact upon the corresponding electrocorticographic processing of that image or provided the participants with some information concerning the particular condition they were experiencing at any one time.

Overall Discussion

The body of research presented here initially began as an exploration of the potential electrocorticographic activity associated with the processing of remote staring detection. However, as it progressed it became an investigation of a possible artifact that has the potential to impact upon a wide range of cognitive neuroscience and psychophysic studies, particularly those that employ event-related measures of electrical activity. The most parsimonious explanation for the effects reported in this paper is that they represent the ability of the human brain to process very small and rapid luminance differences between visual stimuli. The mere possibility of the luminance effect providing condition-relevant information that could be processed by the participant potentially undermines any claims of a remote staring detection effect. It should be noted that this potential artifact is related specifically to the methods used in this paper, specifically exposing the ssee to conventional stimuli concurrently to a remote stare. This would not apply to previous remote staring detection studies, as they did not use this methodology and they also employed the comparatively slow measure of skin conductance. However, whilst it is true that the findings of the third experiment and the photodiode study do suggest a possible luminance difference between the two conditions, the differences involved are so small, namely 2.5 cd/m² for 20 ms, that they represent a

In order to examine the physical properties of the image, a sensitive photodiode was used in order to examine the luminance levels of the image presentation in the different conditions. As the Stryer Present and Stryer Absent conditions from Experiment 3 were equivalent from an equipment perspective, only the Face (Stryer Absent) and Face + Remote Stryer (Stryer Absent) conditions were used for the comparison. This was important because in the Face conditions the camera feed was masked, and in the Face + Remote Stryer it obviously was not.

Method

Materials, equipment, and procedure. The experimental setup was as similar as possible to the procedure of the third experiment. The only main difference was that there was a photodiode reacting to the images on the ssee's screen rather than a participant. The photodiode (BRW21: OSMAR Opto Semiconductors) was positioned 150 mm away from the center of the ssee's screen. The photodiode had a relative spectral sensitivity that is close to that of the human eye. It was connected to a Gould Advanced Digital Storage Oscilloscope OS6000 (Advance Electronics Limited, Wrexham, UK) in order to record the differences in output in response to the different stimuli. The stimuli tested were the Face (Stryer Absent) and Face + Remote Stryer (Stryer Absent) conditions from Experiment 3. These two conditions had the same program code except that the former in the code instructed the camera feed to the ssee's monitor file for all conditions. The image displayed on the ssee's screen was the identical file for both conditions (and indeed, for all of the experiments).

Results and Discussion

The first test was to examine the different stimuli for any differences in the overall output of the photodiode (and therefore the luminance) for the full 5.000 ms of exposure. There was no difference, with both conditions providing a mean output of 266 nV.

The second test was a more specific analysis examining the luminance profiles at the onset of the image display. The test revealed a small difference between the two conditions, with the image in the Face + Remote Stryer (Stryer Absent) condition taking slightly longer to step up incrementally to full luminance than the image in the Face (Stryer Absent) condition. This difference lasted for approximately 20 ms and corresponded with a difference of approximately 2.5 cd/m² (candelas per meter squared; approximately 0.2 lux or 0.7 foot-lambert). As revealed by the first test above, this difference did not continue beyond the first 20 ms as the screen was ramping up to full luminance.
The Journal of Parapsychology

References


Rosenthal, G. T., Soper, B., & Tabony, R. S. (1994). Student beliefs concerning the ability to detect when someone is watching: A re-examination of the Paranormal Belief Scale. *Unpublished manuscript*, Nicholls State University, Thibodaux, LA.


The Journal of Parapsychology


Williams, L. (1985, February). Minimal cue perception of the regard of others: The feeling of being stared at. Paper presented at 10th Annual Conference of the Southeastern Regional Parapsychological Association, West Georgia College, Carrollton, GA.


Centre for Psychological Research
Faculty of Education, Health and Sciences
University of Derby
Kedleston Road
Derby, DE22 1GB, UK
i.s.baker@derby.ac.uk

*Department of Psychology
Faculty of Social Sciences
The Open University
Walton Hall
Milton Keynes, MK7 6AA, UK

Acknowledgments

The research reported here represents part of the first author’s PhD thesis (Baker, 2007) conducted at the University of Edinburgh. We would like to dedicate this paper to the memory of Professor Robert Morris, who was Ian Baker’s primary PhD supervisor until his untimely death. We would also like to thank the INOVA foundation, the Bial Foundation, and the Society for Psychical Research for their financial support. We would also like to thank Paul Staples and Professor David Sheffield for their comments on earlier drafts of this paper.

Anomaly of an Anomaly: The Cortical Electrophysiology of Remote Staring Detection

Abstracts in Other Languages

French

UNE ANOMALIE D’ANOMALIE : ETUDE DE L’ELECTROPHYSIOLOGIE CORTICALE DE LA DETECTION DU REGARD A DISTANCE

RESUME : S’il y a des elements de preuve d’un effet global de la detection du regard a distance, alors il devrait theoriquement y avoir d’autres preuves d’un processus electrophysiologique de traitement de cette information dans le cerveau. Une serie de 3 experimentations examinant les correlats electrocorticaux potentiels de la detection du regard a distance est presentee, suivie par une 4e experience pour examiner un artefact potentiel. La 1ere experience fournit une exploration initiale de cet effet, montrant d’abord que la detection du regard a distance ne correspond pas de maniere evidente a un processus comparable dans le temps mais agit plutot sur les processus se produisant au meme moment. La 2e experience fournit des preuves que cet effet n’est pas specifiquement en lien avec le processus de reconnaissance de visage mais peut avoir un impact sur d’autres processus. La 3e experience met en lumiere un potentiel artefact qui pourrait expliquer l’effet de « regard a distance », qui est verifie dans l’experimentation finale. Les resultats globaux sont discutes a la lumiere d’un subtil et interessant effet de luminance psychophysique qui pourrait potentiellement avoir un impact sur une large variete d’experimentations qui emploient des mesures relatives a des evenements de processus electrocorticaux.

Spanish

ANOMALÍA DE UNA ANOMALÍA: INVESTIGANDO LA ELECTROFISIOLOGÍA CORTICAL DE LA DETECCIÓN DE SER OBSERVADO A DISTANCIA

RESUMEN: Si hay evidencia de un efecto global de poder detectar a alguien nos observa a distancia, teóricamente también debería haber evidencia del procesamiento electrofisiológico de dicha información en el cerebro. Presentamos una serie de 3 experimentos que examinaron posibles correlatos electrocorticales de la detección de ser observado a distancia (DOD), seguidos por un cuarto experimento para examinar un posible artefacto. El primer experimento fue una exploración inicial de este efecto y encontró principalmente que DOD no está asociado a un procesamiento sincronizado evidente, sino que actúa sobre otros procesos que ocurren al mismo tiempo. El segundo experimento proporcionó evidencia de que este efecto no está relacionado específicamente con el procesamiento de rostros, pero puede tener un impacto en otras formas de procesamiento. El tercer experimento mostró evidencia de un posible artefacto que podría explicar el efecto DOD, verificado en el experimento final. Discutimos los resultados globales a la luz de un interesante y sutil efecto psicofísico de luminancia que podría tener un impacto en una amplia variedad de experimentos que emplean mediciones relacionadas con los eventos de procesamiento electrocortical.

German

EINE ANOMALIE EINER ANOMALIE: ZUR UNTERSUCHUNG DER KORTIKALEN ELEKTROPHYSIOLOGIE BEIM NACHWEIS DES BEOBACHTETWEDENS (REMOTE STARING)

Verarbeitungsprozess darstellt, sondern sich vielmehr auf andere Prozesse auswirkt, die gleichzeitig ablaufen. Das zweite Experiment ergab Hinweise darauf, dass sich dieser Effekt nicht spezifisch auf die Gesichterverarbeitung auswirkt, sondern auch andere Verarbeitungsformen beeinflussen kann. Das dritte Experiment fand einen Hinweis auf ein mögliches Artefakt, das den "remote staring-Effekt" erklären könnte, was im letzten Experiment bestätigt wurde. Die Gesamtergebnisse werden im Licht eines interessanten und subtilen psychophysikalischen Luminanzeffektes diskutiert, der möglicherweise für eine größere Anzahl von Experimenten von Bedeutung sein könnte, die ereignisbezogene Messungen der elektrokortikalen Verarbeitung verwenden.