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An exploratory study for an evidence of electroencephalographic changes in isolated subjects for distant mental intention

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Abstract

This double-blind study, as a human experiment of nonlocality, investigated the effects of senders' intention on the central nervous system of a distant human receiver and it explored the roles that motivation might have in modulating these effects. Whole brain activity was measured in the receiver whom was asked to relax in a distant room for 16 minutes; the sending person directed intention of oneness toward the receiver during repeated variable-second epochs separated by variable-second non-intention epochs. The total length of intention epochs and that of nonintention epochs were balanced. Eighteen sessions were conducted. In 9 of those sessions, the sender was the receiver's lover. In another 9 of those sessions, the sender was just acquainted with the receiver before the session. The receiver's whole brain activity recorded during the intention epochs were compared with the same measures recorded during the nonintention epochs used as controls. The statistical difference between the intentions versus controls across 18 sessions was examined by paired-*t* test. In addition, subgroup analysis for the 9 couple sessions and 9 non-couple sessions were additionally examined by the same test. The effect of distant intentionality decreased slow waves or increased EEG fast waves mainly in frontal regions, and increased EEG coherence during the intention epochs. The effects was not statistically significant after Bonferroni correction, but the couple sessions combined showed the largest effect followed by all sessions combined. Non-couple sessions combined showed the smallest effect. The changes in EEG power mean that receiver participants became more alert during the intention epochs and the change in EEG coherence might be evidence of coherent heart influence on EEG activity. Planned comparison with specific hypothesis testing for the suggested changes in this study have to be followed for an evidence of electroencephalographic changes in isolated subjects for the distant mental intention.

Key words: Distant mental intention, EEG, oneness, coherence, nonlocality

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1. Introduction

Recent research in areas as different as distant healing and quantum physics are in agreement with the oldest spiritual teachings of sages, who taught that “separation is an illusion.”(Targ & Katra, 2001) Modern quantum physics confirms that the essence of existence is a wave, not a particle, and that all existence is connected, called nonlocality. The first experiment with nonlocality reported that the spins of twin photons with 13 m of distance between them propagating in the opposite direction were entangled with each other.(Aspect et al., 1982) Henry Stapp estimated that non-locality might be the most important discovery in all of science because it means we are inseparably connected to one another.(Stapp, 2001) There was evidence that even DNA can send spooky electromagnetic imprints of itself into distant cells and fluids, called quantum imprint.(Montagnier er al., 2011) A meta-analysis of several studies related to distant intercessory healing was published in the Annals of Internal Medicine in 2000, but it is difficult to draw conclusions regarding distant healing and suggested further studies.(Astin and Harkness, 2000) Various, broader meta-studies of the literature have arrived at conflicting conclusions. A meta-analysis on 14 studies concluded that "There is no scientifically discernible effect for intercessory prayer as assessed in controlled studies"(Kevin et al., 2006). However, a systemic review of 17 studies on the use of intercessory prayer indicated that there are "small, but significant, effect sizes for the use of intercessory prayer" in the reviewed literature.(Hoge, 2007) The levels of evidence reviewed found "some" evidence for the hypothesis that "Being prayed for improves physical recovery from acute illness".(Powell et al., 2003) It concluded that although "a number of studies" have tested this hypothesis, "only three have sufficient rigor for review here"(Byrd, 1988; Harris et al., 1999; Harris et al., 1998) In all three, "the strongest findings were for the variables that were evaluated most subjectively. This raises concerns about the possible inadvertent unmasking of the outcome assessors. Moreover, the absence of a clearly plausible biological mechanism by which such a treatment could influence hard medical outcomes makes one inclined to be skeptical of the results". By contrast, when distant intentionality is tested under controlled laboratory conditions, the evidence is less ambiguous. Meta-analyses indicate that distant intention produces repeatable effects in the human autonomic nervous system, detected typically by monitoring fluctuations in a person’s electrodermal activity (EDA) while a distant person mentally attempts to influence the target person’s emotions or attention.(Radin et al., 2008; Schlitz & Braud, 1997; Schmidt et al., 2004) However, most of the studies have observed the effects in the autonomic nervous system, which is not sufficient in explaining the biological mechanism of distant (nonlocal) healing. The EDA reflects a sympathetic nervous activity of human autonomic nervous system which is connected with central nervous system, so thus we reasonably infer the central nervous activity can also be influenced by the distant intention. Therefore, the goal of this study was to see what would happen in the objective measure of the central nervous system using background EEG (electroencephalogram) activities rather than EDA and tried to understand what kind of biological mechanisms could be taking place while effect of distant intentions occurs. The role of motivation in which the relationship between the sender of the mental intention and the receiver might be modulating these effects was also explored.

2. Methods

2.1. Participants

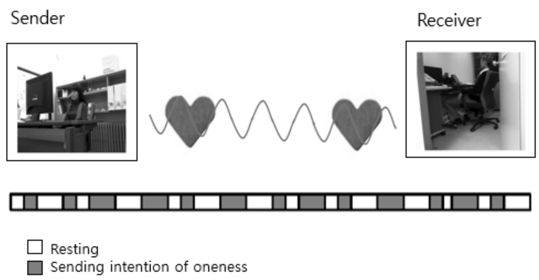
Participants were recruited through medical campus of Seoul National University's web-advertisement. The experimental procedure was approved by the Research Ethics Committee of the Seoul National University Hospital. When the participants arrived at the lab, the study design was explained to the participants, including the objective of the study, the role of the participant, the session procedures, and their rights as voluntary participants were explained, and informed consent was obtained from each participant prior to the commencement of the study. In a session, two participants make a pair, in which one of the pair was assigned the role of the sender of the distant mental intention (DMI) and the other the role of the receiver of the DMI. A total of 15 participants ($F = 6$, $M = 9$) were enrolled to the study (Age = 29 .1 ± 4.7 years, range = 23~38) in which participants assigned to multiple sessions to make 9 couple sessions and 9 non-couple sessions.

2.2. Recording conditions

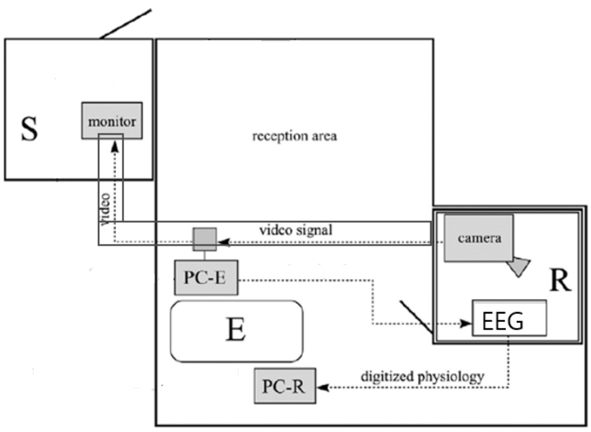
The researcher attached EEG cap to the receiver person to monitor whole brain activities. EEG data were collected with a 19-channel ECI electrode cap from the following locations: Fp1, Fp2, F3, Fz, F4, F7, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, and O2. These scalp locations were referenced to the linked ear lobes, with the ground at the AFz. Impedances were kept below 10 kHz. The signals were recorded with a band pass of 0.43 ~ 80 Hz and a digitization rate of 256 Hz.

2.3. Procedures

There were two types of sessions, couple sessions and non-couple sessions. In the couple session, the sender and receiver were lovers, while the sender and receiver were not acquainted with each other before the session in the non-couple session. During the session, the receiver was asked to relax in a distant room. After the receiver was settled in the distant room, the sender was led to a room 10 meters away and asked to sit in a chair about a half meter in front of a video monitor. The sender was asked to intentionally focus, the feeling of oneness, on the receiver only when the real time image of the receiver was displayed on the monitor in front of them. The written statement delivered and attached to the sender's positions was "When you can see the receiver on the monitor, you have to actively stare the receiver, imaging your mind energy can reach to the receiver. Otherwise, you have to shift to your attention to another thing, such as book reading" The receiver was informed that the sender would be viewing his or her live video image at random times from a distant location, and that during those periods the sender would try to make a special intentional effort to mentally connect with him or her. A video camera was focused on the receiver's face, and the video signals were routed outside the distant room via video cable to the sender's location in which the receiver's video image was delivered at random times and blocked at other times. No one involved in the experiment knew exactly when those random intention periods would occur, as they were selected by a computer while the total length of the intention epochs and nonintention epochs were balanced at 8 minutes. The timing of the viewing periods was controlled by a Windows PC running a program written in Microsoft Visual studio 2.8 (C++). When that program was launched, it created a random timing schedule for either 20-second or 40-second visual stimulus epochs. The epochs were separated from one another by a randomly determined 20- or 40-second inter-epoch interval. To synchronize the sender's intention and receiver's physiological signals, at the beginning of each session, the computer switched the video signal from the receiver's chamber to the video monitor in front of the sender via a 10-m long video cable and then started recording the receiver's whole brain activities after a predetermined interval. Then, the video monitor in front of the sender showed either the receiver's real-time image or a green image for the randomly determined interval, respectively. When everything was in order, a researcher started the session. At the end of the session, the researcher checked to see if the physiological recordings and video switch were operating properly. When everything was in order, the researcher ended the recording for the session to end.



(a)



(b)

Fig. 1 (a) Timeline of the experiment. While the sender in a room send or rest according to the random time schedules, the receiver in other room just relax during the experiment. (b) Laboratory layout. The experimenter's computer(PC-E) connect the EEG machine for recording receiver's physiology and the monitor for distant intention. The PC-E controlled the random timing and a video switch and receiver's EEG saved into the PC-R(Recording space). The receiver was in an isolated room .The sender was in a distant room behind a double wall.

2.4. EEG analysis

EEG indices were divided into two categories: the power for each of the 19 channels and the connectivity between these channels. Power indices were computed from the power spectra and defined as the absolute power, relative power, and power ratio. Connectivity indices were coherence, phase difference, and asymmetry, defined as below.

The absolute EEG power spectra were computed by fast-Fourier transform (FFT) based on 512 points corresponding to 2-s epochs with a resolution of 0.5 Hz. The EEG power spectra were calculated by 1Hz-bins and predefined frequency bands. The frequency bands were defined as follows: delta (δ), 1.0~4.0 Hz; theta(Θ), 4.0~8.0 Hz; alpha(α), 8.0~12.0 Hz; beta(β), 12.0~25.0 Hz; High beta(Hβ), 25.0~30.0 Hz; gamma(γ), 30.0~40.0 Hz; High gamma, 40.0~50.0 Hz. Alpha, beta and gamma band was divided by subbands as follows : alpha1(α1), 8.0~10.0 Hz; alpha2(α2), 10.0~12.0 Hz; beta1(β1), 12.0~15.0 Hz; beta2(β2), 15.0~18.0 Hz; beta3(β3), 18.0~25.0 Hz; gamma1(γ), 30.0~35.0 Hz; gamma2(γ), 35.0~40.0 Hz. There were 14 bands defined as total frequency bands. The relative power spectra were computed from the absolute power spectra by dividing the total EEG power at each frequency band. The power ratio was computed from two absolute powers of the predetermined frequency band at each EEG channel. The 10 power ratios were defined as follows: δ/Θ, δ/α, δ/β, δ/Hβ, Θ/α, Θ/β, Θ/Hβ, α/β, α/Hβ, and β/Hβ.

EEG coherence was computed for all 171 intrahemispheric and interhemispheric pair wise combinations of electrodes. Coherence was defined as

$$\Gamma^2_{XY}(f) = \frac{G_{XY}(f)^2}{G_{XX}(f)G_{YY}(f)} \qquad (2.1)$$

where Gxy(f) was the cross-power spectral density and Gxx(f) and Gyy(f) were the respective autopower spectral densities. Coherence was averaged for all pairwise combinations of the 19 channels for each of the 14 frequency bands. The EEG phase was defined as an arctangent of the ratio of the real and imaginary components for each channel at each frequency band :

$$\emptyset_X(f) = \tan^{-1}\left(\frac{Imag(G_X(f))}{Real(G_X(f))}\right) \quad (2.2)$$

where Gx(f) is the Fourier transform of channel X. The EEG phase difference between the channels was defined as

$$\emptyset_{XY}(f) = \emptyset_X(f) - \emptyset_Y(f) \quad (2.3)$$

where øX(f) and øY(f) were the phase of the X and Y channels at each frequency band, respectively.

Amplitude asymmetry was defined as

$$A_{XY}(f) = \frac{abs(G_X(f)) - abs(G_Y(f))}{abs(G_X(f)) + abs(G_Y(f))} \times 2 \quad (2.4)$$

at each frequency band.

Under the null hypothesis, the influences of the sender's intention should not matter because the receiver was thoroughly isolated from the sender. The principal hypothesis was that the sender's DMI directed toward the distant and isolated receiver would influence the receiver's central nervous system. A secondary analysis explored whether the factor of motivation modulated the postulated effect. Using individual paired-t test, the receiver's whole brain activity recorded during the intention epochs was compared with the same measures recorded during non-intention epochs, used as controls, in each session. The whole brain activity includes the absolute power, the relative power, the power ratio, the coherence, the phase lag and the amplitude asymmetry. In each individual paired-t test, the degree of freedom for the test was 238(480/2-2) because a total length of 8 minutes (480sec) for the intention epochs, as well as the non-intention epoch, corresponded to 240 EEG data sets (EEG data were analyzed with 2 sec epochs as described above). The statistical difference between the intentions versus the controls across 18 sessions was also examined by group paired-t test. Moreover, subgroup analysis for the couple and non-couple sessions were additionally examined by the same test.

3. Results

3.1. Changes in EEG power variables

EEG indices were divided into two categories: the power for each of the 19 channels and the connectivity Table 1 shows the number of EEG power variables significantly changed during the mental intention epochs compared to the non-intention epochs. A $p < 0.05$(uncorrected) was considered as significant.(Refer section 5 for the significance correction) When listing in increasing order of total number of significantly changed power variables, couple sessions, all sessions, and non-couple sessions are followed. Stronger evidence was observed in the couple sessions in terms of EEG power.

Table. 1. Total number of EEG power variables significantly changed during mental intention epochs compared to non-intention epochs(p < 0.05, uncorrected)

EEG Power Index	All Session (N=18)	Couple Session (N=9)	Non-Couple Session (N=9)	Total num-ber
Absolute power	5	2	0	14 × 19
Relative Power	5	5	3	14 × 19
Power ratio	3	4	1	14 × 19
Absolute Power(1Hz)	10	41	3	50 × 19
Relative Power(1Hz)	26	32	14	50 × 19
Total	49	84	21	

Figure 2 provides the overall patterns of significant changes in the power variables at the 14 predetermined frequency bands. The statistical results for the absolute power combining all sessions showed a decrease in the frontal slow waves while the results combining all couple sessions showed an increase in the fast waves. However, the absolute power for the non-couple sessions did not show any changes. For the relative power, the Fz decreased for all 3 groups whereas other patterns did not show any consistent changes. Frontal delta/theta or delta/alpha power ratios increased for all sessions and for the couple sessions while the non-couple sessions showed different patterns.

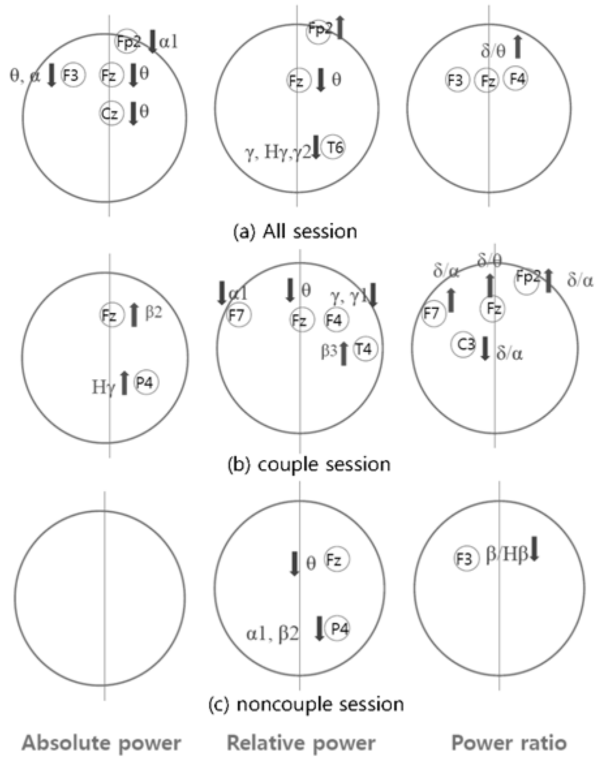


Fig. 2 Overall patterns of significant (p < 0.05, uncorrected) changes in the power variables at the 14 predetermined frequency bands. For example, mean of the Fz theta relative power during the intention epochs across all session was 13.7 ± 4.6% and same for the non-intention epochs was 14.5 ± 4.8% (non-corrected p=0.009, N=18)

3.2. Changes in EEG connectivity variables

Figure 3 provides the overall patterns of significant changes in EEG coherence at 8 predetermined frequency bands. The statistical results of coherence changes combining all sessions showed a decrease in the slow wave's coherence while the results combining the non-couple sessions also showed to a lesser degree a decrease in the slow wave's coherence. However, coherence changes for the combined couple sessions showed an increase in the slow and fast wave coherence simultaneously with decreasing coherence patterns

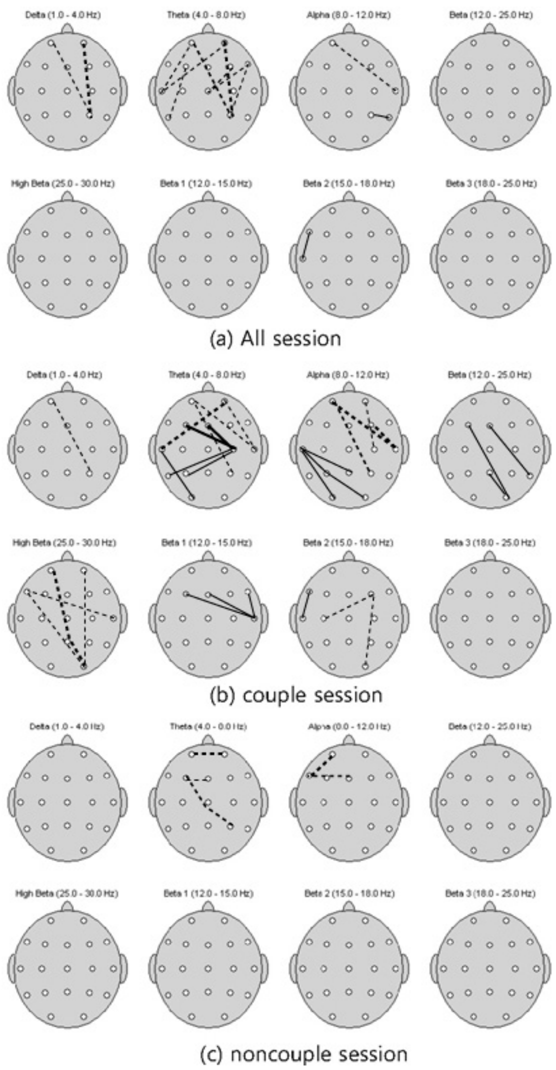


Fig. 3 Overall patterns of significant($p < 0.05$, uncorrected) changes in the coherence variables at 8 predetermined frequency bands. Dotted line indicate decreased coherence while Solid line indicate increased coherence during the intention epochs compared to non-intention epochs across sessions

Table 2 shows the number of EEG connectivity variables significantly changed during the mental intention epochs compared to the non-intention epochs. When listing in increasing order of total number of significantly changed connectivity variables, couple session, all session, non-couple session are followed. Stronger evidence was also observed in the couple sessions in terms of EEG connectivity. Interestingly, the number of coherence variables significantly changed was 4 to 6 times larger than the other two groups.

Table. 2 Total number of EEG connectivity variables significantly changed during mental intention epochs compared to non-intention epochs($p < 0.05$, uncorrected)

EEG Connectiv -ity Index	All Session (N=18)	Couple Session (N=9)	Non-Couple Session (N=9)	Total num -ber
Asymmetry	119	95	71	14 × 171
Coherence	22	91	14	14 × 171
Phase difference	80	65	78	14 × 171
Total	221	251	163	

4. Discussions

4.1. Decreasing EEG slow waves

Nonlocality experiments in human physiology had started with ANS (autonomic nervous system) activation results. EDA has been used mainly. Covert observation influences the sympathetic response of the staree by increasing the activation, called distant mental intention.(Schlitz & Laberge, 1997) It has been repeatedly reported that skin conductance level or skin conductance response and amplitude and frequency increase during covert observations. Nowadays, this has been developed to distant healing intention in the application of complementary healing strategies for urgent patients(Radin et al., 2008) Although authors keep evolving guidelines for distant healing intention(Schlitz et al., 2003) the participants were university students and did not have much interest in the topic of study at the time of their participation. They tended to be drowsy when they acted as a receiver. The decrease in the frontal slow wave's absolute power for all sessions and the increase in the fast wave's absolute power for the couple sessions both mean that distant mental intention influenced the receivers by making them more alert. Consistent decreasing theta power at Fz for all 3 groups strongly suggests that the receivers tended to be drowsy only during the non-intention epochs interspersed randomly during each session.(Strijkstra et al., 2003) Frontal delta activation pattern could be inferred from the fact that eye movements are accompanied by sympathetic activation.(Yamada, 1998) Our EEG power results may generally suggest that distant mental intention increases sympathetic activation and the effects was modulated by the relationship between the sender and receiver.

4.2. Increasing EEG coherences

Biological mechanism for nonlocal phenomena of distant intentionality on humans was first proposed by the Institute of Heartmath(McCraty et al., 2004) in which the heart appears to receive and respond to intuitive information prior to EEG changes and even prior to presenting stimulating emotional pictures. They explain that heart coherence synchronized nonlocally, and then, the heart changes result in changes in brain activity. There have been many attempts to integrate ANS activities with CNS (central nervous system) activities. The polyvagal perspective(Porges, 2007), neurovisceral integration model(Thayer et al., 2009) and system theory of neural synergy(Thompson et al., 2010) describe the integrated model. However, electrophysiological data supporting the model has not yet been reported so much. According to published data in the author's laboratory, EEG coherence increases with heart coherent behavior.(Kim et al., 2013; Kim et al., 2013) Assuming heart coherence increases during nonlocal connectedness, EEG coherence could increase as well. Our study showed that EEG coherence among the connectivity variables had the biggest difference across the 3 groups. For the couple group showing, roughly, the largest distant intentionality effect, the increasing coherence pattern only observed in the intention epochs could mean that heart coherence, considered to be involved in nonlocal phenomena, facilitates EEG coherence under our study conditions.

Limitations and Further study

The total number of parameters assessed in this study was 9880. The number of power variable was 2,698($14 \times 19 \times 3+50 \times 19 \times 2$) and the number of connectivity variable was 7,182($14 \times 171 \times 3$). As far as the author's knowledge, there is no prior knowledge of whole brain activity changes during distant mental intentions, so thus the multiple comparison statistics inevitably used in this study. All the significant changed parameters in the significance level of 0.05 did not reach the Bonferroni corrected level of 0.05/9880. But the suggested changes, decreased the slow wave or increased the EEG fast wave mainly in the frontal region, are in line with sympathetic activations repeatedly shown in the EDA study on distant mental intentions while the EEG coherence might be evidence of coherent heart influence on EEG activity. The whole brain activity pattern revealed in this study can be validated by followed independent validation study with same paradigm and a planned comparison with more specific hypothesis testing.

Disclosure statement

No competing financial interest exist.

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