ORIGINAL ARTICLE

Evidence of Macroscopic Quantum Entanglement During Double Quantitative Electroencephalographic Measurements of Friends vs Strangers

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Abstract

One indication of entanglement between two particles is a change in parity or spin in one when the other is changed in order to maintain constancy of the system. Our experiment was designed to discern if this phenomenon occurred at the macroscopic level between the electroencephalographic activities of brains of pairs of people, separated by about 75 m, with various degrees of “entanglement”. About 50% of the variance of the "simultaneous" electroencephalographic power was shared between pairs of brains. Pairs of strangers were positively correlated within alpha and gamma bands within the temporal and frontal lobes. However the power levels within the alpha and theta bands were negatively correlated for pairs of people who had a protracted history of interaction. The latter result might be considered support for the hypothesis of macroscopic entanglement.

Key Words: entanglement; electroencephalographic activity; human; action at a distance; social affiliation

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Introduction

Several authors (Bokkon, 2005; Eccles, 1992, Persinger and Koren, 2007) have hypothesized that consciousness may be the result of neuroquantum interactions. Previously we (Persinger et al, 2008) demonstrated with quantitative electroencephalography (QEEG) enhanced power within a narrow band of theta activity (4-7 Hz) over the cerebral hemispheres when pairs of volunteers were separated by several meters but "coupled" by rotating circumcerebral weak magnetic fields generated by identical devices that were placed on each of their heads. The rates of change of these circumcerebral, counterclockwise rotations were designed to interact with the approximately 20 msec phase-shifts and reiterative latencies of the cohesive, "binding" electromagnetic matrices (Llinas and Ribardy, 1993; McFadden, 2002) within the cerebral cortices.

The volunteers had been strangers before the experiment began but had been randomly assigned to meet with each other or study within 2 m of each other for one to two times per week for four weeks. Randomly selected strangers that had been walking through the hallways and placed in this setting, even with the dual application of the circumcerebal magnetic fields, did not show the enhancement of theta activity. The random assignment experiment was conducted to

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demonstrate that a history of spatial proximity was the important component. It had also been completed to minimize the possible confounding variable of genetic congruence for similar findings in a previous study where brothers and sisters had served as pairs (Persinger et al, 2008). In that study enhanced activity in the theta region had occurred also during periods when the 20 msec phase-shifts in the rotating fields had been implemented relative to no-field baseline conditions.

According to Aczel (2002) entanglement is an application of the superposition principle to a composite system consisting of at least two subsystems. The primary functional result is action at a distance: a change in characteristic of one of these subsystems at some later time when the two subsystems are separated by significant distance results in an alteration of the other. Recent experiments with photons have shown that entanglement is revealed when the spin in one photon is altered. The other member of the pair's spin changes to the opposite direction.

In the present experiment we tested the hypothesis at a macrolevel. We reasoned that pairs of people who had experienced close space-time proximity for protracted periods ("involved") should display a negative correlation between their QEEG power compared to pairs of people who were effectively strangers. On the bases of previous research we predicted the changes should be specific to the left temporal and left frontal lobes within which the experience of the sense of self is most frequently correlated (Persinger, 1993). We also reasoned that if these "connections" were fundamental, they should accommodate a substantial component (at least 50%) of the shared variance in "simultaneous" changes in quantitative EEG power between members of a pair.

In previous studies each member of the pairs were exposed to identical, experimentally-generated circumcerebral phase-shifting magnetic fields to increase the "singularity" of the two spaces occupied by their brains. In those studies one of the subjects was seated within a metal (sound-attenuating) chamber that reduced the intensity of the local geomagnetic field by more than 50% so that the only similarity of connection between the two pairs would be the shared fields generated by the experimental equipment. In the present study the experimental fields were not present. However the earth's magnetic field was shared by both members of the pairs.

Method

Subjects

A total 4 pairs individuals (n=8) between the ages of 20 and 25 years of age served as subjects. They were classified as strangers or as involved (met on at least six occasions).

Procedure

In a single setting 8, 30 sec samples (1 min between samples) for members of each pair were measured simultaneously with two identical Grass EEG Instruments, Models 8-16C. Eight samples were taken for comparison because this number would be sufficient if our hypothesis that the effect sizes should explain at least 50% of the variance was supported. The filter selections for each channel were set for the standard range between 0.5 Hz and 35 Hz. The two units were housed in separate rooms (basement and second story of a second building) separated by approximately 75 m.

While sitting in comfortable chairs each subject's quantitative EEGs were obtained over the frontal (F7,F8), temporal (T3,T4), parietal (P3,P4) and occipital (O1,O2) regions simultaneously. According to a MEDA fluxgate magnetometer the resultant magnetic field at the level of the heads of the subjects were between 45,000 nT and 48,000 nT in both loci. The samples of EEG recordings were completed by two separate experimenters (one in each room) who employed synchronized stopwatches. After two baseline recordings (eyes-opened, eyes closed) to insure the montages were functional, there were six simultaneous recordings (3 eyes opened, 3 eyes closed) each with a duration of 30 s.

Each Model 8-16C machine was interfaced via a custom shielded cable, a parallel analogue shielded interface cable (Nat. Inst. SH100100), and a shielded connector block (Nat.Inst. SCB-100) to a National Instruments PCI-607IE Multi I/O Board computer interface card. The data collection was extracted by a DELL Dimension 8100 Personal Computer on a Windows 2000 Professional Platform. A custom designed user interface or Virtual Instrument (VI) using National Instruments Labview (Version 6.0i-2000) allowed the

multichannel sample to be manually recorded to a fixed disk.

Once the raw data were acquired they were transformed by fast Fourier procedures (Persinger et al, 2008) to the proportion of power (uV^2/Hz) within the delta (1 to 4 Hz), theta (4-7 Hz), low-alpha (8-10.5 Hz) high-alpha (10.5-13 Hz), beta (14-20 Hz), and gamma (30 to 40 Hz) intervals. Correlations (Pearson r) were completed between these values for the 8 samples from each pair for each of the four lobes from each of the two hemispheres between the pairs of subjects. All analyses involved SPSS software on a Vax 4000 computer.

Results

The only consistent statistically significant ($p < .01$) correlations between for both groups occurred over the left frontal and left temporal regions. As shown in Table 1, for both the frontal and temporal regions, the EEG power for both members of the pairs was positively correlated for the strangers and the pairs who had met once.

Table 1. A list of the statistically significant ($p < .01$) correlation coefficients (r) between power levels within different frequency bands for two pairs of individuals who were strangers or two pairs of individuals had histories of spatial proximity (involved).

Relationship	Left Frontal Lobe		Left Temporal Lobe	
	r	Band	r	Band
Strangers 1	.71	4-8 Hz	.85	30-40 Hz
Strangers 2	.73	10.5-13 Hz	.73	30-40 Hz
Involved 1	-.83	8-10.5 Hz	-.71	10.5-13 Hz
Involved 2	-.74	10.5-13 Hz	-.66	4-8 Hz

Discussion

As aptly stated by Aczel (2002) when the quantum system contains more than one particle, the superposition principle gives rise to the phenomenon of entanglement. This involves a system interfering with itself. This "excess correlation" is maintained over great distances such that change in the direction of the spin of one particle results in the opposite change in direction of spin of the entangled particle (Hu and Wu, 2006).

If we assume that the probability or the magnitude of entanglement increases with the numbers of spatial proximities between pairs of units, in these instance two brains, then the results of this study might be considered a macroscopic example of this "excess correlation". The brains of individuals who were strangers showed positive correlations within the electroencephalographic theta and alpha bands over the frontal lobes and with the gamma range over the temporal lobes. Involved pairs, who presumably had been spatially proximal on multiple occasions, showed negative correlations with each others' frontal activity within the alpha band.

Although one would not expect any correlation of brain states between strangers from a quantum perspective, the temporal congruence would be consistent with the recent observations with QEEG that global geomagnetic activity affects brain activity (Babayev and Allahverdiyeva, 2007). Because all human beings are immersed with the earth's magnetic field (Persinger, 1983) even spatially separated pairs of strangers might show similar EEG power shifts. The shared external geomagnetic fluctuations would function as a common zeitgeiber and would not reflect entanglement in the classic sense. However, as suggested by Basharov (2002), a variable geomagnetic field can also facilitate entanglement of particles even without past interaction. It may be relevant that the range in steady-state (background) intensity of the geomagnetic field for the two loci from which the QEEG data were collected overlapped.

However the negative correlation between power levels for the pairs who were involved would be exemplative of entanglement. Over the course of successive temporal segments the increase in power in one of the pair was associated with a decrease in power within the same band and brain regions of the member of the pair. This reciprocality, like the alteration in the polarization of one photon when the other member of the pair's polarization is changed even when the two are separate great relative distances, would be an expected feature of nonlocality (Furusawa et al, 1998).

According to Arnesen et al (2001) entanglement between two spins in antiferromagnetic solids can be increased by increasing the magnetic field. In fact, increasing the magnetic field to a certain value, at least with particles, can also create entanglement between otherwise disentangled spins. They call this entanglement between non-nearest neighbours

"magnetic entanglement" as it was brought about by increasing the field strength. Alternatively the increased field strength may be epiphenomenal to the more central effect of producing a more marked similarity of the complexity between the particles.

We would not conclude that the correlations of brain power within specific bands between pairs of people were coupled with intention. Kawano et al (2000) found that a receiver "sensing qigong" from a practitioner during a remote action procedure (To-ate, an ancient Japanese martial art) showed increases in alpha and higher frequency theta power over the frontal area. In our study correlations between theta-alpha power over the frontal lobes were noted for all pairs.

There are a number of experiments within the domains of physics and astrogeophysics that indicate the existence of macroscopic entanglement (Gosh, et al., 2003; Korotaev, 2006; Korotaev et al, 2006, 2006; Julsgaard et al, 2001; Xu et al, 2005). The engagement of entanglement has been argued to require nothing more than the measurement of a particle's spin which then induces the change in spin in a second particle measured by another observer. Our results indicate macroscopic entanglement may be conspicuously evident during simultaneous quantitative electroencephalographic activity of two brains separated by substantial distance and being observed simultaneously by two experimenters.

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