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Final REPORT

QUANTUM ENTANGLEMENT VALIDATION OF THE JACOBO-GRINBERG-ZYLBERBAUM EFFECT

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Introduction

The study set out to validate the previous work of Jacobo Grinberg-Zylberbaum. It had been previously shown that when two people were emotionally involved with each other a transfer of brain activity between the two people was possible. We set out to confirm this finding by looking at a group of subjects who had meditated together before testing, the active group, and a group of subjects who sat apart form each other and did not interact, the control group. It was argued from the literature that by meditating together subjects would to some extent cause their brain functions to become entangled with each other and there thus should be a transfer of information between the two brains. Tone pips heard by one subject should transfer as a disturbance of brain function into the second meditator. The effects of the tone pips were shown by averaging the electrical activity of the brain in both the transmitting and receiving subjects.

The experiment was conducted in a suite of rooms provided rent-free by the Priory hospital, when not in use for their purposes. While this generous provision made the experiment possible, the need to work around their use (including a complete break for the redecoration of the rooms), together with difficulties encountered in recruiting an adequate cohort of subjects, resulted in delays that prevented us repeating the experiment in the full range of experimental conditions originally envisaged.

Method

The study was started 1 April 2000. Alex Sabell was recruited to the project as a research worker and the study was agreed with the Ethics Committee of the Priory Hospital. Two experimental rooms were allocated to the study, together with a recording cubicle. The study took place in the Priory Hospital Department of Clinical Neurophysiology which was also used for giving ECT. One experiemntal room (# 1) was used by the subject whose brain was to be stimulated by the tone pips, and the other (# 2) was used by the subject whose brain was to respond to those pips. The recording cubicle generated all electrical signals and recorded the amplified EEG signals from the experimental rooms. One experimental room contained a 16 channel SLE EEG recording machine and the second experimental room a 22 channel Nihon Koden EEG machine.

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EEG electrodes were applied according to the 10/20 International system at C3, Cz and C4. Two frontal electrodes were also applied at FP1 and FP2. All electrodes were referred to a linked mastoid reference via two 25 k resistances. In experimental room 1 the subject wore a pair of tight-fitting headphones through which the tone pips at a loudness intensity of 70 dB were played into both ears. In experimental room 2 the second subject wore similar headphones through which white noise at 70 dB was played.

The signals from the two rooms were taken to a CED analysis system and recorded onto disc. A period from one second before the tone pips to one second after the tone pips was recorded. The sampling rate was at 256 samples per second and the filters were a low frequency cut-off with 0.3 second time constant and a 70 Hz high frequency cut-off to prevent aliasing. The signals were analysed off line. 120 trials were taken for each subject but only the first 80 without artefact were averaged. The data were then analysed.

Each trial was examined for artefacts and any contaminated trial was rejected. The trials were then analysed in two ways. 1) By averaging the first 80 accepted trials and then computing on the average wave form the maximum of the peak to peak amplitudes in the five 200 msec intervals before the tone, and the maximum in the five 200 msec intervals after the tone. 2) Each 200 msec average was spectrally analysed by use of the fast fourier transform. The fast fourier transform returned spectral amplitude values in 1 Hz bins. These values were then summed into bands. Band 1 was up to 3-6 Hz. Band 2 was 5-9 Hz. Band 3, 9-12 Hz and the final band, band 4 was 12-15 Hz. The individual 200 msec frequency values were then averaged over the one second periods before and after the stimulus.

The subjects were recruited locally and from local meditation groups. Inclusion criteria were age 18-60, no recent history of drug taking, normal neurology, normal psychiatric functioning, no history of head injury, cerebral damage, left-handedness or epilepsy, and taking no medication. The meditating couples knew each other and had practised meditation for at least two years. Before the session all the subjects were instructed in the study and asked to give informed consent. For the meditation session, the subjects arrived and filled in general health and closeness-to-each-other questionnaires. Control subjects filled in just the general health questionnaire. They then had the electrodes applied in one of the experimental rooms and then both subjects sat together in a curtained off area and meditated. After 20 minutes meditation the subjects, without talking or seeing the researcher, plugged themselves into the EEG machines in the different rooms, and the study began. The procedure was the same for the control group, except that they did not see or speak to their partner, and instead of meditating they just sat quietly and separately.

After the experimental session was over the subjects were asked to complete a questionnaire with details of how they felt and performed during the experimental session. The electrodes were then removed and the subjects allowed to leave.

Results

12 pairs of meditators and 12 pairs of control subjects were recruited. The mean age of the controls was 34.6, the mean age of the meditators 40.6, with SD's of 12.1 and 8.9 respectively, so that there was no significant different between the ages. A multivariate analysis of variance was then carried out. We first of all looked at the overall peak to peak amplitude in the 800 msecs from time -1000 to -200 as the control condition and 0-800 msecs as the active condition, for the group of meditators versus controls, and for the central and frontal electrode placements. There was no significant difference for group or for time or for electrode and group or for time and electrode. We next carried out a frequency analysis and compared the power in the low frequency band (3-6), theta band (6-9), the alpha band (9-12) and the lower beta band (12-15). A multivariate test for time and time v. group showed no significant changes for the theta and the alpha bands. For the lower beta (Cz electrode) there was a significant group effect with an increase in lower beta activity in the meditating group, although this did not change significantly during the analysis period. For the low frequency band there was a significant change, when the time group interaction was examined. Analysis assuming normal distribution gave $p=0.008$, though on correcting for the fact that the power is a positive statistic by taking its logarithm (a proceedure that improved the normality of the data) this probability dropped to $p=0.06$. This analysis showed that for the control group the amount of low frequency activity increased in the second half of the trial, whereas for the mediators there was a significant fall in low frequency power between the first and second halves of the analysis period. No correlations were seen between any scores on the questionnaires which had been given. There were also no change in classification of the groups using the empathy score of all subjects for both the control and the meditations groups. So no further analysis was possible.

Peak to peak analysis was carried out on the amplitude data for each electrode. The peak to peak amplitude for each subject was scored in 200 msec epochs, starting at -1000 msecs to -800 msecs and so on up to +1000 msecs. The five epochs before zero were then meaned together so as to produce a mean peak to peak amplitude for that subject. This mean peak to peak amplitude was then compared with each 200 msec epoch starting after time zero. Thus five comparisons were made, 0-200 msecs, up to 1000 msecs. Paired t tests were used to test any differences in amplitude for the controls, and then for the meditators. The following significances were found for the controls:

Electrode C3 no significant differences

Electrode Cz 400 - 600 msecs $p = 0.03$

Electrode C4 no significant differences.

Electrode fp no significant differences.

No significant differences were found for the meditators.

DISCUSSION

Discussion

Twelve control subjects and twelve meditators were identified and took part in this experiment. The types of meditation used by the meditators varied, but the majority used mantra meditation. All the self-report emotional empathy scores showed that the pairs from the meditating group were in empathic contact with each other in a much stronger way than was rated by the control group. If we accept the ratings as being accurate, then there should have been a statistical difference between the groups.

We carried out a peak to peak analysis similar to our first pilot study, comparing the mean of the peak to peak amplitude for each of the 200 msecs prior to the stimulus with each 200 msec epoch after the stimulus. For the control subjects, significant differences were found at Cz for the third epoch. This finding would suggest that the left hemisphere showed a difference in the controls, and this was less well seen in the central Cz lead. We had predicted that the controls would not show this difference, whereas the meditators would, as the controls did not have an opportunity to form an empathic relationship with each other. The fact that this change occurs could be due to chance, as multiple t tests were done, but the pattern is so consistent that it suggests a true effect for the left hemisphere. Clearly further studies will need to be carried out to confirm this. The reason why this was not seen in our first pilot study is possibly because only a Cz electrode was used in that study.

Only two significant differences were seen in the frequency analysis. There was a significant difference in the lower beta band between the meditators and the controls, with the meditators having higher lower beta activity both before and after the stimulus. This is in agreement with the literature which suggests that lower beta activity is more prominent in subjects who meditate. The final significance was in the low frequency band, where there was a definite significance of the untransformed data, although this was reduced in the logged data, which showed a reduction in low frequency power for the meditating subjects. We predicted that there would be higher low frequency activity post stimulus, as a transfer potential should be of higher amplitude and should contain an increase in low frequency power. The reduction in low frequency power after the stimulus in the meditator subjects cannot be explained using this hypothesis. It would suggest that there was a transfer of a blocking response which reduced low frequency power after the transferred stimulus. An alternative explanation is that as a large number of statistical tests were done, one was likely to be significant by chance and thus it would be necessary to repeat this experiment to confirm that this finding is robust and not due to chance alone.

The results of this experiment are not similar to the pilot study and the question has to be asked why this was so. The subjects in this experiment were in two separate rooms, and therefore the possibility of sensory leakage was significantly reduced. Next, in the first experiment the emotional connectedness may have been different, as the subjects tried to 'feel' each other emotionally during the initial period, whereas in this experiment they meditated together and may not have achieved the same degree of emotional connectedness. Though subjects were asked to meditate and feel the presence of the other person, meditation might perhaps rather be a state of personal space. A further possibility is that the experimenter was different in the two cases. The experimenter in the first study was a mature married man, warm and friendly and capable of setting up strong emotional bonding with his subjects. He also believed strongly in the possibility of a positive result and was thus likely to be a 'sheep.' The second experimenter was a researcher whose parapsychological experiments before had shown no evidence of any psi effects. There is thus the possibility that the experimenter used on the second occasion, though not an avowed sceptic, was nevertheless was an inhibitor of psi effects and thus a 'goat.'

Conclusion

This study does not confirm the initial results of the pilot study. There were three positive findings. Firstly, the meditators had more lower beta activity than the controls during the measurement session, which is in line with the literature on meditation. Secondly there was a significant finding in the low frequency band with the low frequency activity inhibited in the meditators but enhanced in the control subjects after the stimulation of the transmitting subject. Finally, there was a significant difference in the peak-to-peak values from the Cz electrode in the controls. The reasons for these last two effects are not clear. However, it does suggest that some form of transfer may be occurring and a further experiment needs to be done to confirm this. Because the original result was not confirmed, it was not possible to explore the quantum theoretical aspects described in the original proposal.