THE TRANSFERRED POTENTIAL

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Abstract:

It has been suggested that components of an evoked potential (the transferred potential) may be transferred directly from one brain to another brain, provided that the two subjects have a close empathic relationship with each other at the time of the stimulation and recording. This paper provides preliminary support for that view, using auditory evoked responses. One member of a pair listened to tone pips, while the EEG of both pairs was averaged. No transferred potential was found between 6 pairs of non-empathically relating control subjects. However, some peturbation in the EEG response after the stimulus was found in the non-stimulated brains of 6 pairs of empathically-relating subjects. This finding will need replication, but if correct it suggests that some direct brain to brain transfer of activity may be possible, and that some brain processes may therefore be 'non-local'.

Key words:

Evoked potential, EEG, transfer potential, empathic, non-local.

Introduction

Jacob Grinberg-Zylberbaum et al 1993 proposed that it was possible for the brain response, the evoked potential, to a light stimulus, to be transferred from the brain of one person to the brain of another, provided that the two people concerned had an empathic relationship. Grinberg-Zylberbaum goes on to detail a possible mechanism involving quantum mechanics. However, before considering any mechanism, it is essential to replicate the experiment. This study is designed as a simple replication of Grinberg-Zylberbaum et al transferred potential, using auditory stimuli.

Materials and methods

Pairs of control subjects were invited to the laboratory and were asked to fill out a questionnaire detailing their relationship with each other. Most of these subjects met for the first time at the laboratory; if they knew each other, they did not know each other well. They were introduced to the recording room and instructed in the recording procedure.

The recording procedure was as follows. Four electrodes were placed on each subject's head, Cz referred to linked mastoids and an earth electrode. These electrodes were then connected by 1.5

metre leads to a common head box of a Nihon Kohden EEG machine. The subjects' heads were 1.5 metres apart, and the subjects were facing away from each other and were unable to see each other. Each subject was given a pair of tight fitting headphones which excluded the environmental noise. The first subject was then stimulated with tone pips through their headphones, while the second subject relaxed. After the completion of a trial a signal was given to the subjects and they exchanged earphones. The procedure was then repeated with the tone pips given to the second subject. This was repeated twice. After completion of the test, the headphones were removed and the subjects filled out a questionnaire detailing their experiences during the test and their feelings for the other subject while the test was going on. The subjects rated the degree of empathy they felt for the other person in the pair on a three point scale; 0 = no empathy, 1 = some empathy, 2 = strong empathy. They then left the laboratory.

The eleven empathic pairs of subjects were chosen from a pool of pairs who knew each other well and had a positive relationship. When they came to the laboratory the electrodes were placed as for the control subjects. The recording position was explained to them and they were told that they must take it up on hearing a signal. They were then instructed to sit quietly, for twenty minutes, beside each other and to 'feel' each other empathically, and try and strengthen the emotional relationship between them. After the signal, they took up the same recording positions as the control subjects and put on the headphones. Grinberg-Zylberbaum (personal communication) has pointed out that it is

essential that there is no experimenter contact with the empathic subjects once empathic contact has been made. The experiment was then conducted as for the controls.
All control and empathic subjects had normal hearing.

Recording paradigm

One of each pair of subjects was stimulated with a 70dB 1KHz tone pip lasting 20 m.secs, while the EEG was being recorded from both subjects. The inter-stimulus interval was 3.5 seconds and 125 pips were in the average. The EEG gain was set at 70μV per cm, with a 0.3 second time constant and a high cut filter of 3dB down at 70 Hz. The output from the Nihon Kohden was fed into a Neurosciences Brain Mapper, which carried out the averaging on line. Care was taken to ensure that no artefacts entered the averages. The averaging was commenced one second before the tone pip and ended one second after the tone pip.

Measurement

It was not possible in this experiment to predict what form the transferred potential would take, but we did predict that there would be a peturbation of the average waveform after the tone pip in the non-stimulated empathic subjects. The average waveform trace was thus divided up into five 200 m.sec periods before the

tone pip and five after. The greatest peak to peak amplitude within these 200 m.secs was the score which was used in the measurement and statistics of the results. The averages for each subject were recorded on paper and measured blind by two raters, correlation coefficient between raters was 0.98.

Results

Analysis of the empathic rating scales completed by the control subjects showed that there was no empathic contact between the pairs. All but two rated their empathy as 0 (none); those two individuals rated their empathy as 1 (some) but they were not in the same pair. Most of the empathic pairs showed strong empathic contact. In two pairs both partners rated their empathy as 2 (strong). Three pairs rated 2 and 1, one pair 1 and 1, two pairs 1 and 0 and three pairs 0 and 0. Both groups of subjects reported that they could hear no external noise through the earphones during either half of the experiment. They all denied being able to hear the tone pips given to the other subject.

The mean amplitude of the 12 unstimulated control subjects (6 pairs) for the first second (mean amplitude of five 200 m.sec epochs) was 2.9μV (sd 1.6) and for the 2nd second 2.7μV (sd 1.2). A paired t-test between the mean of the first second and the mean of the 2nd second for all 12 subjects showed no statistical significance, $t = 1.4$, $p = 0.2$. A correlation coefficient between these values was $r = 0.95$. For the 22 unstimulated

empathic subjects (11 pairs) analysed in the same way as for the controls, the pre-stimulation mean was 2.5 μV (sd 0.8), and for the post-stimulation mean was 2.8μV (sd 1.1), $t = 1.96$, $p = 0.06$ and $r = 0.63$. The empathics thus showed a change which indicated a strong trend towards significance.

FIGURE 1 ABOUT HERE

The empathic subject group was then split. Five pairs of subjects in which either partner had rated their empathy as 0 were rejected and only those who had empathy scores of 1:1, 1:2 or 2:1 were used. There were six pairs and the following analysis is done only on these twelve subjects (true empathics - TE).

For the unstimulated TE subjects, the mean for the 1st second was 2.5μV (sd 0.85), and for the 2nd, 3.3μV (sd 1.1). A paired t-test was significant, $t = 3.5$, $p < 0.005$, $r = 0.73$. For the true empathics there was thus a highly significant change after the stimulus. The five empathic pairs who felt no empathy were also analysed; the means were 2.5μV (0.7), 2.3μV (0.6) $t = 1.42$, $p = 0.19$, $r = 0.73$. Thus the empathic group which felt no empathy showed no significant effect.

The stimulated subjects were analysed in the same way. The

control subjects' first second was 3.0μV (1.3), and for the 2nd second was 6.3μV (1.5). A paired t=test was significant, t = 9.33, p < 0.001, correlation 0.61 For the TE subjects, the corresponding figures were, 2.9 (1.4); 5.8 (1.8). t = 10.1; p = <0.001, r = 0.83.

When paired t-tests were calculated between the mean of the first second and the individual 200 m.sec values after the stimulus was given, there were no significant differences for the control subjects. There was, however, an interesting change in significance for the 12 TE subjects. Significance was highest between 200 and 600 m.secs after the pip, and after 800 m.secs the significant differences from the pre-stimulus values had disappeared. (Table 1, fig. 1).

TABLE 1 ABOUT HERE

The results for the stimulated pairs are similar for the controls and the TE subjects and show a picture of the expected standard evoked potential for the Cz response to a tone pip. (Table 2,fig. 1).

TABLE 2 ABOUT HERE

Discussion:

This paper appears to provide confirmation of Grinberg-Zylberbaum et al's experiment which suggested that some effect of auditory stimulation on the brain of one subject could be directly transferred to the brain of another empathic individual.

In our experiment, provided a pair of subjects were self-rated as being in empathic contact, a significant effect was found in the non-stimulated subject after a tone pip in the stimulated subject. This effect was not seen in the non-stimulated control subjects or in those non-stimulated empathics who felt no true empathic contact. The effect was a greater peak to peak amplitude in the EEG of the non-stimulated subject after the stimulus was given to the stimulated subject. This EEG change had the appearance of non-specific runs of activity, which started after the first 200 m.sec and died away after 800 m.sec.

There are several possible explanations for this effect. Firstly, there could be electrical coupling between the experimental pair. This is unlikely because the machine was tested to exclude any coupling and none was seen in the test runs. In the actual experiment, no effect was seen in the control subjects. The next explanation is that subliminally the non-stimulated empathic subjects heard the tone pips, and the result is a modified evoked response. This is unlikely as both controls and empathics were tested in the same way and both

denied hearing either tone pips or external noise. There was no difference in hearing between the groups. Furthermore, the transferred response is spread out up to 800 m.secs after the tone, which would not be typical of a subliminal response. It could also be argued that the empathic subjects cheated in some way despite observation by the technicians. This is unlikely as when the empathic group was split, no effect was found in those empathic subjects who did not have empathic contact.

A third explanation is that the true empathics were able to pick up subtle physical cues that the control subjects and other subjects could not. This is highly unlikely as the subjects could not see each other and 125 averages were used which would tend to reduce any responses which were not strictly time-related to the pip.

There is thus a high probability that we have successfully replicated Grinberg-Zylberbaum et al's experiment. It is clear that the experiment should be repeated with the subjects in separate rooms, and two different EEG machines to eliminate the possibility of electrical or sensory coupling. Because of the significance of this experiment, which suggests that there are non-local effects within a brain and that one brain may directly affect another, it is important that other laboratories attempt

further replication studies. If this finding is correct then the most likely explanation is that some brain structure may mediate

Quantum Mechanical effects.

References:

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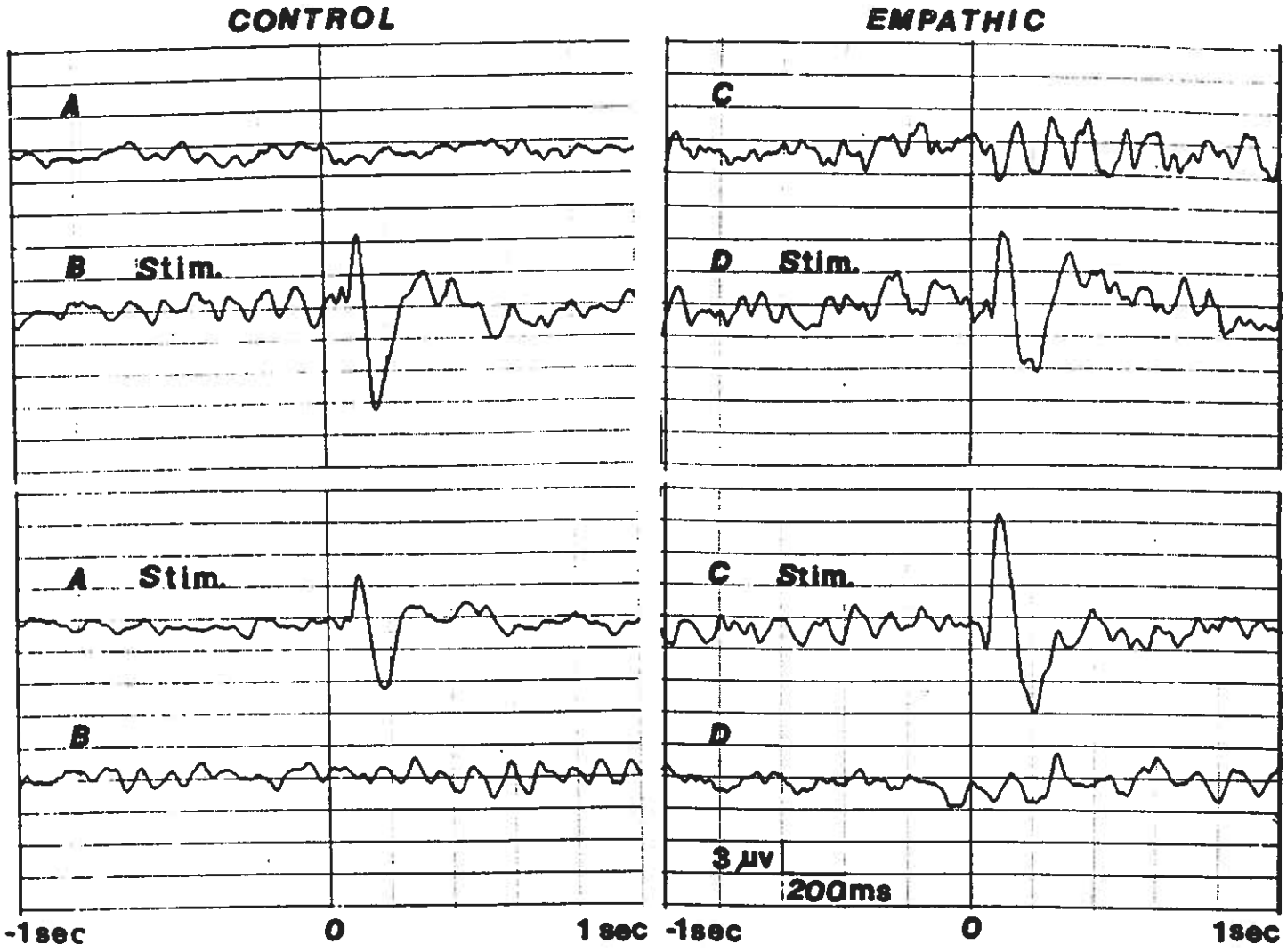

CAPTION

Figure 1

The evoked responses for the 12 control subjects, six pairs A and B,. and the full empathic group, 22 subjects, eleven pairs, C and D. The traces were measured from Cz to linked mastoids, 125 sweeps in the average, the tone pips were given at time 0. The graphs show the averaged EEG for one second before and one second after the stimulus. The stimulated channel of the pair is marked 'Stim.' In the control group there is no clear peturbation in the averaged response of the non-stimulated pair after the stimulus, whereas for the empathic group the averaged response in the non-stimulated pair is peturbed post-stimulus compared to pre-stimulus.

TABLE 1

Unstimulated

Controls (12)

M (Mean) v	0-200	M v 200-400	M v 400-600	M v 600-800	M v 800-1000ms
mean.ms	3.2 (1.9)	3.0 (1.6)	2.7 (1.2)	2.5 (1.2)	2.8 (1.2)
t	0.7	0.3	1.1	1.2	0.5
p	0.49	0.70	0.29	0.24	0.62
r	0.78	0.90	0.85	0.69	0.85

Unstimulated

True Empathics (12)

mean.ms	3.2 (1.4)	3.5 (1.3)	3.5 (1.4)	3.0 (0.9)	3.0 (1.0)
t	2.2	3.8	3.7	2.3	1.8
p	0.05*	0.003*	0.003*	0.04*	0.11
r	0.66	0.71	0.73	0.63	0.51

The value of 't' and its significance from a paired t-test and the correlation coefficient between the mean, (standard deviation), of the first second amplitude values with each of the values for the first, second, third, fourth and fifth 200 m.secs after the tone pip for the controls and the true empathics in the non-stimulated subjects.

TABLE 2

Stimulated Subjects

Controls (12)

mean.ms	13.2(2.7	8.2(2.7)	3.6(1.6)	3.4(1.8)	3.1(1.8)
t	10.8	7.34	1.9	0.94	0.43
p	<0.001*	<0.001*	0.08	0.37	0.68
r	0.24	0.44	0.75	0.67	0.80

True Empathics (12)

mean.ms	12.7(3.7)	7.1(3.3)	3.4(1.7)	3.3(1.3)	2.8(1.1)
t	10.7	5.3	1.7	1.4	0.5
p	<0.001*	<0.001*	0.10	0.18	0.64
r	0.53	0.61	0.88	0.78	0.72

The value of 't' and its significance from a paired t-test, and the correlation coefficient between the mean of the first second amplitude values with each of the values for the first, second, third, fourth and fifth 200 m.secs after the tone pip for the controls and the true empathics in the stimulated subjects.