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## Experimental

# HUMAN COMMUNICATION AND THE ELECTROPHYSIOLOGICAL ACTIVITY OF THE BRAIN

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### ABSTRACT

Electrophysiological evidence is presented showing an interaction between brain activity of human subjects during *direct communication*, an interaction which occurs when subjects are able to feel each other's presence without the use of any sensory stimuli. Subjects who had previously established *direct communication* were asked to sit in complete darkness in two different electromagnetically insulated chambers. One of the subjects was stimulated and it was found that the potential thus evoked could be "transferred" to the nonstimulated subject. These findings support the postulates of the Synergetic Theory.<sup>1</sup>

**KEYWORDS:** Electrophysiology, human communication, transferred potential, EEG, EPR

## INTRODUCTION

**T**he question about the ability of the human brain to detect subtle information was made and answered 2500 years ago when Buddha reached the state of enlightenment and described the condition referred to as omniscience in which an enlightened subject is able to experience and encode all that happens in the Universe (*see The Surangama Sutra*).<sup>2</sup> Pathanjali, the propounder of Yoga, described a method called *Samyama*<sup>3</sup> in which subjects are able to learn about whatever they wish, without the use of intellectual intermediaries, by merging themselves with the chosen object. The *Samyama* technique requires the subject to concentrate completely on an object until that object occupies all of his or her field of consciousness. If concentration is further maintained, the subject's consciousness merges with the object, thus giving him or her direct knowledge of the object, from the inside so to speak. The limits of *Samyama* are unknown and its area of application unlimited, as shown by an experiment carried out by one of the authors some years ago<sup>1</sup> in which subjects were required to apply *Samyama* to their own EEG activity and evoked potentials. These subjects were able to decode very subtle characteristics of their own brain activity and became increasingly conscious of brain activity that had passed by unnoticed before using the technique. The *Samyama* technique has been employed in a school in Mexico with children aged 6 to 12, as part of their process of education, with amazing results.<sup>4</sup>

The condition of omniscience and the success of the *Samyama* technique imply, as a *sine qua non*, the natural and physiological capacity of the human brain to detect subtle information using mechanisms not limited by sensory decoding. These mechanisms could be related to the detection of energy fields and of distortions of the space-time continuum.

According to the Synergetic Theory developed by one of the authors,<sup>1</sup> all the neuronal changes in each of the brain's neurons produce a distortion in the lattice of the space-time continuum. The interaction of each of these microdistortions creates a hypercomplex macrodistortion of the same lattice. In the Synergetic Theory, this distortion is called the Neuronal Field. According to this same theory, perceptual experience is the result of the interaction of the Neuronal Field with the space-time continuum. If this is so, the mechanism for the detection of subtle events and of the activity of other brains would be

this same interaction between one Neuronal Field and the lattice, or with other Neuronal Fields.

Neurophysiology began to publish serious research about direct interactions between human brains in 1965 when an article written by Duane and Behrendt appeared reporting that alpha blocking of the EEG induced in one subject activated the same change in his identical twin located at a distance.<sup>5</sup> In 1974, Targ and Puthoff reported clear indications that human subjects were able to detect information presented at a distance without using sensory channels.<sup>6</sup> They also reported evidence of EEG changes in response to remote stimuli.

This evidence shows that the human brain is capable of directly detecting events (changes in brain activity and natural stimuli) that take place at a distance, thus indicating that this ability is part of our human heritage. In more recent research,<sup>7</sup> it was found that the interhemispheric coherence of subjects located in one laboratory changed when another group of subjects located at a distance from the first group began to meditate. According to different studies, meditation causes an increase in brain coherence.<sup>8,9</sup> Thus, when a brain changes its coherence, other brains located at a distance are influenced by this change and also modify their coherence.

**T**he same year in which the results of the above-mentioned experiment were published, (1982), Grinberg-Zylberbaum<sup>10</sup> reported three different experiments with similar findings, that is, a change in the interhemispheric coherence and correlation of one subject's brain affects other subjects' brains to the same extent. In one of these experiments, the EEG activity of a psychoanalyst was recorded together with that of his patient during an actual therapeutic session. The EEG activity of both analyst and patient became similar in direct correspondence with the degree of empathy between them. In 1987, Grinberg-Zylberbaum and Ramos reported evidence showing that interhemispheric correlation patterns of the EEG activity of human brains becomes similar when subjects are able to establish a level of communication that was termed "direct."<sup>11</sup> *Direct communication* occurs when pairs of subjects are able to feel each other's presence without using any sensory stimuli, in complete darkness and without touching or speaking. It was also found that the subject with the greatest interhemispheric correlation "attracts" toward his own level the interhemispheric correlation state of the subject with whom he established *direct communication*.

In 1935, Einstein, Podolsky and Rosen published a paper describing the EPR paradox (named after the three scientists in question) according to which if Quantum Mechanics is correct, when two elementary particles interact and are later separated in space, a change in one of them will be correlated with a corresponding change in the other no matter the distance between them.<sup>12</sup> In 1982, Aspect, Dalibard and Roger carried out an experiment which supported the effect of this interaction between particles.<sup>13</sup>

**I**n the light of the EPR paradox, and taking into consideration the results of the experiments described above, we designed a further series of experiments to show that not only a general measure of brain activity, such as the blockage of the alpha rhythm or interhemispheric coherence and correlation is sensitive to the interaction between subjects but that a specific event related response such as the evoked potential can also be transferred from brain to brain. We attempted to demonstrate that, without the intervention of any known sensory system, the human brain is able to detect precise changes taking place at a distance.

In order to do this, we used two sound proof, electromagnetically shielded chambers. Both chambers were completely shielded by metal netting and were thus presumably completely electromagnetically insulated. No sound or light could pass from one chamber to the other. One subject was stimulated in one of the chambers, while, in the other chamber, sat another subject who was not stimulated. We searched for any brain response in the non-stimulated subject that resembled the evoked potential obtained in the stimulated subject. The experiments are described in detail in the following sections.

## EXPERIMENT 1

### INTRODUCTION

In our first experiment, we decided to test the possibility that a potential evoked by a stimulus in one of the subjects sitting in one of the chambers could be “transferred” to a non-stimulated subject in the other chamber as a “transferred” potential, and to see if the non-stimulated subject could sense that the other subject was receiving a stimulus.

## METHOD

Five pairs of human subjects of both sexes were asked to sit, side by side, inside a soundproof, electromagnetically shielded room for about 20 minutes. They were instructed to use any procedure they wished in order to establish nonverbal, empathic communication in which they could feel each other's presence directly, without the need of any vocalization or physical contact. We termed this kind of communication *direct communication*.<sup>1</sup> To facilitate the occurrence of *direct communication*, the lights of the chamber were turned off and a condition of silence was maintained. This sensory isolation procedure increases the ability of the subjects to feel each other's presence, as this is the only stimulus that exists inside the chamber.

When the subjects announced that they had reached a state of *direct communication*, one of them was asked to sit in another sound proof, electromagnetically shielded chamber separated from the first by an electromagnetically shielded wall. No sound, light or smell could pass from one chamber to the other. In this condition, both subjects were asked to maintain their *direct communication* even though they were now in two different chambers and separated by a distance of 270 cm. The subject who remained in the original chamber was then stimulated with simultaneous visual and auditory stimuli at random intervals, while the other remained in complete darkness in the second chamber receiving no stimulation and unaware that his/her partner was being stimulated. The subject in the second chamber was asked to use special sound insulation devices similar to the ones used in airports to ensure complete isolation in this respect.

**M**onopolar vertex EEG activity was recorded in all subjects during the presentation of the previously mentioned visual flashes activated by a Grass PS22 photo-stimulator set at its highest intensity, together with a 100 msec train of 1000 Hertz sound activated by a Grass S88 stimulator.

We also devised a control situation in which two subjects, who had not interacted before, sat in different chambers. These subjects had never met and did not know that another subject was in another Faraday chamber.

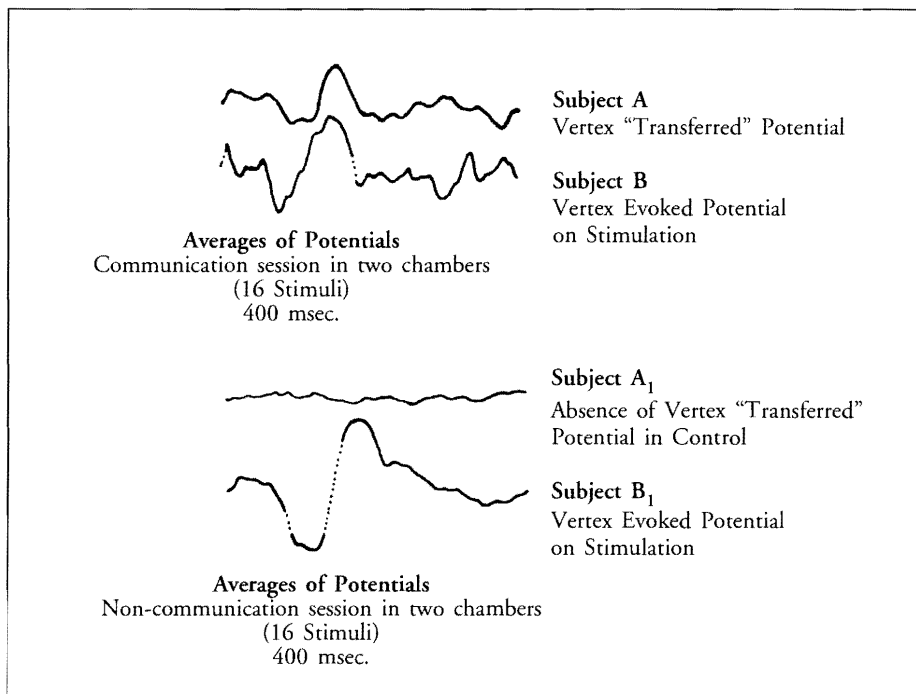
## ANALYSIS

All sessions were recorded on magnetic tapes which were analyzed in order to quantify the presence of evoked potentials and the possible existence of “transferred” potentials. Eight, 16 and 32 samples of EEG activity, synchronized with the stimuli, were averaged separately for each subject’s brain wave in order to detect the presence of evoked and “transferred” potentials. The recordings were digitized every 8 msec and were compared one to the other in the following way:

- 1) Correlations were calculated between the average “transferred” potential and the average evoked potential using Pearson correlation.
- 2) The calculation consisted in correlating the first 32 pairs of digits of both signals thus obtaining a first correlation value.
- 3) The following pair of values was then added to the 32 original pairs and the first pair of that series of 32 was removed in order to again calculate correlation for this new series of 32 pairs. This operation of adding the following pair of values in the sequence and removing the pair at the beginning was continued until all pairs were used in the calculations.
- 4) In this way, between 83 and 139 correlation values were obtained for each comparison of the averages of the evoked and “transferred” potentials, depending on the duration of the epochs which varied between 200 and 400 msec.
- 5) Only positive correlations with values greater than 0.600 were accepted as meaningful.

## RESULTS

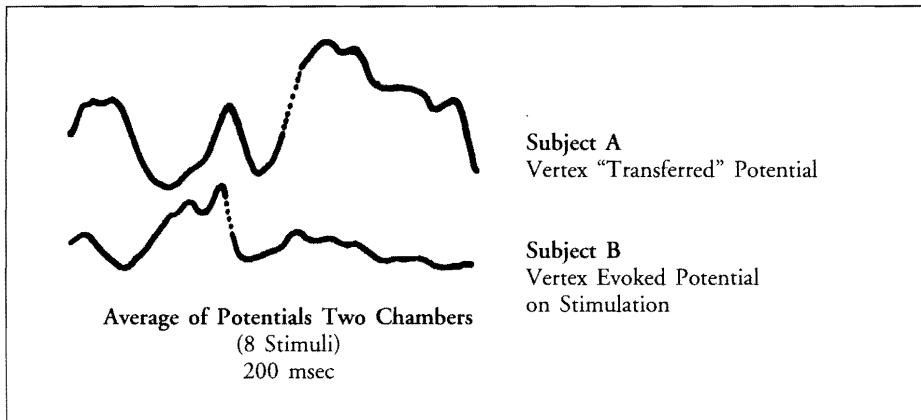
Figure 1 shows averages of 16 clear, evoked “transferred” potentials in a communication session after the subjects had interacted for 20 minutes, and a control situation in which we worked with two subjects in two chambers who had not



*Figure 1 presents averages of 16 samples of EEG activity. Subjects B and B1 (second and fourth lines) receive light and sound stimuli inside a Faraday cage while subjects A and A<sub>1</sub> (first and third lines) receive no stimulation while isolated in another Faraday cage. The top two lines show the existence of a “transferred” potential in subject A and an evoked potential in subject B during a **direct communication** session. The Pearson correlation between the evoked and the “transferred” potentials ranged from  $r = 0.629$  to  $r = 0.966$  between latencies of 150 and 276 msec (see text). The two lower lines show the absence of a “transferred” potential in subject A and the presence of an evoked potential in subject B<sub>1</sub> during a session in which there was no **direct communication**. All the recordings are from the vertex and are monopolar. These results indicate that the “transferred” potential appears during **direct communication** but is absent when there is no communication.*

interacted and therefore had not established a state of *direct communication*. The absence of the “transferred” potential is of note in this situation compared with its presence when communication exists. When communication did take place, the correlations calculated between the evoked and the “transferred” potentials ranged between  $r = 0.629$  and  $r = 0.966$  between latencies of 150 and 276

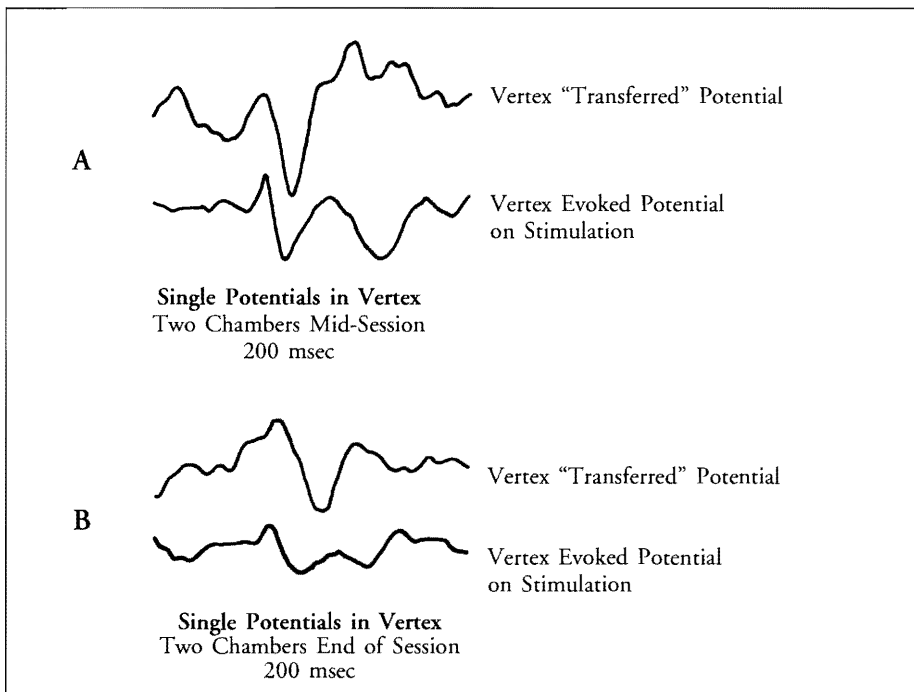




*Figure 2. Examples of a vertex "transferred" potential in one subject (A) and vertex evoked potential in a second subject (B) during a session with a high degree of direct communication. The traces are taken by averaging eight 200 msec samples. The Pearson correlation values ranged between  $r = 0.640$  and  $r = 0.671$  between latencies of 124.5 and 140 msec (see text).*

msec. At 150 msec the correlation value was  $r = 0.629$ ; it reached a maximum value of  $r = 0.966$  at 250 msec. When there was no communication, no correlation was meaningful. Figure 2 shows another example of "transferred" and evoked potentials. It can be seen that the "transferred" potential morphology is very similar to the vertex evoked potential morphology. In this case, the correlation values between latencies of 124.5 and 140 msec. were between 0.640 and 0.671.

- 1) When the subject receiving the stimulus presented a low amplitude evoked potential, there was also a decrease in the amplitude of the transferred potential (see Figure 3).
- 2) No "transferred" potentials were found in subjects who had not previously achieved *direct communication* during the recording sessions in two chambers (see Figure 1).
- 3) We found a clear similarity between the morphologies of the evoked and the "transferred" potentials, as can be seen in Figure



*Figure 3 shows unaveraged examples of vertex "transferred" potentials (first and third lines) and of vertex evoked potentials (second and fourth lines) half way through a direct communication session (top lines) and at the end of the same session. The subjects were each in different Faraday chambers. The figure shows the morphological similitude of the evoked and "transferred" potentials and their habituation. In 3A, the Pearson correlation values between the evoked and "transferred" potential ranged between  $r = 0.604$  and  $r = 0.934$  between latencies of 142 and 152 msec. and in 3B, potential ranged between  $r = 0.611$  and  $r = 0.824$  between latencies of 89.6 and 114 msec. (see text).*

3. In the first case (3A), the correlation values between latencies of 142 and 152 msec. ( $r$  between 0.604 and 0.934), in the second case (3B) between latencies of 89.6 and 114 msec ( $r$  between 0.611 and 0.824).
- 4) Finally, in only two cases, the subjects who showed "transferred" potentials mentioned that something "strange" had happened to their partners during the transfer session, but no subject was able to clearly detect that his/her partner was receiving the light or sound stimuli.

## EXPERIMENT 2

### INTRODUCTION

The results obtained from the first experiment showed the appearance of “transferred” potentials with a similar morphology to that of the evoked potentials. In order to replicate this experiment but using a different analysis technique and including new controls, we decided to carry out the experiment described below.

### METHOD

A total of 14 subjects, 6 men and 8 women ranging from 21 to 45 years of age were studied. Pairs of subjects of both sexes were asked to sit, side by side, inside a sound proof, electromagnetically shielded room, again in complete darkness, with their eyes closed and without touching each other. They were asked to try to establish a state of *direct communication* and when they announced that they had done so, one of them was instructed to sit in another sound proof, electromagnetically shielded chamber.

The subjects were asked to maintain a state of *direct communication* and the subject who stayed in the first chamber was then stimulated using flashes activated by a Grass PS22 Photo stimulator set at highest intensity. In some experiments, the stimulated subject was asked to keep his eyes closed while the flashes were activated, whereas in others the subject was asked to lie down and observe the flashes with eyes half-open. The flash lamp was located inside the chamber in some experiments and outside in others, with the light from the lamp penetrating the chamber through a shielded one way glass pane. In all cases, intervals between the flashes were randomized so neither stimulated nor non-stimulated subjects could know when a flash was to be given.

Electrical activity of the brains of both subjects was recorded using a vertex monopolar derivation in some cases and a fronto-vertex bipolar derivation in others. In some experiments, only the brain activity of the subject located in the second chamber, the non-stimulated subject, was recorded. In these experiments, the activity of the subject in the original chamber, stimulated by flashes,

was not recorded and no electrodes were placed on his or her head. This procedure was used in order to prevent any possibility of 'inside equipment' interaction.

The EEG activity was recorded by means of a Beckman polygraph and averaged using two different, independent machines: an analog computer (Tracor-Northern) and a PC. Two averaging devices were used in order to assure reliable measurements. The flash stimuli were presented either automatically or manually by pushing a button on a Grass S88 stimulator that synchronized the onset of the flash and simultaneously activated the averaging program in the PC and the analog computer. In both cases, there was a random interval between stimuli.

In the condition in which the stimulated subject had electrodes placed on his or her head, the vertex or fronto-vertex potential evoked by the flash stimuli was averaged using a maximum of 512 flashes. The subject located in the second chamber was not stimulated and did not know that his or her partner was receiving any stimulus. The same 512 samples of EEG activity of the non-stimulated subject were averaged and each sample was synchronized with the onset of the flash stimulus presented to his or her partner.

**T**wo averages of 256 samples each and a complete average of 512 samples were obtained from the brain of both the stimulated and the non-stimulated subjects. An evoked potential in the stimulated subject and a "transferred" potential in the non-stimulated subject were said to have been produced only if Pearson correlation reached a minimum positive value of  $r = 0.600$ . When only the non-stimulated subject was recorded, the same procedure of successive correlations performed on 256 sample averages was used to locate any repetitive signal of the EEG synchronized with the applied stimuli. Sometimes, the series of 512 flashes was not applied in its entirety due to the subjects getting tired. Nevertheless, when this occurred, a minimum of 240 presentations was given and then partial averages of 120 samples were compared using the same procedure as described earlier in "Analysis."

In some experiments, when both subjects were enthusiastic and motivated, they were asked to reinforce their *direct communication* by sitting together once again inside the original chamber and when ready, the subject who had originally gone into the second chamber stayed in the first and was stimulated, while the

other subject now went into the second chamber. Using this procedure the existence of the “transferred” potential was investigated in both subjects.

## RESULTS

**I**n Experiment 1, we only accepted as clear “transferred” potentials those whose waveshapes were definitely similar to the corresponding evoked potential in the stimulated subject. In the present experiment, we were not interested in the similarity between the “transferred” and the evoked potentials but in any event related response which appeared repeatedly in our averages and that was not a product of chance or noise—in other words, only if the two 240 or 120 averaged samples of the non-stimulated brain triggered the moment the flash was given to the stimulated subject, were statistically similar (minimum  $r = 0.600$ ). We then interpreted this similitude as a real “transferred” potential. This similarity was computed by means of a correlation program similar to the one used and explained in Experiment 1 and its results are depicted in each of the figures presented.

In Figure 4, an example of the “transferred” potential and the corresponding evoked potential in a couple of subjects are depicted. The “transferred” potential correlation varied between  $r = 0.606$  and  $r = 0.980$  between latencies of 100 and 178 msec. The evoked potential correlation reached high values in almost all the points. Similar results were obtained in 8 subjects; in other words, in about 57% of all cases.

We were obviously aware of the possibility that our results were due to an unknown artifact related to four different factors:

- 1) Possible internal interactions inside the equipment.
- 2) Some signal passing from one chamber to the other.
- 3) An electromagnetic pulse entering both chambers as a consequence of the activation of the flash.

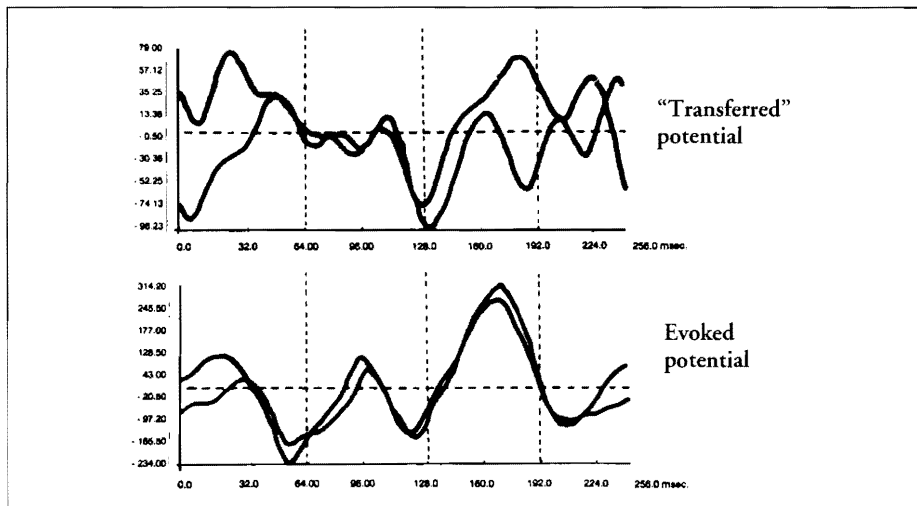


Figure 4. At the top, an example of the “transferred” potential obtained in a non-stimulated subject with the corresponding evoked potential (at the bottom) produced by the stimulated subject during the same session. Each graph represents 256 samples averaged by a PC. The “transferred” potential correlation varied between  $r = 0.606$  and  $r = 0.980$  between latencies of 100 and 178 msec. The evoked potential correlation reached high values in almost all the points. Total time = 256 msec. The vertical axis is in analog/digital converter units.

- 4) A natural cycle of brain activity in the non-stimulated subject synchronized by chance with the triggering stimulus.

We discarded these four possibilities:

- 1) by recording with only one channel (the one from the non-stimulated subject) and by avoiding any connection between the stimulated subject and the equipment;
- 2) by complete sensory isolation of both chambers and even using special sound isolation earphones that the non-stimulated subject had to use;

- 3) by placing the flash outside the Faraday cage and using two independent synchronization pulses and two independent averaging procedures. A control was also carried out in which we made recordings from free electrodes submerged in electrolytic solutions placed in both chambers while flashes were presented inside and outside the first chamber, when no observer was present. No signal of any induced potential was recorded in either chamber;
- 4) by stimulating at random intervals.

**W**e found no differences between the characteristics of the “transferred” potential recorded at the monopolar vertex and those recorded at the bipolar fronto-vertex derivation, except for a clearer recording when the latter derivation was used. Our impression is that the “transferred” potential is a real brain response that does not depend on the condition of the stimulated subject except in one respect: the psychological condition of both subjects seems to be of great importance. If the subjects made great efforts *to communicate with each other or used rational strategies the “transferred” potential could hardly be noticed. If the subjects were sensitive and maintained a fluid, natural, relaxed attitude, the “transferred” potential appeared with more clarity.* More research is needed to know which conditions block and which favor the appearance of the “transferred” potentials.

## EXPERIMENT 3

### INTRODUCTION

Buddhism states that there is a collective consciousness which becomes manifest in a community (*Sangha*) which can even strengthen certain individual states of consciousness. The experiments so far indicate that there are direct interactions between brains, possibly mediated by relationships between the individual Neuronal Fields postulated in the Synergetic Theory which also holds that Neuronal Fields are able to interact with one another and with the structure of space, giving rise to a new level of organization called the “Hyperfield.”<sup>1</sup> Each Neuronal Field is affected by the Hyperfield and thus whatever happens to any human being has repercussions on the state of everyone else. In order

to study the “transferred” potential and the Hyperfield, we carried out the following experiment.

## METHOD

Four subjects, 2 men and 2 women, aged between 25 and 44 years participated in this experiment. The four subjects were all asked to sit inside the first Faraday chamber in complete darkness and silence, with their eyes closed and without touching each other. Each subject was asked to establish a state of *direct communication* with the other participants and when they all felt they were communicating directly, three of the subjects were asked to go into the second chamber while the fourth subject remained in the first. They were then instructed to maintain the state of *direct communication* they had previously established. The three subjects in the second chamber were then stimulated with flashes of light activated by the Grass PS22 Photo stimulator set at highest intensity. Both the statistical analysis procedure and the stimulation methodology were similar to the ones used in Experiment 2. The recording was made using a monopolar vertex derivation.

## RESULTS

As can be seen from Figure 5, a very clear “transferred” potential was obtained in the non-stimulated subject. The Pearson correlation values ranged between  $r = 0.603$  and  $r = 0.994$  in the following latencies: between 1 to 66 msec; 73 to 108 msec; 136 to 149 msec; and 179 to 192 msec.

This preliminary result possibly means that when many subjects share the same condition (in this case, the flash stimulation) there are probable summation effects of each Neuronal field that increase the possibility of transfer. However, more experiments of this type must be carried out before we can state our conclusion with any certainty.

## CONCLUSIONS

The data from these experiments indicate that when an evoked potential is produced in the brain of one subject, the brain of another subject who has



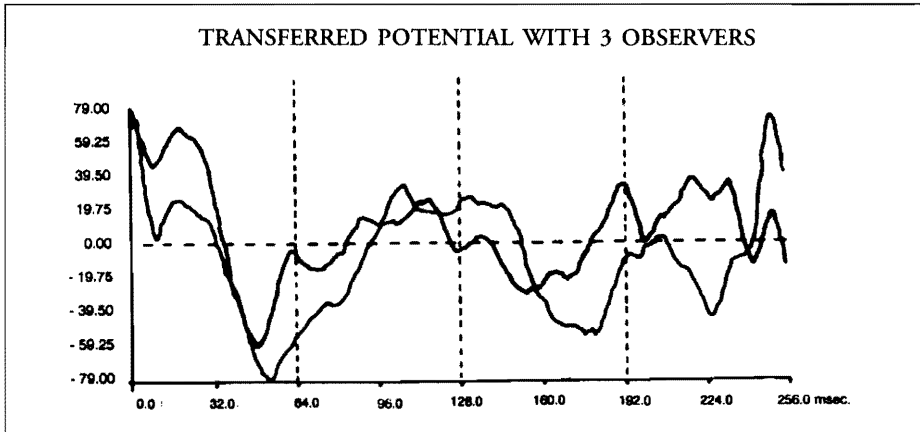


Figure 5 shows "transferred" potentials from one subject's brain, while three observers were stimulated in another chamber. Each graph represents an average of 256 samples. The Pearson correlation values ranged between  $r = 0.603$  and  $r = 0.994$  in the following latencies: 1 to 66 msec, 73 to 108 msec, 136 to 149 msec, and 179 to 192 msec. Total time = 256 msec. The vertical axis is in analog/digital converter units.

established a state of *direct communication* with him/her and who is not stimulated can also respond with a potential which we have called the "transferred" potential.

These results indicate that the EPR paradox can be extended to complex biological systems such as the human brain.

Quantum physics conceives space as having different levels of organization.<sup>14</sup> The most fundamental level can be conceived as a complex lattice with an absolute degree of coherence and symmetry in all its portions. The appearance of an elementary particle can be understood as a specific distortion of the lattice in one of its locations. The dual corpuscular-undulatory nature of elementary particles can be explained as a manifestation of these lattice distortions. In other words, the particle is, at the same time, part of the lattice and a located 'something' that has a corpuscular nature.

One possible explanation of our results is that the human brain is capable of modifying the basic structure of space and this modification affects other human brains. This postulation is included in a theory that one of us has developed.<sup>1</sup>

## THE SYNERGIC THEORY

This theory is a psychophysiological attempt to explain the quality of perception. It is based on the previously mentioned consideration that space has many levels of organization. The basic level of space organization is a hypercomplex matrix known as the space-time lattice.<sup>1</sup> Each portion of this lattice contains concentrated information about the rest of the lattice. In empty space, the lattice is completely symmetrical and has a high level of coherence. Each elementary particle is a microdistortion of the basic high symmetry and high coherence lattice. Each activation of a neuronal cell is also a microdistortion of the same lattice. The conjugated activity of the brain creates a hypercomplex macrodistortion of the lattice. This macrodistortion results from the interactions between all the elementary microdistortions in each and every neuron in the brain and is called the “Neuronal Field.”

**A**ccording to the Synergetic Theory, perception appears as an interaction between an individual Neuronal Field and the lattice itself. This interaction between the Neuronal Field and the lattice creates a hypercomplex multidimensional interference pattern. According to this theory, there are mutual interactions between individual Neuronal Fields and between them and the rest of the distortions of the lattice.

The Synergetic Theory also postulates that all the interactions between individual human brains create a Hyperfield in which the experience of each and every one is inscribed. The Hyperfield could be conceived of as a collective Neuronal Field with which individual Neuronal Fields interact. The Hyperfield would then be the global resultant of all the individual distortions provoked in the structure of space by all interactions between Neuronal Fields and could be one of the strata of unification where there is no separation between individual consciousnesses.

Our results agree with these postulates of the Synergetic Theory. We found that the brain of a non-stimulated subject is affected by the stimulation applied to another brain as if both brains were capable of directly interacting. According to the Synergetic Theory, this interaction would be due to the interference pattern created when two Neuronal Fields interact. The lack of “transferred” potentials when there was no *direct communication* indicates the importance of *direct communication* for these potentials to appear.

These results cannot be explained by any visual, auditory, tactile or odor stimulus or by mechanical vibrations passing from one chamber to the other, or by an electromagnetic pulse passing through both chambers or by inter-equipment short circuits.

Another possible explanation is that when two subjects are able to establish *direct communication*, both their brains form a unique system such that, when one part of the system is affected, the whole system responds. But whatever the explanation of the “transferred” potential may be, the fact is that it is a real occurrence as our results indicate: *the human brain is interconnected with other brains with which it has established deep, strong communication.*

• • •

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