Proposed Experiments to Determine if There is a Connection Between Biological Nonlocality and Consciousness

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Experiments are proposed based upon present research in an attempt to deal with the decades old question as to the possible role consciousness plays in the discontinuous collapse of the wave-function. Other interrelated problem areas will be investigated including the influence of mental events upon neuronal events, the entanglement of neurons in the brain and the transference of conscious subjective experience, all from the standpoint of biological nonlocality between not only human subjects but any living entity.

key words: biological nonlocality, induced evoked potential, photostimulation, measurement problem, neurons, Faraday chamber, electroencephalogram.

1. Introduction

Analysis of experiments which have been conducted and which are ongoing, leads me to believe that a possible solution to one or more of the so called 'problems' confronting us in the field of consciousness studies, may have already been achieved. These are referred to as the 'measurement' problem, 'binding' problem, 'reverse' problem and the 'transference of conscious subjective experience' problem. These experiments appear to lend credibility to the concept of biological nonlocality, which is essential for the success of this analysis, and represents an extension of a proposal I made at the Tucson 2000 Consciousness Conference [1]. This is also referred to as biological utilization of quantum nonlocality [2].

2. Duane-Behrendt Identical Twins Experiment

Analysis of a paper written over 3 decades ago has led me to a rather interesting conclusion, namely that biological nonlocality may have already been accidentally and unknowingly discovered, albeit in a very rudimentary manner and, in contradiction of both quantum mechanics and special relativity [3]. This paper was written around the same time as Bell's landmark paper which addressed the problem of nonlocality [4]. This question of nonlocality had first been raised by Einstein-Podolsky-Rosen (EPR), who claimed that if quantum mechanics were a complete model of reality, then nonlocal interactions between particles had to exist [5]. Since they felt that nonlocality was impossible, quantum mechanics either had to be wrong or at least incomplete. An experiment was later performed which showed that nonlocal influences do exist once these particles interact and, that one can test the explicit quantum nature of systems

via the use of EPR nonlocality, since this nonlocality cannot be duplicated by a classical system [6,7].

The researchers had noted that the nonscientific literature was replete with instances in which illness or trauma in one of a pair of identical twins affects the other, even when they are far apart. They decided to alter the brain wave pattern of one twin, and see if this would produce a similar response in the brain waves of the other twin. In this instance, the alpha rhythm was utilized, which are brain waves of from 8-13 Hz and approximately 50 microvolts. The alpha rhythm can be elicited when a subject closes his eyes, stares at a uniform unpatterned background or sits in the dark with her eyes open. Since eye closure in a lighted room elicits immediate and reproducible results, it was chosen as the method for investigation.

Identical twins were seated in separate rooms hooked up to EEG machines to measure their brain waves. They were asked to leave their eyes open, until one was instructed to do otherwise. It was noted that in 2 out of 15 pairs of twins tested in this instance, eye closure in one twin not only produced an immediate alpha rhythm in his brain but, also in the brain of the other twin, even though he had kept his eyes open throughout this procedure. Under these conditions it is highly unusual to see an alpha rhythm in the 2nd twin.

Even though these experiments were not carried out in a Faraday chamber, one could interpret the results as favoring biological nonlocality, since they were achieved without conventional classical elicitation of an alpha rhythm in one twin, while it was being evoked under standard conditions in the other twin who had closed his eyes. I have since been informed by one of the researchers that they conducted additional experiments with 50 pairs of twins in which they got not only correlated but, anti-correlated effects where the alpha rhythm could be enhanced, blocked out or overridden by the

recipient [8]. And, in which they were able to correlate the alpha rhythm of unrelated subjects!

3. Grinberg-Zylberbaum EPR Experiment

Experiments were undertaken 30 years later by Grinberg-Zylberbaum, under much more stringent conditions, to determine if nonlocal correlations might occur at complex levels such as the human brain [9]. These experiments tested the possibility of the existence of a transference of specific signals between two brains, in a nonclassical fashion.

Unrelated pairs of subjects were allowed to meditate together until their brains' EEGs displayed phase coherence. Approximately 25% of the subjects attained what they called quantum correlation or direct communication. The subjects were put into Faraday chambers attached to EEGs. One of the subjects was stimulated by a series of unpatterned flashes of light from a photostimulator, which resulted in an evoked potential being elicited. An evoked potential is a normal electrophysiological brain response produced by a sensory stimulus [10].

When the stimulated subjects showed a distinct evoked potential, similar potentials were found in 25% of the nonstimulated subjects, which they called *transferred potentials*.

With the use of photostimulation they were able to achieve a much more distinct and replicable evoked potential than that obtained by merely closing one's eyes. While both techniques revealed the same striking similarity regarding the brain waves being in phase coherence, in neither case was there any transference of conscious subjective experience between the subjects.

I have proposed that in addition to using subjects who have meditated together, that we can also rely upon identical twins and

other familial combinations whose brain waves already appear to be in phase coherence due to genetic factors [11]. There is a large body of literature dealing with not only the EEGs of identical twins but, fraternal twins, and mother/son, father/daughter, etc. combinations [12-16]. In addition, it appears that unrelated subjects may possess varying degrees of phase coherence as a result of certain universal genetic factors and empathy. Analysis of both the Duane-Behrendt and Grinberg-Zylberbaum research, appears to reveal that controllable biological quantum nonlocality may have been achieved at that time [17].

4. University of Washington NIH Study

A research project commenced last year at Bastyr University and the University of Washington, under a 2 year grant from the NIH, to replicate the Grinberg-Zylberbaum experiments [18]. Their long term goal is to develop and utilize neurophysiological techniques to evaluate hypotheses emerging from the field of mind-body medicine, specifically the possibility that conscious states can exert biological effects at a distance.

Selected pairs of subjects, who have been identified as possessing cross-correlated evoked potentials during patterned photostimulation, are placed in Faraday chambers, along with separate EEGs, and just one of them is subjected to photostimulation. It will then be determined if the nonstimulated subject displays a similar *induced evoked potential* as the stimulated subject. In addition, they are also using functional magnetic resonance imaging (fMRI) as a second independent neurophysiological measure of transfer of information between two human brains. The author was asked to collaborate in the early phase of this project in light of a similar proposal I had made at the Tucson 2000 Conference [1].

5. Magnetic Dipoles and Quantum Coherence in Muscle Contraction

Recent research indicates that an extremely minute aspect of biological quantum nonlocality has been observed in the coherence of induced magnetic dipoles involved in muscle contraction [19]. The observed magnetization was robust against thermal fluctuations, which should effectively deal with objections raised by some physicists, that biological quantum coherence and superposition is impossible, due to ambient thermal considerations [20]. Compelling arguments have recently been advanced supporting quantum coherence [21].

6. Biological Nonlocality and Problem Areas in Consciousness

A demonstration of biological nonlocality between the brains of human subjects, will enable us to examine in a fairly simple fashion, several seemingly disparate problem areas presently confronting us in the field of consciousness studies, by utilizing these same techniques with minor experimental modifications. This is based on the assumption that some or all of these areas might be interrelated by virtue of biological nonlocality arising from neuronal quantum coherence and entanglement.

This would include:

a. The 'measurement' problem, which relates to the possible states of a system, characterized by state vectors, or wave-functions, changing either continuously as a result of a passage of time, or discontinuously if a measurement is carried out on the system [22-24]. In an attempt to get around this measurement problem, it was postulated that consciousness collapses the wave-function in a

discontinuous fashion, when a measurement is carried out on a system by a human subject [22-26]. In the proposed experiment, the measurement is carried out by the use of patterned photostimulation on a subject, which gives rise to an evoked potential. This is conveyed simultaneously in nonlocal fashion to the nonstimulated subject, where an *induced evoked potential* is elicited, possessing a similar waveform. This means that we could be looking at the actual collapse of the wave-function in both of the conscious subjects on a repetitive-regenerative level, based on the Hz of the photostimulation!

In order to determine if the above reasoning is correct it, is only necessary to place the nonstimulated subject under general anesthesia, where she is unconscious, and seeing if an *induced evoked potential* still shows up in her EEG. If it does not, this would mean that collapse had taken place for the stimulated *conscious* subject but, not for the *unconscious* subject. If it does, collapse is able to take place for both *conscious* and *unconscious* subjects. An indication that the latter hypothesis may be correct is based on the fact that a visual evoked potential (VEP) can be elicited from a subject whose eyes are closed and is asleep. A more detailed series of experiments concerning the measurement problem have also been proposed by the author [27].

b. The 'reverse direction' problem, or whether mental events can influence or control neuronal events, since we already know that the opposite is true, that cerebral events or processes can influence, control and presumably 'produce' mental events, including conscious ones [28]. Analysis reveals that this may have already been demonstrated in the experiments of Grinberg-Zylberbaum, when a *transferred potential* was elicited in the EEG of the nonstimulated subject. Since both subjects were in Faraday chambers, no neural or electromagnetic energy could penetrate

such an arrangement. If the ongoing experiments at the University of Washington replicate this finding in a robust fashion, this will help to confirm my hypothesis. This may be further demonstrated, if there is a concomitant transference of conscious subjective experience from the photostimulated subject to the nonstimulated subject, reflecting the type of patterned photostimulation that is being used, based upon an introspective report by the nonstimulated subject, while both of them are in Faraday chambers.

c. The 'binding' problem, or how it is that the brain can fuse together the many disparate features of a complex perception [29,30]. I.e., what mechanism transforms the firing of neurons in numerous areas of the brain into a unified experience? In this instance we could be dealing with a large number of neurons which are entangled, and relying upon this connectivity which would be inherent in biological nonlocality [30]. It would appear that the binding problem and reverse direction problem are inextricably linked, since any solely mental stimulus would have to be nonlocal. I have also attempted to deal with this matter of quantum coherence at the individual neuronal level [31].

d. The problem concerning 'transference of conscious subjective experience', and whether this can be transferred from the photostimulated subject having this experience, to a nonstimulated subject [29]. Once again this may be demonstrated if the nonstimulated subject is able to give an introspective report about 'seeing' some modicum of the pattern that is being used, while an *induced evoked potential* is being elicited in her brain. This would also have a direct relationship to the binding problem and the reverse direction problem.

I have chosen to not directly address the question of the Neural Correlates of Consciousness (NCC), which is supposedly a specific

system in the brain whose activity correlates directly with states of conscious experience [32]. It can be readily seen that the NCC may be intimately intertwined with one or more of the above items. A solution to this problem may lie in a simultaneous EEG-fMRI analysis, coupled with the nonstimulated subject being awake in one experiment and under general anesthesia in another. The same rationale applies to the 'hard' problem, or that of understanding the nature of the conscious experience [33].

7. Transcranial Magnetic Stimulation (TMS) in lieu of patterned photostimulation

In addition to the use of patterned photostimulation, I have also suggested that TMS might be used [34]. This is a non-invasive technique of directly stimulating the human cortex using a pulsed magnetic field without any discomfort to the subject and requiring no direct contact with the scalp [35]. This selective stimulation of different cortical areas can be correlated with a measured external response, such as an evoked motor potential in a particular muscle group such as the hand or leg. In addition, subjects also report phosphemes (the sensation of light) in darkness as a result of TMS over the occiput.

TMS could be administered to a stimulated subject, giving rise to either an evoked motor potential in a particular muscle group or the appearance of phosphemes. We would then want to see if these same motor potentials or phosphemes are elicited in the nonstimulated subject, in a similar manner as the *induced evoked potentials.*

8. Future Potential: Animal Consciousness

It now appears possible to address the question of whether animals are conscious, by simply modifying the experiments above, and using

primates such as chimpanzees. Since they possess a high degree of intelligence and empathy or rapport with their trainers, they could look at a TV screen, upon which the same patterned photostimulation that is displayed for human subjects, would be shown [36,37]. We would expect to elicit a visual evoked potential in their brains, which is very critical, without the need to attach any electrodes.

A trainer would be in a separate room, hooked up to an EEG machine, so that while the chimpanzee is being photostimulated, we are able to see if an *induced evoked potential* is simultaneously being received by the nonstimulated trainer! This method could also be used with dolphins. While the success of this technique would not necessarily be evidence per se for animal consciousness, it now opens up a whole new experimental area formerly considered unattainable. We could then proceed further, and use specific patterned photostimulation, and determine if there is some degree of rudimentary, discernible conscious subjective experience, transferred from these mammals to their trainers. One can also conduct experiments using other animals, even including our original ancestors, the single-celled microorganisms Paramecia and Euglena, since they all generate an action potential [38,39]. The Euglena would especially lend itself to this type of experiment, since it possesses a very primitive eyespot or photoreceptor [40]. Efforts are now underway to explore the possibility of conducting experiments with dolphins in Hawaii and with primates in the United States.

9. Conclusion

One can surmise that the preliminary experiments at the University of Washington have been successful so far, based upon data which they have made public. First, an analysis of the title of a paper listed at the annual Society for Scientific Exploration (SSE) Conference,

'Nonlocal induction of evoked potentials via fMRI'. Second, an interim report submitted to the NIH in which preliminary data from the neural energy transfer (NET) study suggests that a transfer of visual evoked potentials may be possible. The repeated appearance of *induced evoked potentials* from a large subject base would lend support to the hypotheses I have advanced in the following areas:

a. That biological nonlocality was observed, if both subjects were in Faraday chambers and/or separated by several km [1].
b. Collapse of the wave-function was also observed in a biological system, on a repetitive-regenerative basis, obeying the conservation law of energy between two human subjects, if there was no back reaction, thereby providing us with a possible answer to the 'measurement' problem.
c. It appears that it was also demonstrated that mental events can influence or control neuronal events, or what is referred to as the 'reverse direction' problem, since neither neural or electromagnetic energy could have penetrated two Faraday chambers [1].
d. That the *induced evoked potentials* could represent a rudimentary indication of the transference of conscious subjective experience, which might be determined by utilizing different patterns for photostimulation [1].

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