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Testing the Field Nature of Consciousness: A Pilot Test

Kurt Kleinschnitz[1] & Frederick Travis[2]

[1] Physics Department, Maharishi International University, USA

[2] Center for Brain, Consciousness and Cognition, Maharishi International University, USA

Correspondence: Frederick Travis, Center for Brain, Consciousness and Cognition, Maharishi International University, 1004 North B Street, Fairfield, IA 52556, USA. Tel: 641 472 1209. E-mail: ftravis@miu.edu

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Abstract

Researchers are exploring consciousness as a field permeating the world around us, rather than just a feature of human experience. If consciousness is a field, then one should be able to affect others by acting from the field of consciousness. This study used a random-assignment, double-blind design to probe effects of nine students practicing the Transcendental Meditation technique on the subjective experiences and physiological patterns of another student also practicing Transcendental Meditation. For 12 recording sessions, the group (sender) either practiced the Transcendental Meditation technique or read a textbook. When the group was meditating, the individual (receiver) reported more settled meditation experiences, and they exhibited higher alpha EEG power, a correlate of deep meditation experiences. Effect sizes for all measures were large. This was a pilot study to identify markers of field effects of consciousness. Future research could replicate these findings with a larger sample size, modify the distance between the sender and receiver, explore EEG synchrony between the senders and the receiver, called hyperscanning or collective neuroscience, and explore differential effects between friends, family, and strangers to test social influences. This design could meaningful probe the nature of consciousness.

Keywords: EEG coherence, field effects, consciousness, meditation

1. Introduction

Our senses tell us that the world is composed of distinct objects that interact. Physics gives us a different story. Field theories in physics explain that particles have both a particle and wave nature and are fluctuations of underlying fields (see Greene for discussion (Greene, 2003)).

Consciousness is generally understood as distinct, personal experiences of changing perceptual, mental, emotional and bodily states. We are considered "conscious" when we can report what we are experiencing (Parnia et al., 2023). When we cannot report our experience, we are considered unconscious, such as during sleep. Consciousness understood as conscious experiences appears to be created by brain functioning (Boly et al., 2017; Storm et al., 2017).

Neuroscience can elaborate the steps by which light hitting the sensory systems lead to volleys of activity in the brain. Neuroscience cannot, however, explain how neural activity, which functions in time and space, is transformed into a conscious experience, which can quickly go back and forth in time and space. This is called the explanatory gap (Pauen, 2009) and the hard problem of consciousness –how can we explain the quality of our inner experience? (Chalmers, 1997). Twenty-five years ago, Chalmers (a philosopher) bet Koch (a neuroscientist) that neuroscience research over the next quarter of a century will be no closer to explaining how the brain generates the blend of perceptions, memories, and feelings that accompany conscious experience then they were then. Chalmers won the bet (Horgan, 2023).

The laws of neuroscience cannot explain the quality of conscious experience (qualia). With this in mind, Chalmers questioned whether consciousness may be "… an irreducible entity (similar to such physical properties as time, mass, and space) that exists at a fundamental level and cannot be understood as the sum of its parts"((Chalmers, 1997), pg 16).

1.1 A Field Model of Consciousness

This assertion is admittedly outside of the usual scientific paradigm, which equates consciousness with reportable experience (Derrien et al., 2022) and is defined by the neuronal events and mechanisms that reliably occur with a mental event (James, 1890). Conscious experiences have a clear beginning and end, and include psychological content such as memories, attention, emotions, habit, sensations, perceptions, reasoning or will (James, 1890).

Researchers are exploring the possibility that consciousness permeates reality, rather than just being a unique feature of human subjective experience (Chalmers, 1997; Cook, 2020). This concept, termed panpsychism, does not claim that all things reflect on their ongoing behavior—the electron does not wish it was more than a probability wave. All things do not have human self-reflective consciousness. Rather, it is a rudimentary level of consciousness that Tononi in his Integrated Information Theory quantifies as the degree to which an organism can change its future state (Tononi, 2004). Nader takes this definition of consciousness one step further. He suggests that consciousness is the general ability to sense and react to the world around us (Nader, 2015, 2024). Electrons move in a probability cloud around the nucleus as they sense and react to charges in the nucleus. Plants respond to changes in sunlight, temperature, water, or to caterpillars on their leaves (Appel & Cocroft, 2014). Domesticated animals recognize their owner. These examples all involve sensing and responding to the environment in a way that ensures the integrity of the system—from atoms to animals to humans.

1.2 Empirical Testing of a Field Model of Consciousness

1.2.1 If Consciousness is a Field, Can Individuals Experience It?

When our attention projects outwards through the senses we are conscious of changing content—perceptions, thoughts, feelings, and body sense. As William James said over a century ago, most people will maintain that they do not see "an abiding state of consciousness"((James, 1890), p 300); they see a stream of conscious experiences. Meditation practices, however, can turn the attention within to experience a field of consciousness without content at the source of thought. As such, meditation practices could be tools for science to investigate more expanded characteristics of consciousness.

Meditations practices have different procedures and are structured for different purposes (Travis & Shear, 2010). Meditations in the Focused Attention category teach one how to control the mind, to keep the mind focused on breathing (Vipassana), on a pure feeling of loving kindness (compassion and loving kindness meditation) or on the body (Zen). Meditations in the Open Monitoring category teach one how to be aware of moment-by-moment experiences as in mindfulness practices and Zazen. Meditations in the Automatic Self-Transcending category teach one how to transcend the steps of meditation practice—begin with thinking and end with Being, a state of wakefulness without customary mental and emotional content (Maharishi Mahesh Yogi, 1969; Travis & Pearson, 2000). Meditations in this 3rd category, such as Transcendental Meditation, lead to an expanded state of consciousness that have field characteristics.

1.2.2 Subjective Analysis of Experiences during Transcendental Meditation Practice

Transcendental Meditation is a procedure that allows the attention to move from surface thoughts to the experience of a silent field of consciousness at the source of thought, called pure consciousness (Maharishi Mahesh Yogi, 1969). Ninety-six subjects described their deepest experiences during Transcendental Meditation practice. Content analysis of these descriptions yielded three themes that characterized these experiences: the absence of time, absence of space and absence of body sense (Travis & Pearson, 2000). Notice pure consciousness is described as a state of wakefulness, consciousness, without changing content. It is an experience completely unlike any during waking, which are characterized by an experiencer and changing content (Travis, 2014). Pure consciousness experiences are associated with slower breath rates, reduced sympathetic activation and higher frontal alpha coherence (Travis et al., 2010; Travis & Pearson, 2000).

This experience during meditation practice is an individual experience. However, logically it must be the same field that everyone is experiencing during their Transcendental Meditation practice because this field is described in similar terms—the lack of time, body and body sense, indeed the lack of any changing content. If each person was experiencing a different reality, then there would need to be different qualities in their experiences to distinguish them. Rather, this experience appears to be the same for different viewers, which suggests that individuals may be experiencing a common field of consciousness. If individuals are experiencing the same field of consciousness, then would it be possible for one person to contact that field and affect another?

1.2.3 Affecting Others through the Proposed Field of Consciousness

Research compared EEG coherence between pairs of subjects. One subject practiced the Transcendental Meditation technique. The other, who did not meditate, performed a concept learning task in an adjacent room.

Coherence estimates were calculated for 15 coherence pairs (all combinations of two frontal, two central and two parietal electrodes) and averaged in 10-sec periods over the ten-minute meditation period. Time series analysis was used to quantify the relation between the 60 coherence estimates for the meditating subjects and the non-meditating subjects. The time series analysis yielded a significant leading relation in alpha coherence in the meditating subject, which predicted changes in coherence in the non-meditating subject. When coherence was higher in the nonmeditator subject, they performed better on the concept learning task (Travis & Orme-Johnson, 1989).

This finding is hard to explain. The subjects did not interact. The non-meditating subject did not know the TM subject was next door.

These findings could be explained by a field model of consciousness. The meditator stirred that field during their Transcendental Meditation practice leading to the field being more "functionally significant" in the non-meditating subject. This practically means that the non-meditating subject was clearer, more awake, and so performed better on the concept learning task.

1.3 Study Primary Hypothesis

To directly test the prediction that individuals can communicate through a common field of consciousness, this study measured changes in subjective reports and physiological patterns in a single person practicing Transcendental Meditation, when a group of students either practiced Transcendental Meditation or read a textbook. If the group's meditation affected the subjective experience and physiological measures of an individual meditating in an adjacent room, it supports the model that consciousness may be a common field that can be stirred through Transcendental Meditation practice. We predict that when a group is practicing Transcendental Meditation, then the meditation experience of another person will be enhanced, as measured by self-report, length of deep experiences during Transcendental Meditation and alpha EEG coherence.

2. Materials and Methods

2.1 Subjects

Ten subjects participated in this study. One subject acted as the receiver of the field effect and was measured during twelve experimental sessions. This subject was a 20-year-old right-handed female with six months Transcendental Meditation practice. She participated in a five-minute EEG screening session before the research sessions to identify the EEG pattern typically seen during her Transcendental Meditation practice. Her EEG was marked by increased alpha power and coherence with the beginning of Transcendental Meditation practice—a pattern which is typically reported (Travis et al., 2010). A novice meditator was used, because the proposed influence might be more noticeable in an individual for whom the experience of the field of consciousness may be more novel and so the subject's physiology might "swing" further as it travels between usual waking consciousness to the state of pure consciousness.

The other nine subjects served as the senders. They include four males and five females who had practiced Transcendental Meditation for an average of 12 .1 ± 8.5 years.

2.2 Procedure

The receiver-subject came in the afternoon on consecutive days. She was told that the purpose of the study was to investigate the stability of EEG patterns during Transcendental Meditation practice. Each day, sensors were applied to record EEG with an Electrocap fitted for six close bipolar pairs: AF3-F3, AF4-F4, FC3-C3, FC4-C4, CP3-P3, and CP4-P4 with a linked ears reference. Bipolar recording was used to reduce the effect of volume conductance on the EEG (Travis, 1994). All impedances were below five kOhms. Heart rate was recorded by a Lead II configuration—right wrist to left ankle. Electrodermal activity was recorded from the medial phalanges of the right and middle fingers using standard Unibase and saline solution. Breath rate was recorded with a nasal thermistor. Following application of sensors, the receiver-subject entered a small experimental room. The experimenter monitored her during data acquisition via a closed-circuit TV system and communicated with her via an intercom system.

Four of the twelve sessions were alone sessions in which the receiver-subject practiced her Transcendental Meditation without the senders outside the room. For the other eight sessions, the senders silently came into the large area outside of the small experimental room after the receiver-subject was in the experimental room and

before she started her meditation session. After their arrival, the investigator signaled the receiver-subject to sit with eyes-closed and rest for five-minutes. Then she was instructed to begin a 20-minute Transcendental Meditation session.

While the receiver-subject was meditating the senders either practiced Transcendental Meditation—the field-effect condition, or read a textbook, the reading condition. The senders were three meters from the receiving subject and there was an insulated 2x4 stud wall with sheet rock on either side between them. After the 20-minute session, the senders stopped their activity (Transcendental Meditation practice or reading) and moved to another room. The receiver-subject stopped her meditation practice and sat easily for five minutes, as is usually done after Transcendental Meditation practice. At the end of the five minutes, the experimenter entered the room and removed the sensors.

The receiver-subject completed a questionnaire with an 11-point Likert Scales to quantify the depth of her meditation experiences during that session.

The receiver-subject did not know that the group was outside the room. Also, the researcher (first author) recorded data in a separate equipment room and so he was not aware whether it was the field-effect condition, when the group practiced Transcendental Meditation, or the reading condition when they read a book. He was only told this was an "A" or a "B" condition. Thus, this was a double-blind study. The blinding was broken after the data were analyzed.

2.3 Data Analysis

2.3.1 Visual Examination of the Raw Data

The raw data were visually analyzed for episodes of the experience of pure consciousness during Transcendental Meditation practice as marked by the simultaneous occurrence of slowing of breathing (breath period 200% longer than the previous one) with a skin conductance response and slowing of heart rate at the onset of breath changes (Travis & Pearson, 2000; Travis & Wallace, 1997). Incidents of the experience of pure consciousness and their duration were counted by the first author and verified by the second author.

2.3.2 Likert Scale of Depth of Meditation

The response on the 11-point Likert Scale of depth of meditation was recorded and averaged over the field-effect, reading, and alone conditions.

2.3.3 Alpha Relative Power

Power was calculated for the six bipolar-pairs in one-Hz bands from 5 to 40 Hz and converted to relative power. Relative power was used because it is more sensitive to patterns in the EEG (Psatta et al., 2000). Relative power in the alpha band (8-12 Hz) was averaged and compared between the three conditions. This frequency band was selected because it characterized deep meditation experience in previous studies (Travis, 2014; Travis et al., 2010; Travis & Wallace, 1997b).

2.4 Statistical Analysis

Heart rate and electrodermal activity were used to indicate onset of the experience of the field of consciousness. They were markers of the onset of sub-periods during the meditation session and do characterize the entire session. Therefore, they were not compared across the three conditions. This reduced the number of analyzes conducted.

Three repeated-measures ANOVAs were conducted with the three conditions as the repeated measures, and self-reported experiences, duration of deep experiences, and alpha relative power as variates. If there were significant effects, individual repeated ANOVAs were conducted between the field-effect and reading conditions.

Effect sizes were also calculated between the field-effect and the reading conditions according to Cohen for these three measures (Cohen, 1988). Effect sizes were calculated to guide planning of subject sizes for future larger studies.

3. Results

Large effect sizes were seen for all three measures, though with the small sample size only self-reported experiences and alpha relative power reached statistical significance.

3.1 Length of Periods with Deep Experiences

The repeated measures ANOVA yielded no significant differences in duration of deep experiences during Transcendental Meditation practice across the three conditions ($F(2,6) = 2.8$, $p = 0.14$). The average duration for the three conditions were: 27.8 ± 19.4 sec (field effect), 18.3 ± 7.6 sec (reading) and 7.5 ± 7.6 sec (alone). The effect size was large (d=0.80)

3.2 Self-Reported Depth of Meditation Practices

The repeated measures ANOVA yielded significant differences in self-reported depth of experiences during Transcendental Meditation practice across the three conditions ($F(2,6) = 5.46$, $p = 0.045$). The subjective ratings during Transcendental Meditation practice were deeper during the field-effect condition (6.7 ± 0.5) than during the reading condition (6.2 ± 0.6) and the alone condition (5.8 ± 1.3). A within ANOVA reported a trend for deeper experiences during the field-effect condition compared to reading ($F(1,3) = 7.7$, $p = .069$) and the effect size was large ($d = 0.97$).

3.3 Relative Alpha Power

The repeated measures ANOVA yielded significant differences in percent alpha power across the three conditions ($F(2,6) = 7.14$, $p = 0.026$). Relative alpha power was higher during the field-effect condition (0.43 ± 0.08) than during the reading condition (0.14 ± 0.21) and the alone condition (0.10 ± .09). A within ANOVA reported significantly higher alpha percent power during the field-effect condition compared to reading ($F(1,3) = 11.3$, $p = .041$) and the effect size was large ($d = 0.98$). Figure 1 presents the relative power estimates during the field-effect (solid line) and reading conditions (dotted line). The alpha peak during the field-effect condition at 10 Hz is clearly visible.

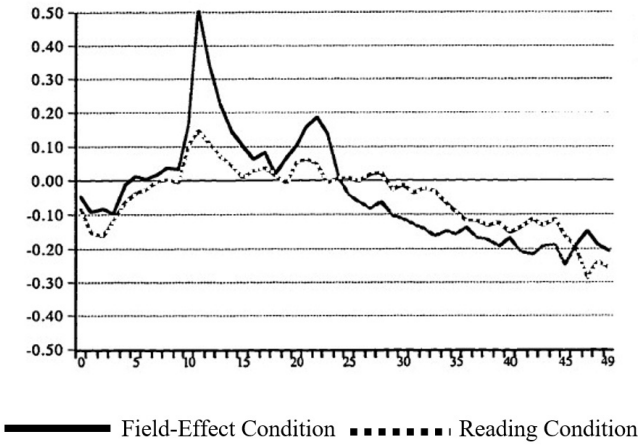

Figure 1. Relative Power during the Field-Effect Condition and the Reading Condition

Note: Beta2 and gamma percent power were lower during the field-effect condition. This could reflect the fact that relative power is being displayed on this graph. If there is a high relative power peak in the alpha band, then the relative power would be lower in other bands.

4. Discussion

When a group of nine individuals practiced Transcendental Meditation, compared to the reading and alone conditions, significant effects were seen in self-reported experiences and alpha relative power in a single person also practicing Transcendental Meditation. Individual contrasts reported significantly higher alpha relative power and a trend for deeper meditations during the Meditation condition compared to the Reading condition. Effect sizes for all measures were large.

The group of nine did not speak or directly interact with the individual. The individual was blind to the presence of the group outside her room. However, both were practicing the same meditation technique. They were turning their attention away from outer sensory experiences and towards the field of pure consciousness at the source of thought. This shared experience appeared to have a measurable effect.

One explanation of this result is that the same state of pure consciousness was experienced at the source of thought by both the group and the individual. Deep meditation experiences are described by the absence of time, absence of space, absence of body sense (Travis & Pearson, 2000). There is no sensory, mental, or emotional content—just wakefulness. It is like a wave that has settled down to the ocean and when one wave settles it could stir the other waves around it.

This pilot study is a step in a research program to probe field effects of consciousness. It replicated the earlier finding that EEG coherence in a meditator led changes in EEG coherence of a non-meditator in another room (Travis & Orme-Johnson, 1989). Future research could replicate these findings with a larger sample size, modify the distance between the sender and receiver to test proximity effects, and explore differential effects between friends, family, and strangers to test social effects. EEG could also be recorded simultaneously between pairs of people, called hyperscanning or collective neuroscience, to more directly assess the connection between people as reflected in brain-to-brain synchrony between them (Astolfi et al., 2011). This research program could be instrumental in exploring the full range of consciousness.

4.1 Limitations

This was a pilot test to identify possible subjective and physiological measures to quantify relations between individuals. As with most pilot tests, it was under powered and would lead to Type II error. However, it has yielded effect sizes to help guide future research.

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