

A Paradigm-Breaking Hypothesis for Solving the Mind-Body Problem

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The modern scientific understanding of mental phenomena asserts that the brain is the sole causal agency of mind. This view is substantiated by the correlations ordinarily observed between subjective mental states and objective brain states. Yet, there is an increasing amount of evidence suggesting that, under certain extraordinary circumstances, the correlation between peak subjective experiences and brain states breaks. This strongly indicates either that the brain is not the sole causal agency of mind, or (and more likely) that it is not a causal agency at all. In this paper, an alternative hypothesis for the relationship between the mind and the brain will be discussed; one that is entirely consistent with current neuroscience data and increasingly supported by the latest scientific evidence. The hypothesis explains not only why brain states are, ordinarily, tightly correlated to mind states, but also how, under extraordinary conditions, subjective experience can occur independently of the brain. This paper offers a rational, evidence-based, yet fundamentally different perspective on the nature of consciousness, life, identity, and death than that offered by materialism.

Introduction

There is an undeniable correlation between brain states and subjective experience. Anyone who has ever been intoxicated with alcohol will be able to attest to marked changes in cognition accompanying the changes in brain chemistry. In addition, alterations of consciousness accompanying physical trauma to the brain, as well as the use of anesthetics and psychiatric drugs, are also examples of the tight link between mind and brain that many of us are personally familiar with. Laboratory studies have provided evi-

dence that this correlation is even more specific than one could infer from direct experience: particular conscious experiences have been linked to specific neuronal activation patterns in the brain (Metzinger 2000). Experiments with Transcranial Magnetic Stimulation (TMS) have also demonstrated that deactivation of specific brain regions correlates tightly to specific changes in subjective experience (Pascual-Leone *et al.* 2002). Therefore, any theoretical hypothesis purporting to explain the ontological status of mind must be able to explain why and how subjective experience seems, ordinarily, so tightly correlated to brain processes.

Yet, that mind states are correlated to brain states does not necessarily imply that brain states *cause* mind states. Assuming so is a known fallacy in science and philosophy called the '*cum hoc ergo propter hoc*' fallacy. For instance, the presence of large numbers of firefighters *correlates* with large fires, but firefighters do not *cause* fires. Similarly, the voices one hears coming out of an analog radio receiver correlate very tightly to the electromagnetic oscillations in the radio's circuitry, but that does not mean that the radio circuitry *synthesizes* the voices. Indeed, many logical possibilities remain open to explain the ordinarily observed correlation between subjective experience and brain activity, not only the materialist assumption that the brain causes the mind.

The Reigning Materialist Paradigm

By postulating that material brain states *are* (the sole cause of) subjective experience, the reigning materialist paradigm tentatively explains the ordinary correlations between subjective experience and brain states rather simply. Yet, such a paradigm is currently articulated in only a

vague and promissory manner, in that neuroscience does not specify precisely, or unambiguously, what measurable parameters of brain processes map onto what qualities of subjective experience. For instance, most neuroscientists assume a direct link between conscious experience and neuronal firings. Therefore, one would expect to find a consistent and straightforward mapping between the qualities of a subjective experience and measurable parameters of the associated neuronal firings; after all, the experience supposedly *is* (solely caused by) such firings. However, empirical observations in fact reveal an inconsistent and even contradictory relationship between the two (Tononi 2004a). Partly to deal with this kind of inconsistency, many neuroscientists speak of *specificity*: certain types of experience, regardless of their complexity or intensity, are supposed to be (solely caused by) the activation of particular subsets of neurons, regardless of the amount of neurons or neuronal firings involved (Gross 2002). Specificity thus seems arbitrary, for if experience *is* (solely caused by) particular neuronal firings, there should then be *some kind* of proportionality between the two.¹ Finally, there isn't even consensus that experience correlates with neuronal firings at all: Some neuroscientists postulate, for instance, that mental states originate from unobservable quantum-level processes taking place within neuronal microtubules (Hameroff 2006).

So we end up in a peculiar situation wherein *ignorance* is used to substantiate materialism: Since we don't know what specific material process is (the cause of) consciousness, given any individual observation neuroscientists can *always* postulate a hypothetical mapping between a physiological process and subjective experience that could conceivably explain such observation; all that is required is some (*any*) level of metabolism *anywhere* in the brain, which is not too difficult to find or reasonably assume.

The reason such surprising ambiguity is tolerated is this: when it comes to consciousness,

there is no way, *not even in principle*, to logically deduce the properties of subjective experience from the properties of matter (Chalmers 2006). In other words, there is no way to logically deduce conscious perception, cognition, or feeling from the mass, momentum, spin, position, or charge of the sub-atomic particles making up the brain. Indeed, nature abounds with structures wherein particles combine in extraordinarily complex and exquisite ways and yet seem to lead to no subjective experience at all. Even in the human brain this is the case: much of the neuronal processing in our heads, entailing the exact same kind of neurons that otherwise lead to awareness, is completely unconscious (Eagleman 2011). Such seemingly insurmountable difficulty in logically deducing the qualities of experience from the properties of matter is called 'the explanatory gap' (Levine 1999), or 'the hard problem of consciousness' (Chalmers 2003). This way, since we have no intuition to judge whether a particular mapping between a brain process and a conscious experience is at all reasonable, *any* proposed mapping seems just as good (or as bad) as any other; a fact easily misused in support of materialism.

In all fairness, neuroscientists readily admit that our current understanding of the brain is limited. As such, it is entirely legitimate that they remain open to many different alternatives for explaining conscious experience on the basis of material processes. But in doing so they are also acknowledging that, currently, there is no one mapping between specific parameters of brain physiology and subjective experience that is consistent with all empirical observations. Therefore, it is *not* possible to claim that the empirical data supports materialism, for such a claim would imply a coherent hypothesis (i.e. *one* mapping) that currently doesn't exist. To substantiate this further, let us briefly look at what Dr. Christof Koch, one of the world's leading neuroscientist in the field of consciousness research, considers the best materialist theory of

¹ Technically, what I mean here is that, if the neuronal firings of an excitatory brain process are (the sole cause of) a conscious experience, then an increase in the complexity or intensity of the experience should be accompanied by a corresponding increase in the firings of that associated excitatory process, *given a constant level of inhibition*. It is understood that consciousness, in general, is related to an interplay between excitatory and inhibitory processes in potentially different brain regions.

consciousness available today (Koch 2011): Giulio Tononi's information integration theory (Tononi 2004b).

The Materialist Theory of Consciousness

Tononi's theory takes as input what he calls 'complexes': Neuronal processes in the brain, each with a given topology. The amount of information integrated by a complex, represented by the variable Φ , is then calculated for each complex based on its respective topology. The idea is that, when Φ crosses a certain threshold, the complex is considered conscious. The specific value of this threshold is determined through empirical calibration. When the calibration is reliable, researchers can then predict which brain processes cause conscious experience simply by looking at the corresponding Φ value.

Clearly, Tononi's theory merely provides a heuristic indicator for the presence of consciousness; an *ad hoc* rule-of-thumb. As such, it explains consciousness no more than a speedometer explains how a car moves: when the needle of the speedometer moves up, one knows that the car is moving; but that needle movement provides no insight into the fact that there is a combustion engine freeing up energy stored in the molecular bonds of hydrocarbons, thereby making such energy available for turning a crankshaft connected to an axle, which causes the car's wheels to turn, which in turn grip the irregularities of the road and, through Newton's third law of motion, cause the car to move. The latter would be a causal explanation, but Tononi's theory entails nothing analogous to it.

Let us look at an example from the field of biology to make this contrast clearer: the Krebs cycle of cellular respiration (Krebs and Weitzman 1987) is a full causal explanation for how energy is made available to an organism's cells. We know the inputs of the process: molecules of sugars and fats. We understand the oxidization reactions that progressively free up the energy stored in the molecular bonds of these sugar and fat molecules. We know in what form this energy becomes available to the cells: ATP. We

know where all of this takes place: In the mitochondria. And, we know how the cells put the ATP to use. In other words, we have a closed and complete causal chain that allows us to deduce the properties of the observed phenomenon (i.e. the ability of cells to perform work), from the properties of the process correlated to it (i.e. oxidization reactions, cell structures like the mitochondria, etc.).

Tononi's theory does not offer us any such causal chain in the case of consciousness. It does not allow us to deduce, not even in principle, the properties of the observed phenomenon (i.e. subjective experience), from the properties of the process correlated to it (i.e. neuronal physiology). It only offers a heuristic indicator without any explanatory model for clarifying where subjective experience comes from, or why a certain level of information integration leads to such an extraordinary property as being conscious. Nearly all relevant questions remain unanswered by Φ just like all relevant questions about how the car moves remain unanswered by the speedometer.

Since Tononi's theory is claimed, by materialists, to be the best materialism has to offer, it is fair to conclude that materialism currently does not provide a sufficient explanatory framework for tackling the mind-body problem.

An Alternative Hypothesis

I hope to have established that the notion that consciousness is merely (the result of) material brain activity not only lacks explicit and specific elaboration, it cannot strictly be said to be supported by empirical observations. Therefore, it is legitimate and appropriate to offer alternative explanatory models.

All scientific models need, ultimately, to postulate ontological primitives: irreducible natural entities – which themselves can't be explained, but must be accepted as simply existing in and by themselves – on the basis of which to construct explanations for the rest of nature. Today, for instance, String Theory and M-Theory postulate imagined, abstract, undetectable 'superstrings' as the fundamental, irreducible building blocks of nature, on the basis of which every-

thing else is supposedly explainable in principle (Greene 2003). Materialism attempts to reduce conscious experience to physical entities like those. As such, it assumes consciousness to be derivative, not fundamental.

However, recent and powerful physical evidence indicates strongly that no physical entity or phenomenon can be explained separately from, or independently of, its subjective apprehension in consciousness (Gröblacher *et al.* 2007). If this is true, the logical consequence is that consciousness cannot be reduced to matter – for it appears that it is needed for matter to exist in the first place – but must itself be fundamental. From a philosophical point of view, this notion is entirely coherent and reasonable, for conscious experience is all we can be certain to exist; entities outside of consciousness being, as far as we can ever know, merely abstractions of mind. Such a notion also circumvents the ‘explanatory gap’ and the ‘hard problem of consciousness,’ since both only arise from the attempt to reduce consciousness to matter. Therefore, in the hypothesis elaborated upon below, conscious experience is itself taken to be an ontological primitive.

Now, if consciousness is primary and irreducible, then the brain cannot be the causal agency of mind; mind must exist *a priori*, ontologically preceding the brain. How can we then explain the empirical observation that, ordinarily, mind states correlate tightly to brain states?

The hypothesis here is that the function of the brain is to *localize* consciousness, pinning it to the space-time locus of the physical body. In doing so, the brain *modulates* conscious perception in accordance with the position and perspective of the body in space-time. Indeed, there would be clear survival advantages for the brain to evolve to do just that: by localizing and modulating subjective experience according to the space-time locus of the body, the brain coaxes mind to identify itself with the body and, therefore, contribute actively to the body’s survival. When not subject to this localization and modulation mechanism, mind is unbound: It entails awareness of all there is across space, time, and perhaps beyond. It is difficult to imag-

ine such a state of mind as having a vested interest in the survival of localized and ephemeral aggregations of matter, such as physical bodies. Seen this way, the brain is a surprisingly effective mechanism constructed by evolution to capture, constrain, and put to use an otherwise unbound and irreducible aspect of nature: subjective experience itself. This can be seen as something analogous to how plants evolved to capture an otherwise unbound aspect of nature, sun light, and put it to use for the benefit of their own metabolism and survival.

According to this ‘filter’ hypothesis of mind-brain interaction, no subjective experience is ever created by the brain, but merely *selected* by it according to the position and perspective of the body in space-time, as Bergson so cogently argued (1912) over a hundred years ago. This selection process is akin to a ‘*filtering out*’ of conscious experience: analogous to how an analog radio receiver selects, from among the variety of stations present concurrently in the broadcast signal, that which one wants to listen to; all other stations being filtered out and never reaching the awareness of the listener. As such, all subjective experiences exist *a priori*, irreducibly; the brain merely selects those that are useful for the survival of the physical body. The brain activation patterns that ordinarily correlate to conscious experience reflect the filtering process at work: They are analogous to the circuit oscillations in the radio’s tuner, which correlate tightly to the sounds the radio produces. The presence of such circuit oscillations obviously does not mean that the radio is *generating* the broadcast signal itself, but merely selecting a subset of information from a preexisting signal. Analogously, brain activation patterns do *not* mean that the brain is generating the correlated conscious experience, but merely selecting it from a broader, irreducible superset.

Therefore, the ordinarily observed correlation between brain and mind states is a direct and necessary consequence of this selective filtering out of subjective experience: when the filtering mechanism (i.e. the brain) is interfered with – physically, as in a blow to the head, or chemically, as during anesthesia or alcohol in-

toxication – the filtering process that modulates our conscious experience is perturbed, so that corresponding perturbations of experience follow. Such perturbations are analogous to the confusing and incoherent sounds one hears when messing randomly with the analog radio's tuning knob. In conclusion, the hypothesis offered here remains consistent with all observed correlations between subjective experience and measurable brain states.

One last point must be made. For there to be a survival advantage in capturing an otherwise unbound consciousness within the space-time confines determined by the brain, consciousness must have materially-irreducible causal efficacy on brain function. In other words, there must be downward causation from consciousness towards brain structure and/or activity, otherwise consciousness would be merely a useless 'spectator' providing no survival advantage. As it turns out, there is indeed significant empirical evidence that downward causation does occur. Experiments have been performed in which subjects could physically alter their own neuronal wiring – thereby reversing previously diagnosed brain pathologies – simply by directing their conscious intent (Schwartz and Begley 2004). This surprising effect is known as 'self-directed neuroplasticity,' and it suggests that conscious intent is not only ontologically independent from, but can also causally affect, brain activity and structure, thereby potentially tilting the survival fitness of an organism.

The Predictions

An alternative hypothesis for addressing the mind-body problem is only useful insofar as it makes predictions that *differ* from the predictions of the mainstream materialist assumption. Below, I will elaborate on the two most important points where the 'filter' hypothesis discussed above departs from materialism in its predictions.

Firstly, the 'filter' hypothesis implies that consciousness, in its unfiltered state, is unbound. As such, consciousness is fundamentally unitary and non-individualized. The emergence of multiple, separate, and different conscious

perspectives, or egos, is a consequence of the filtering process: different egos, occupying different points in the fabric of space-time, retain awareness of different subsets of a universal superset of all potential subjective experiences; the rest being filtered out. It is the differences across subsets that give each ego its idiosyncratic characteristics, personal history, and sense of personal identity.

The part of the universal superset of subjective experiences that is filtered out becomes, then, the unconscious mind of the respective ego. Since each ego retains only an infinitesimally small part of the universal superset – given the unfathomable variety of conscious perspectives that exist in potentiality – the unconscious minds of different egos will differ only minimally; the vast majority of the unconscious being identical across egos. As such, the 'filter' hypothesis, unlike the materialist assumption, predicts the existence of a collective unconscious; a shared repository of potential experiences that far transcends mere genetic predispositions of a species. It is conceivable that, either through natural fluctuations or intentional interference with the filtering mechanisms that modulate our individual experiences, parts of this collective unconscious can occasionally percolate up into conscious awareness.

Secondly, and most importantly, the 'filter' hypothesis predicts that one can conceivably have experiences that do *not* correlate to one's brain states. Since here the brain is seen merely as a mechanism for filtering out experiences, it is conceivable that, when this mechanism is interfered with so as to be (partially and/or temporarily) deactivated, one's subjective experience could delocalize, expand beyond the body in time and space, and perhaps even beyond time and space as such. In other words, the 'filter' hypothesis predicts that transpersonal, non-local experiences can conceivably happen when particular brain processes are (partially and/or temporarily) *deactivated*. This possibility, of course, is excluded by the materialist interpretation.

The key element of this second prediction of the 'filter' hypothesis is that non-local, transper-

sonal experiences are predicted to correlate precisely to certain *reductions* of brain activity. This is counterintuitive from a materialist perspective, since the latter entails that experience *is* (solely caused by) brain activity.

The Evidence

Empirical evidence for the existence of a collective unconscious was, in the modern era, first compiled by Swiss psychiatrist Carl Jung (1991). Based on his professional experience with countless patients, as well as self-experimentation (2009), Jung has found that mental contents from the collective unconscious can percolate up to conscious awareness through dreams, visions, and other non-ordinary states of consciousness. Diligent students of Jung's work have no doubt that his characterization of the collective unconscious far transcends the scope of mere genetic predispositions. The observations of Jung have been confirmed and extended by many other modern psychiatrists and psychologists. Indeed, under the umbrella of the field of Transpersonal Psychology, an enormous body of empirical evidence has been accumulated for the existence of an unconscious segment of the mind that spans across individuals (*Journal of Transpersonal Psychology*). All this evidence is consistent with the 'filter' hypothesis discussed here, and contradicts the predictions of materialism.

Moving now to the second key prediction of the 'filter' hypothesis, there is indeed a broad pattern of empirical evidence associating non-local, transpersonal experiences with procedures that *reduce* brain metabolism:

a) Fainting caused by asphyxiation or other restrictions of blood flow to the brain is known to sometimes induce intense transpersonal experiences and states of non-locality. The highly dangerous 'choking game,' played mainly by teenagers worldwide, is an attempt to induce such experiences through partial strangulation, often at the risk of death (Neal 2008). Erotic asphyxiation is a similar game played in combination with sexual intercourse. The effect has been described as 'a lucid, semi-hallucinogenic state [which,] combined

with orgasm, [is said to be] no less powerful than cocaine' (Shuman 2007:80);

- b) Pilots undergoing G-force induced loss of consciousness (G-LOC) – where blood is forced out of the brain, significantly reducing its metabolism – report experiences similar to the notoriously non-local and transpersonal NDE (Near-Death Experience) (Whinnery and Whinnery 1990);
- c) The technique of Holotropic Breathwork, as well as more traditional Yogic breathing practices, use a form hyperventilation to achieve a similar effect: They increase blood alkalinity levels, thereby constricting blood vessels in the brain and causing hypoxia and dissociation (Rhinewine and Williams 2007). This, in turn, reportedly leads to significant transpersonal, non-local experiences (Taylor 1994). Even straightforward hyperventilation, done informally without specific techniques, can lead to surprisingly intense non-local experiences. For instance, an anonymous male reported the following: 'One of us stood against a tree and breathed deeply for a while and then took a very deep breath. Another pushed down hard on his ribcage or actually just at the place where the ribs end. This rendered the subject immediately unconscious...When I tried it, I didn't think it would work, but then suddenly I was in a meadow which glowed in yellow and red, everything was extremely beautiful and funny. This seemed to last for ages. I must say that I have never felt such bliss ever again' (Retz 2007);
- d) Psychedelic substances have been known to induce highly complex, intense, non-local, transpersonal experiences (Strassman *et al.* 2008). It had always been assumed that they do so by exciting the parts of the brain correlated to such experiences. Yet, a very recent study has shown that psychedelics actually do the opposite. The study reported that 'profound changes in consciousness were observed after [the administration of the psychedelic], but surprisingly, only decreases in cerebral blood flow...were seen.' (Carhart-Harris *et al.* 2012:1) Indeed, the researchers 'observed no increases in cerebral blood flow in any region.' (Carhart-Harris *et al.* 2012:2) Even more striking, they reported that 'the magnitude of this decrease [in brain activity] predicted the intensity of the subjective effects.' (Carhart-Harris *et al.* 2012:1) In other words, the intensity of the experience was

inversely proportional to the activation of the brain, precisely as predicted by the 'filter' hypothesis;

- e) The use of Transcranial Magnetic Stimulation (TMS) can inhibit cortical function in highly localized areas of the brain by extinction of the associated electromagnetic fields. When the neuronal activity in the angular gyrus of a patient with epilepsy was inhibited in this way, Out of Body Experiences (OBEs) were reportedly induced (Blanke 2002);
- f) If the trend above is consistent, we should be able to extrapolate it further: Brain damage, through deactivating certain parts of the brain, should also induce non-local, transpersonal experiences under the right circumstances. And indeed, this has been reported. Two prominent examples are the case of neuroanatomist Dr. Jill Bolte Taylor, who underwent a profound transpersonal experience as a consequence of a stroke (2009), and a systematic study recently carried out in Italy (Urgesi *et al.* 2010). In the Italian study, patients were evaluated before and after brain surgery for the removal of tumors. Statistically significant increases in feelings of self-transcendence were reported after the surgery;
- g) Near-Death Experiences (NDEs) are the ultimate example of non-local, transpersonal experiences associated with not only reduced, but *absent* brain activity. Evidence for the validity of NDEs continues to be collected under scientific protocols, and has been mounting (Kelly, Greyson and Kelly 2009).

The pattern here is not only clear, but striking. The most complex, coherent, intense, non-local, and transpersonal experiences people report are associated precisely with reductions, or even elimination, of brain metabolism. This is consistent with the 'filter' hypothesis discussed here, and contradicts the materialist assumption.

Conclusions

The broad pattern that associates peak transpersonal, non-local experiences with reductions in brain metabolism seems to contradict the tentative, promissory materialist solution to the

mind-body problem. Instead, it substantiates the notion that the brain is a kind of 'filter' of consciousness, which selects from a universal superset of irreducible subjective experiences those which correlate with the space-time locus of the body. It is reasonable to think that there were survival advantages for the brain to evolve this capacity, which the empirical evidence for downward causation further substantiates. This 'filter' hypothesis explains how traditional techniques for the attainment of transpersonal insight work: by reducing the activity of certain brain regions, they (partially and/or temporarily) take the filtering mechanism offline, allowing consciousness to de-clench and expand beyond the space-time locus of the body. From this perspective, physical death is not the end of consciousness, but its liberation.

Bibliography

- Bergson, H. (1912). *Matter and Memory*. London: George Allen & Co.
- Blanke, O. *et al.* (2002). Stimulating illusory own-body perceptions: The part of the brain that can induce out-of-body experiences has been located. *Nature*, No. 419, pp. 269-270.
- Carhart-Harris, R. L. *et al.* (2012). Neural correlates of the psychedelic state as determined by fMRI studies with psilocybin. *Proceedings of the National Academy of Sciences of the United States of America*. [Online]. Available from: www.pnas.org/content/early/2012/01/17/1119598109 [Accessed 6 June 2012].
- Chalmers, D. (2003). "Consciousness and its Place in Nature." In: Stich, S. and Warfield, F. eds. *Blackwell Guide to the Philosophy of Mind*. Malden, MA: Blackwell, pp. 102-142.
- Chalmers, D. (2006). "Strong and Weak Emergence." In: Clayton, P. and Davies, P. eds. *The Re-Emergence of Emergence*. Oxford: Oxford University Press, pp. 244-254.

Paranthropology: Journal of Anthropological Approaches to the Paranormal

- Eagleman, D. (2011). *Incognito: The Secret Lives of the Brain*. London: Canongate.
- Greene, B. (2003). *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. New York, NY: W. W. Norton & Company.
- Gröblacher, S. et al. (2007). "An experimental test of non-local realism." *Nature*, 446, 871-875.
- Gross, C. G. (2002). "Genealogy of the "Grandmother Cell."" *Neuroscientist*, Vol. 8, No. 5, pp. 512-518.
- Hameroff, S. (2006). "Consciousness, neurobiology and quantum mechanics: The case for a connection." In: Tuszynski, J. A. ed. *The Emerging Physics of Consciousness*. Berlin: Springer, pp. 193-241.
- Jung, C. G. (1991). *The Archetypes and the Collective Unconscious*. London: Routledge.
- Jung, C. G. (2009). *The Red Book: Liber Novus*. New York, NY: W. W. Norton & Company.
- Journal of Transpersonal Psychology*. Palo Alto, CA: Association for Transpersonal Psychology.
- Kelly, E. W., Greyson, B. and Kelly, E. D. (2009). "Unusual Experiences Near Death and Related Phenomena." In: Kelly, E. D. et al. *Irreducible Mind: Toward a Psychology for the 21st Century*. Lanham, MD: Rowman & Littlefield, pp. 367-421.
- Koch, C. (2011). "The Neurobiology and Mathematics of Consciousness." [Online video]. In: *Singularity Summit 2011*. Available from: www.youtube.com/watch?v=6i9kE3Ne7as [Accessed 6 June 2012].
- Krebs, H. A. and Weitzman, P. D. J. (1987). *Krebs' citric acid cycle: half a century and still turning*. London: Biochemical Society.
- Levine, J. (1999). "Conceivability, Identity, and the Explanatory Gap." In: Hameroff, S., Kaszniak, A., and Chalmers, D. eds. *Toward a Science of Consciousness III, The Third Tucson Discussions and Debates*. Cambridge, MA: The MIT Press, pp. 3-12.
- Metzinger, T. ed. (2000). *Neural Correlates of Consciousness: Empirical and Conceptual Questions*. Cambridge, MA: The MIT Press.
- Neal, R. M. (2008). The choking game. In: *The Path to Addiction: And Other Troubles We Are Born to Know*. Bloomington, IN: AuthorHouse, pp. 310-315.
- Pascual-Leone, A. et al. eds. (2002). *Handbook of Transcranial Magnetic Stimulation*. London: Hodder Arnold.
- Retz (2007). "Tripping Without Drugs: experience with Hyperventilation" (ID 14651). *Erowid.org*. [Online]. Available from: www.erowid.org/exp/14651 [Accessed 6 June 2012].
- Rhinewine, J. P. and Williams, O. J. (2007). "Holotropic Breathwork: The Potential Role of a Prolonged, Voluntary Hyperventilation Procedure as an Adjunct to Psychotherapy." *The Journal of Alternative and Complementary Medicine*, 13(7), pp. 771-776.
- Schwartz, J. M. and Begley, S. (2004). *Mind and the Brain*. New York, NY: HarperCollins.
- Shuman, G. D. (2007). *Last Breath: A Sherry Moore Novel*. New York, NY: Simon & Schuster.
- Strassman, R. et al. (2008). *Inner Paths to Outer Space*. Rochester, VT: Park Street Press.
- Taylor, J. B. (2009). *My Stroke of Insight*. London: Hodder & Stoughton.
- Taylor, K. (1994). *The Breathwork Experience: Exploration and Healing in Nonordinary States of*

Paranthropology: Journal of Anthropological Approaches to the Paranormal

Consciousness. Santa Cruz, CA: Hanford Mead.

Tononi, G. (2004a). "Consciousness and the brain: theoretical aspects." In: Adelman, G. and Smith, B. eds. *Encyclopedia of Neuroscience, 3rd Edition*. Elsevier.

Tononi, G. (2004b). "An information integration theory of consciousness." [Online]. *BMC Neuroscience*, Vol. 5, No. 42. Available from: www.biomedcentral.com/1471-2202/5/42 [Accessed 6 June 2012].

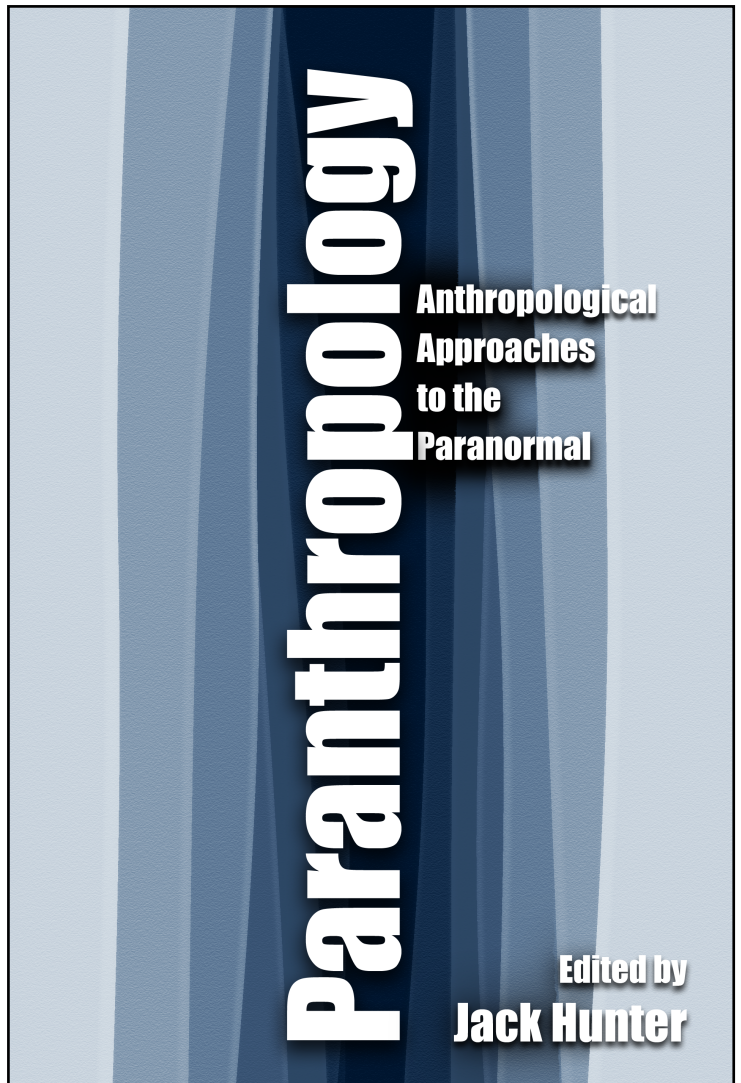
Urgesi, C. et al. (2010). "The Spiritual Brain: Selective Cortical Lesions Modulate Human Self Transcendence." *Neuron*, No. 65, pp. 309-319.

Whinnery, J. and Whinnery, A. (1990). "Acceleration-Induced Loss of Consciousness: A Review of 500 Episodes." *Archives of Neurology*, Vol. 47, No. 7, pp. 764-776.



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