

Subjective Reality: "The Hard Question"

Owen Hughes

Formerly Vice Chancellor of Pacific Adventist University

Paper presented at the "Brainstorm: Recent Developments in Neural Science"

Conference held by the Faculty of Science and Mathematics

Avondale College of Higher Education

May 29 - 30, 2009.

ABSTRACT

The manner in which the 100 billion or so neurons in the human brain work together to give us the rich subjective reality of conscious experience has been referred to as the "hard question". This paper seeks to explore this question: exposing some of its difficult dimensions as well as noting and critiquing various attempts to probe and explain its mysteries. The views of some prominent Christian scholars, such as Donald McKay and Charles Taliaferro, conclude this analysis.

Keywords: consciousness, physicalism, emergence, mind-body

INTRODUCTION

Before I launch into the deep water surrounding my chosen topic, I believe it would be of value for me to explain something of my academic background and why I have an interest in this topic. During the first few years of my working life as a secondary school science teacher I attended Auckland University after school most evenings to study psychology part time. Lectures were usually informative and interesting but for the most part I was uncomfortable with the philosophical orientation of the department and the course. This was the early sixties and B F Skinner's brand of behaviouristic psychology was embraced by the Department. I had hoped to explore

the dynamics of human behaviour but instead spent most of my time studying the hooded rat. My very first laboratory experiment involved the operant conditioning of a rat in a Skinner box. I have vivid memories of one occasion when fellow students assisted a reluctant rat on its journey through a T-maze with a meter rule late in the evening in order to clear the lab and let the caretaker shut up for the night.

But why rats? Skinner's brand of psychology operated on the assumption that observed behaviour rather than internal human states provided the only acceptable data for psychology. In adopting a rigorously experimental approach to the discipline and a naturalistic world-view, Skinner, my

Department and the vast majority of psychologists at that time were simply trying to be good scientists. Nobel Laureate Roger Sperry (1987) put it this way: "As a brain researcher, I'd started out simply accepting the strictly objective principles of the behaviourist position. In the 1950's and early 1960's, all respectable neuroscientists thought in these terms. In those days we wouldn't have been caught dead implying that consciousness or subjective experience can affect brain processing". The assumptions of a naturalistic world-view were logically extended to the belief that humans are nothing but matter and that the human mind is a by-product of functioning matter. And if matter is ruled by cause and effect relationships then humans, who are mere matter, must likewise behave in a completely determined way. Inner feelings, motivation, reasoning, rational choices, it was assumed, were the result of operant conditioning, reinforced by factors within the environment.

So there was the dilemma. My Christian heritage and the wider culture had led me to value human thought processes and to be mindful of moral responsibility but my new discipline was teaching me that the human mind was merely a by-product of functioning matter and that thoughts were the *result* of behaviour rather than its *cause*. What then was the locus of the human mind and what was its significance for human behaviour and responsibility?

CONSCIOUSNESS AT THE INTERSECTION OF SCIENCE, PHILOSOPHY AND THEOLOGY

Perhaps the most unforgettable words that come to scientists from the twentieth century are those of Albert Einstein: 'God does not play dice with the universe'. Einstein found himself in profound disagreement with many of his colleagues who held that quantum mechanics was incompatible with the 'deterministic' world of Isaac Newton and those who followed him. While agreeing with his colleagues that it was physically impossible to measure simultaneously the position and momentum of sub-atomic particles, it was his view that the experimental results obtained by his colleagues did not justify abandoning the view that every event has a cause. Einstein suggested that in the counter intuitive world of quantum mechanics the notion of cause and effect should be extended to include the idea that some effects may not be definitively linked to their causes. In every branch of science, we continue to look for cause and effect relationships that can be understood in terms of consistent natural law.

It is not surprising then that the majority of scientists assume that the study of human consciousness and mind can be best pursued by taking on board the metaphysical assumption of causal determinism, that is, that all events including mental events are caused by and hence determined by previous events. Causal determinism then is an

underlying belief about the nature of reality and is therefore a philosophical orientation that guides almost all scientific endeavour. Causal determinism however does not relate comfortably to the study of mind and consciousness for two major reasons.

The first of these relates to the overwhelming sense of freedom to make choices that humans enjoy. Except in the case of mental illness or other mitigating circumstances, humans feel free to make any decision they choose. This perspective is assumed without question in the Universal Declaration of Human Rights, a 1948 United Nations General Assembly proclamation, in which the very first sentence of the preamble talks of the inherent dignity of all members of the human family as the foundation principle supporting their right to freedom. Articles 18, 19, 20 and 23 for example speak of freedom of thought, conscience, religion, opinion, freedom of peaceful assembly and choice of employment. Each of these freedoms appears to fly in the face of causal determinism. It is no wonder that Skinner, the shining light of behaviourism was provoked into writing his best-selling paperback, *Beyond Freedom and Dignity*, in which he argued that entrenched belief in free will and moral autonomy was a hindrance to the use of his proposed scientific approach for building a happier and better organised society.

Causal determinism also has theological implications. Christians believe

that they have fundamental responsibilities to both their neighbours and to their Creator. However, tension arises as to how they can simultaneously believe that they are able to choose to meet their responsibilities to God and their neighbour and at the same time accept that their behaviour is determined at a level over which they ultimately have no influence. It is beyond the scope of this short paper to address the tension between human freedom and causal determinism. Barbour, in his award-winning text, *Religion and Science* (1997 pages 312 and following), outlines how a number of Christian researchers have dealt with this issue.

The second major difficulty in accounting for human consciousness in terms of physical, chemical or electrical causes within the brain is the qualitative gulf between such causal mechanisms and the mental phenomena for which they are supposed to be responsible. There seems to be an unbridgeable chasm between the physics of brain circuits and the experience of subjective reality. It is this unbridgeable chasm that has come to be known in the literature as 'the hard question' (Chalmers, 1995).

A popular but controversial approach to the study of consciousness is that advocated by Julian Jaynes (1976) in which he sidesteps the hard question by defining consciousness much more narrowly than as commonly understood. For Jaynes consciousness is

not synonymous with what occurs, for example, during the human experience of learning, thinking, or reasoning as each of these processes may occur at times without conscious attention. For Jaynes, consciousness is created through the metaphorical use of language thus allowing for the spatialisation of time and the visualization of past and future events.

Jaynes' account of the origin of consciousness has failed to attract a wide following among the academic community.

ORIGIN OF THE TERM – 'THE HARD QUESTION'

Many ideas for scientific research originate in a unique and improbable way and the story of the study of consciousness as distinct from cognitive science is no exception. Stuart Hameroff, a collaborator with Roger Penrose in consciousness theory, tells the story in the following words:

It was there in Tucson 1 - the first Tucson conference - in 1994. It was the first ever international interdisciplinary conference on consciousness and we had it all planned out. The first day was philosophy, the second day was neuroscience, the third day was cognitive science, and so on.

On the first day a very well known, famous philosopher spoke first and he gave a very boring talk, the second speaker was kind of dull, and so I was getting worried – like

the playwright's opening night, you know - that this was gonna flop. Then the third speaker was an unknown young philosopher named David Chalmers, who got up there with hair down to his waist, in a T-shirt and jeans, and gave the best talk I'd ever heard on the topic of consciousness. He talked about the easy problems of consciousness (which include reporting, perception, and things like that) and then the hard problem of conscious experience, which is 'what it's like to be' ... or raw sensations.

After, there was a coffee break and I went out among the people, as one of the organizers of the conference, listening in like a playwright on opening night. And people were just buzzing about Dave's talk and the 'hard problem', as he called it. I think that moment really galvanized an international movement in consciousness, because the problem was identified. From then on we knew what distinguished this field from cognitive science and other fields that deal with how the brain works. They (i.e. cognitive science, neuroscience etc.) don't attempt to grasp the difficult problem of consciousness itself" (Susan Blackmore 2005, pp.115–116).

So what is the 'hard question' (Chalmers 1995)? It is simply this; how do

100 billion neurons in the human brain somehow work together to give us the richness of experience of conscious mind? Douglas Hofstadter directs our attention to this question by asking a series of currently unanswerable questions:

What is the nature of human thought in general? Is what goes on inside our heads just a deterministic physical process? If so, are we, no matter how idiosyncratic and sparkly, nothing but slaves to rigid laws governing the invisible particles out of which our brains are built? Could creativity ever emerge from a set of rigid rules governing miniscule objects or patterns of numbers? Could a rule-governed machine be as creative as a human...? Could a machine make its own decisions? Have its own opinions? Be confused? Know it was confused? Be unsure whether it was confused? Believe it had free will? Believe it didn't have free will? Be conscious? Doubt it was conscious? Have a self, a soul, an "I"? Believe that its fervent belief in its "I" was only an illusion, but an unavoidable illusion? (Hofstadter 2007, p.110).

Our experience of the world around us is so compelling that few of us pause to reflect on how this sense of reality is achieved. Sense receptors located in the eye, ear, mouth, nose and throughout our bodies respond to

various physical forces and chemical substances in our environment and convert these external stimuli into neural impulses of varying rates of firing and intensity. The brain processes these data and then converts the 'booming buzzing confusion' of our eternally dark, silent and odourless world into the brilliant world that we all experience. We should pause to remember here that each person's unique past experience stored as memory within the brain modifies incoming sensory data so that each person's view of the world is in some respects unique. While the scientific community has developed a range of objective measures to describe the physical energies that surround us, getting a handle on the subjective reality of first- person experience is proving to be much more difficult.

The hard question then concerns the relationship that exists between the objective reality of the world around us and the subjective reality of human experience. The study of this aspect of consciousness lies on the fringes of science because of necessity its data involve a first-person perspective, in contrast to the public third-person data of traditional science.

We should not underestimate, however, the tremendous advances in the understanding of consciousness since the time of Skinner. Serious attempts have been made over recent years to bring the study of consciousness firmly into the scientific fold as evidenced,

for example, by the fact that annual conferences of the Association for the Scientific Study of Consciousness have been conducted since 1997. The domain of human consciousness also continues to be also of vital concern within the disciplines of philosophy and theology.

VARIOUS APPROACHES TO CONSCIOUSNESS

Scientists in general assume a materialist point of view in which they implicitly assume that only that which is physical and thus measurable is real. The subjective realm of the mind and its accompanying mental processes are directly associated with their accompanying biological states and processes. With some notable exceptions scientists spend their energies endeavouring to unravel the physical processes of the brain and leave the philosophers and theologians to argue about the more subjective elements of consciousness. Some of the better known philosophical positions which are defended in the current literature are summarised below. The positions presented are not intended to provide an exhaustive survey of the details of each theory but rather to illustrate something of the range of positions held and the difficulty of achieving consensus.

1. Classical Dualism – Consciousness a Non-material Entity

Dualists have a view of the nature of reality in which mind and matter are of

different essence and in which mental phenomena are in some respects non-physical. This view of reality can be traced from Hindu philosophy (c.650 BCE), the Greek philosophers Plato and Aristotle and church scholars including Augustine. Perhaps the best known version of dualism comes to us from Rene Descartes (1596 – 1650) who clearly identified the mind with consciousness and self-awareness and distinguished this from the brain.

Descartes was a scholar of giant intellect who made substantial contributions not only to philosophy but also to physics, mathematics, astronomy and physiology. He also held a degree in law. His major failing is said to be his habit of reading, writing and thinking in bed until noon. Cutting through time honoured philosophical approaches to thinking about nature he is honoured as the first modern thinker to provide a philosophical framework for the natural sciences as they began to develop. As a devoted Catholic believer it was natural for him to think in terms of body and soul. For him the brain-and-body functioned like a steerable machine following the laws of physics, with the soul acting as pilot. On the other hand the mind (or soul), as a non-material entity, was not subject to the laws of physics. There was reciprocal action between mind and body at the pineal gland. He was thus the first to clarify what has later come to be called the mind-body problem – that is, the way in which a nonmaterial mind could possibly influ-

ence a material body.

Dualist views are not commonly held today and indeed have not been widely accepted for some time. One notable exception, however, was Sir John Eccles. There is no question that until his death in 1997 he was regarded as one of the world's most eminent electrophysiologists. He was professor of physiology at the Australian National University from 1952 – 1966 and was jointly awarded the Nobel Prize in Medicine or Physiology for his research on the biophysical properties of synaptic transmission. Eccles' perspective is nicely summarised by Gliedman, in his article, "Scientists in search of the Soul":

. . . Eccles strongly defends the ancient religious belief that human beings consist of a mysterious compound of physical and intangible spirit... Our nonmaterial self controls the "liaison brain" the way a driver steers a car or a programmer directs a computer. Man's ghostly spiritual presence, says Eccles, exerts just the whisper of a physical influence on the computer-like brain, enough to encourage some neurons to fire and others to remain silent. Boldly advancing what for most scientists is the greatest heresy of all, Eccles also asserts that our nonmaterial self survives the death of the physical brain (Gliedman 1982, p.105).

2. Panpsychism - Consciousness is a Property of All Matter

Those who adopt panpsychism as a philosophical orientation hold that consciousness exists, everywhere, at all times and in every material thing. According to this view, "... there is a proto-consciousness in all matter, even in elementary particles. According to panpsychism, the evolutionary development of the brain is associated merely with an amplification and refinement of what was already there as a property of all matter. It merely is exhibited more effectively in the complex organizations of the brains of higher animals" (Eccles & Robinson 1984, p.14).

Panpsychism finds a home in the philosopher's realm of metaphysics but does not find any place in the scientist's domain of physics.

3. Epiphenomenalism - Consciousness Irrelevant

According to this view the mind is a passive reflection, a trivial by-product, a mere side effect of brain activity. The whistle of a steam locomotive, the chime of a clock or the babbling of water do not affect the progress of the train, the time of day or the flow of the brook; rather they are passive reflections of their activity. Just so, it is asserted, conscious mental events are a passive reflection of physical changes within the nervous system but these same mental events are incapable of causing any physical changes.

Even if the notion that mental events are merely epiphenomena were true, it leaves unexplained what most needs explaining: Why should particular physical changes in our nervous systems cause feelings and thoughts? Even epiphenomena need to be accounted for.

4. Radical Materialism - Consciousness Does Not Exist

There is a small but vocal group of philosophers that parade under the title of 'the radical materialists'. Perhaps the most influential philosopher of science holding this position is Daniel Dennett who wrote in his 1991 volume, *Consciousness Explained*, "In short, the mind is the brain. According to the materialists, we can (in principle) account for every mental phenomenon using the same physical principles, laws and raw materials that suffice to explain radioactivity, continental drift, photosynthesis, reproduction, nutrition and growth. It is one of the main burdens of this book to explain consciousness without ever giving in to the siren song of dualism . . ." (Dennett 1991, p.33).

From this perspective, "there is a denial or repudiation of the existence of mental events. They are simply illusory." (Eccles 1992, pp.17–18). While many reviewers interpret Dennett as denying that consciousness exists at all (for example Trefil 1997, pp.182–184) Andrew Brown (1999, pp.153–154) gives a more charitable account: "The heart of Dennett's position seems to be

that consciousness itself is a misleading category, and that the only way to make sense of it is to redefine all one's terms in terms of externally visible states and behaviours".

While remaining true to science's doctrine of seeking explanations only within the natural world, radical materialists are forced into the uncomfortable position of having to deny the overwhelming importance of their own experience of subjective reality, as well as insisting that ultimately human responsibility, a basic assumption of the world's legal systems and Christianity's most fundamental assumption, is an illusion.

5. Physicalism - allows for conscious experience

Physicalism as a philosophical orientation has grown out of the materialist position and in keeping with its origins asserts that everything that exists is no more extensive than its physical properties. The term physicalism however, has come to be preferred over materialism by scientists of more recent times because it incorporates such non-material concepts for example as wave/particle relationships and the non-material forces produced by particles. It is also favoured by some Christian scholars because it avoids the atheistic connotations of materialism. The earliest versions of physicalism were reductionist and in many respects mirrored the views of the radical materialists, which reduce mental states and processes to physical

states and processes.

Almost the entire scientific community has adopted a physicalist orientation. Its value can be appreciated by observing the exponential advances in our understanding across all of the major disciplines. The physicalist approach is decidedly weak however when it comes to the explanation of qualia - the experiences of subjective reality. The hard question for physicalists is how to account for subjective experiences in an otherwise entirely physical world, such as perceiving the redness of an apple, appreciating the sounds of a symphony, or experiencing the pain of a bee sting.

6. Emergent Materialism – Consciousness, a Higher Order Feature of the Brain

Emergent materialism as a perspective on consciousness crystallised late in the twentieth century. Emergence is a property of a system that occurs when that system exhibits properties that are greater than the sum of its parts. According to Roger Sperry emergence occurs when two or more entities, (sub-atomic particles, atoms or molecules) create a new entity (consciousness) with new laws and properties that were formerly non-existent. Even though consciousness is generated by neural activity and is fully dependent upon such activity it is none-the-less quite separate from it. Conscious mental states are thus created by complex information processing within the brain and out of

that complexity, a new property, consciousness, emerges at a higher level.

There are divided opinions within this community about whether individuals can ultimately be held responsible for their actions. Some, such as philosopher John Searle, hold emergentist views that leave no room for moral action. For him conscious thoughts, like the rest of nature, are determined at the basic micro-level of physics (Reichenbach & Anderson 1984, p.93).

On the other hand in Nobel laureate Roger Sperry's brand of emergent materialism, consciousness and other mental phenomena are products of the dynamic living brain in action. Once these emergent mental properties appear, they have *causal control potency* over the 'lower' activities of the brain at the sub-nuclear, nuclear and molecular levels. For Sperry, mind emerges from brain, then takes charge as chief or director in the complex chain of command within the brain (see Voneida 1998). In Sperry's view, there is no need to appeal to any source outside the living brain in order to explain the origin and existence of mental phenomena (see Cousins 1985, pp.66–67). This position accommodates the capacity for inner purpose and moral action as well as the multitude of other complex thoughts and behaviours that make us uniquely human.

Roger Sperry's perspective is attractive to those who do not accept the traditional dualist perspective but wish to

retain a belief in moral responsibility and purposive behaviour. The major weakness of this position, like that of other positions discussed earlier, is that it merely reflects the bias of the proponent. Eccles puts the situation this way: "... (N)owhere in the laws of physics or in the laws of the derivative sciences, chemistry and biology, is there any reference to consciousness or mind ... its emergence is not reconcilable with the natural laws as at present understood" (Eccles 1992, pp,19–20).

The approaches to the study of consciousness outlined above represent some of the more important models that can be selected from more than three hundred scattered throughout the literature. While not exhaustive in either scope or treatment, the approaches covered give some idea of the varying orientations toward the mind-body problem.

VIEWS OF CHRISTIAN SCHOLARS

There have been some worthwhile contributions to an understanding of the mind brain problem that come to us from Christian scholars who do not hold to the dualistic body-soul dichotomy. I will conclude this paper by briefly discussing the contribution of two such Christian writers. The first contribution comes from Donald MacKay who at the time of writing (1984) held the post of Professor of Communication and Neurosciences, University of Keele, England. It was

his view that while "(n)obody can rule out on scientific grounds the idea that some events in the human brain may violate the physical principles that apply in other parts of the natural world ... it would be both unnecessary and dangerously misleading for Christians to try to defend any such theory in the interests of the doctrine of man" (MacKay 1984, p.43). It is his view that scientists have not only the privilege but also the duty to apply their mind to an understanding of the brain as part of the natural world as an expression of reverence for its Creator and as part of the scientific enterprise that accomplishes so much that is positive in human society.

MacKay believes that humans can be both free and exercise moral responsibility while at the same time having a body, including the brain, that is subject to the laws that govern the rest of nature. He argues that just as a computer operates at more than one level, so also does the human brain. This approach appears to place him close to the emergent materialist camp.

When a mathematician describes his computer as 'solving an equation', he means that the behaviour of the machine is determined (note the term) by the particular equation. This does not imply that there are 'gaps' in the physical chain-mesh of cause-and-effect linking its components, through which some invisible entity called an 'equation' exerts quasi-physical

influences on the transistors. Indeed the electronic engineer in charge of the machine will insist that every physical event in it is determined (note: the same word) by other physical events in its depths. Far from contradicting this, the mathematician will insist that he relies on its being true as the basis for his own claim, that the behaviour of the machine as a whole was determined by the equation! He will insist equally strongly that computer hardware and mathematical equations are distinct concepts, in quite different categories . . . A computing machine is simply one example of a situation that needs explanations at more than one level in order to do it justice. Each level may specify in its own concepts what determines the behaviour at that level without necessarily conflicting with the claims of the other. No matter how complete the electronic engineer's explanation, the mathematician's is necessary, and not merely an optional extra, if we are not to miss the whole point of what a computer is and does. The equation determines what the network of transistors do, not by prodding them with quasi-physical 'forces', but by being embedded in it.

The point of this illustration is not of course to argue that computers have minds, still less that men (sic) are 'nothing but' computers.

Its purpose is only to suggest an alternative way of doing justice to biblical data and to common experience, by regarding 'body', 'mind' and 'spirit' as entities recognizable at three different levels of significance of our mysterious and complex human nature, rather than three different kinds of 'stuff' that have somehow to exert forces on one another. According to this view, which I like to call 'comprehensive realism', mental activity determines brain activity by being embedded in it. Spiritual life similarly shapes mental life by being embedded in it. . . . (T)his way of thinking about man, as a unity with at least three levels of significance, is if anything more harmonious with biblical emphasis than the Cartesian . . . model (MacKay 1984, pp. 46–47).

The second contribution of a Christian perspective is that of Charles Taliaferro, at the time of writing, Professor of Philosophy at St Olaf College, Minnesota. He notes that:

Christians have differed in their account of when there is a soul or ensoulment (for consciousness). Some hold that God creates each person or soul directly, others (such as myself) hold that the emergence of consciousness is the outcome of God's comprehensive creative will. That is, I hold that when you came into being, this was indeed a divine creation, but

rather than being a special divine act (like a miracle) it is God's comprehensive will that when there is a level of physical complexity and coherence, then there emerges consciousness (Taliaferro 2005, p.193).

In answer to the question raised earlier in his discussion, "What if future science were able to produce consciousness from non-conscious causes?", Charles Taliaferro replies, "If God has made the cosmos such that consciousness emerges when certain physical conditions obtain, then presumably this emergence would take place if or when scientists re-create the very same physical conditions" (Taliaferro 2005, p.194).

CONCLUSION

No clear progress has been made toward solving the mysteries of 'the hard question'. Just how our brains construct the world as we perceive it and how we as individuals are able to direct the mental operations associated with the complexities of living, remains a mystery. To suggest that our experience of subjective reality and other complex mental constructs emerge at higher levels of brain functioning holds some promise of a useful way forward. The major difficulty with this approach, however, is that its central thesis is untested and may in fact be untestable.

While Christians may do their science within a physicalist framework they do not live their whole lives within that

worldview. Attributes such as rational thought, creativity and moral choice suggest that humans possess capacities that transcend that which is merely physical. Belief in a freely acting, intelligent Creator makes it simpler for them to accept that they share in a limited way some of the non-physical attributes they ascribe to their Creator.

QUESTIONS

1. How would you define consciousness?
2. What relationship do you see between the "soul" and consciousness?
3. How would you answer Dennett's assertion that the mind equates with the brain?
4. Have you ever wondered what actually happens between a thought being generated and a muscle moving, thus producing some physical consequence? How do our thoughts become reality, or influence reality?
5. How do you react to Sperry's concept of emergent mental properties, such as consciousness, having "causal control potency" over the lower activities of the brain?

REFERENCES

- Blackmore, S. (2005). *Conversations on Consciousness*. New York: Oxford University Press.
- Brown, A. (1999). *The Darwin Wars*. London: Simon and Schuster.

- Barbour, I.G. (1997). *Religion and Science*. New York: Harper and Collins.
- Chalmers, D.J. (1995). Facing up to the problem of consciousness. *Journal of Consciousness Studies*. 2(3), 200-219.
- Cousins, N. (1985). Commentary. In *Nobel Prize Conversations*. Dallas TX: Saybrook.
- Eccles, J.C. (1992). *The Human Psyche*. London: Routledge.
- Eccles, J.C. and Robinson, D.N. (1984). *The Wonder of being Human: Our Brain and Our Mind*. New York: The Free Press.
- Gliedman, J. (1982). "Scientists in search of the soul," *Science Digest*, July. 90(7), 77-79, 105.
- Glynn, I. (1999). *An Anatomy of Thought: The Origin and Machinery of the Mind*. New York: Oxford University Press.
- Hofstadter, D. (2007). *I Am a Strange Loop*. New York: Basic Books.
- Jaynes, J. (1976). *The Origin of Consciousness in the Breakdown of the Bicameral Mind*. Boston: Houghton Mifflin.
- MacKay, D.M. (1984). Brain science and human responsibility. In *Behavioural Sciences: a Christian Perspective*. Leicester: Inter-Varsity Press.
- Reichenbach, B. and Anderson V.E. (1995). *On Behalf of God*. Grand Rapids, MI: Eerdmans.
- Sperry, R. (Dec, 1987/Jan, 1988). New mindset on consciousness. *Sunrise*.
- Trefil, J. (1997). *101 Things You Don't Know About Science and No One Else Does Either*. New York: John Wiley.
- Voneida, T.J. (1998). Sperry's concept of mind as an emergent property of brain function and its implication for the future of humankind. *Neuropsychologica* 36(10), 1077-1082.
- Taliaferro, C. (2005). 'Where Do Thoughts Come From?' in Westcott, M. and Ashton, J.F. (eds), *The Big Argument*. Sydney: Strand publishing.