

## Editorial - Commentary

CITATION: Dulany DE. What Explains Consciousness? Or...What Consciousness Explains? Mens Sana Monogr 2014;12:11-34.

# What Explains Consciousness? Or...What Consciousness Explains?

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### ABSTRACT

*In this invited commentary I focus on the topic addressed in three papers: De Sousa's (2013<sup>[16,17]</sup>) *Toward an Integrative Theory of Consciousness*, a monograph with Parts 1 & 2, as well as commentaries by Pereira (2013a<sup>[59]</sup>) and Hirstein (2013<sup>[42]</sup>). All three are impressively scholarly and can stand – and shout – on their own. But theory of consciousness? My aim is to slice that topic into the two fundamentally different kinds of theories of consciousness, say what appears to be an ideology, out of behaviourism into cognitivism, now also influencing the quest for an “explanation of consciousness” in cognitive neuroscience. I will then say what can be expected given what we know of the complexity of brain structure, the richness of a conscious “vocabulary”, and current technological limits of brain imaging. This will then turn to the strategy for examining “what consciousness explains” – metatheory, theories, mappings, and a methodology of competitive support, a methodology especially important where there are competing commitments. There are also increasingly common identifications of methodological bias in, along with failures to replicate, studies reporting unconscious controls in decision, social priming – as there have been in perception, learning, problem solving, etc. The literature critique has provided evidence taken as reducing, and in some cases eliminating, a role for conscious controls – a position consistent*

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Received 2 July 2013. Revised 3, 31 July, 30 Aug, 10, 18 Sept 2013, 18 Oct 2013. Accepted 30 Jan 2014. Further modified 8 Feb 2014. Final acceptance 10 Feb 2014.

Access this article online	
<b>Quick Response Code:</b> 	<b>Website:</b> <a href="http://www.msmonographs.org">www.msmonographs.org</a>
	<b>DOI:</b> 10.4103/0973-1229.130283

*with that ideology out of behaviourism into cognitivism. It is an ideological position that fails to recognize the fundamental distinction between theoretical and metaphysical assertions.*

**Key Words:** *Brain imaging; Causal learning; Consciousness; Ideological influence; Mentalistic metatheory; Volitional control*

**Peer reviewer for this paper:** Alfredo Periera Jr.

## **Introduction: What is Consciousness to be Explained?**

Announcing a “definition of consciousness”, De Sousa (Part 1, 1.1<sup>[16]</sup>) provides lists of phenomena we all recognize as conscious – the waking state, the contents of momentary experiences, and then the propositional experiences of hope and belief in conscious thinking. And then of course there is the sensory experience in the sensory modalities, even the interoceptive and tactile as well as the exteroceptive. This does list much of “what is to be explained.”

In a preceding issue, Singh & Singh (2011<sup>[71]</sup>), following their International Seminar on Mind, Brain, and Consciousness, lay out an overlapping but somewhat broader conception of consciousness, referred to as the Consciousness Tetrad:

1. Default consciousness: The state that separates the living from the non-living.
2. Aware consciousness: Ranging from wakefulness, through drowsiness, to sleep – and also altered states from delirium to the comatose.
3. Operational consciousness: Sensory, motor, cognitive, emotive, aesthetic, creative, etc.
4. Exalted consciousness: A form of awareness, characterised by some, and by metaphysicians, as spiritual or a contact with a divine entity. For the authors, “Consciousness is a tetrad of brain functions (CT)” (p. 25).

## **An Ideological Context**

Although I have elaborated this history and ideology in greater detail (e.g. Dulany, 1991<sup>[25]</sup>, 1997<sup>[26]</sup>, 2003<sup>[27]</sup>, 2008<sup>[29]</sup>, 2009<sup>[30]</sup>, 2011<sup>[31]</sup>, 2012<sup>[32]</sup>), the message over decades has been clear and strong: When John B. Watson (1924<sup>[76]</sup>) rejected the study of consciousness and launched the behaviourist revolution, the message was unequivocal: “Behaviourism claims that ‘consciousness’ is neither a definite nor a usable concept; that it is merely a word for the ‘soul’ of religion of more ancient times. The old psychology is thus dominated by a kind of subtle religious philosophy” (p. 3). From Watson onwards, there was to be no place in science for a consciousness that is (a) ontologically nonmaterial, and (b) granted a *free*

*will* in the sense of *indeterminism* — just what would be needed for choices that could bring it *immortality*.

When Watson rejected consciousness as the *soul* of religion, psychology became the science of behaviour, with a focus on animals unable to report anything troubling for the guiding ideology. Then with the cognitive revolution and the computational view of mind, cognition was said to run in the brain the way software runs in the hardware of a computer. And consciousness? That was only a non-causal emergent (Haugland, 1978<sup>[41]</sup>), useless enough for philosophy's *eliminativists* (e.g. Churchland, 1993<sup>[12]</sup>) to consign consciousness to *folk psychology*. Then, on the information processing view, consciousness was identified with attention, a small enough part of a working memory system to diminish the working significance of consciousness and leave complex symbolic activity to a "cognitive unconscious" (Kihlstrom, 1987<sup>[47]</sup>). With the relative insignificance of consciousness, the ideological aim of behaviourism endured in cognitivism.

Now we can see that something echoing the metaphysical fear in behaviourism and cognitivism has spilled over into cognitive neuroscience. We have had, for example, Pinker's (2007<sup>[62]</sup>) "The Mystery of Consciousness", with two to five paragraphs each by McGinn, Gazzaniga, Baars, Damasio, and Dennett — presented also for the public at large in *Time: Special Mind & Body Issue*. The article leads with what Francis Crick (1996<sup>[14]</sup>) called his "Astonishing Hypothesis," what he believed to be the answer to any "Scientific Search for the Soul": Conscious states "consist entirely of physiological activity in tissues of the brain", as Pinker would have it (p. 62).

Put in general terms, Seth, Izhevich, Reeke, & Edelman (2008<sup>[67]</sup>) begin with "Any scientific study of consciousness is based on the premise that phenomenal experience is entailed by neuronal activity in the brain" (p. 10799). But how is "entailed" to be interpreted? Some see this as pursuit of what Chalmers' (1995<sup>[11]</sup>) contrastively termed the "Easy" Problem — only relatively "easy", but essentially this: Questions about consciousness subject to empirical investigation with manipulation and assessment and explainable theoretically by computational or neural mechanisms. This can be instructions and phenomenal reports and even *neural correlates*. Or should we see this as taking on Chalmers' "Hard" Problem, variously explained and interpreted, but essentially this: How the brain actually *constructs the nature of conscious states: The qualia*, even their *ontology* — a problem that Pinker suggests is so hard that it could really be trying to "sneak the soul back in" (p. 69). The metaphysical fear lives.

## Neural correlates and neuroanatomical models of consciousness

There is a list of the NCC that Koch (2012<sup>[48]</sup>) and others have famously collected, various brain areas and functions associated with forms of conscious experience, and De Sousa usefully lists them: 40 Hz oscillations in the cortex,

intralaminar nuclei of the thalamus, re-entrant loops of the thalamocortical system, neural assemblies bound by NMDA, the inferior temporal cortex, visual cortex connections to the frontal lobe, and visual processing within the visual stream (Part I, 1.6<sup>[16]</sup>). Drawing on much more of the literature, De Sousa (Part 2.1-2.7<sup>[17]</sup>) then presents valuable summaries of what can now be said about the structures and general functions of several neuroanatomical systems, in each case with mention of evidence suggesting their relations to some form of consciousness: Ascending reticular activating system, amygdala, cerebellum, thalamus, parietal-frontal circuits, prefrontal cortex, and the precuneus region of the parietal lobe.

Pereira (2013a<sup>[59]</sup>) would add astrocytes, drawing on Pereira (2012<sup>[58]</sup>) and Fields (2009<sup>[36]</sup>) for descriptions of astroglial networks processing information in parallel with neural networks. And Hirstein (2013<sup>[42]</sup>) sees the importance of fronto-parietal circuits and thalamo-cortical oscillations.

There are examples offered here of conscious coordinates, from emotion states to cognitive control – and there are, of course, many more coordinates of consciousness and neural states and mechanism in this exploding literature. We can think of this as the many elements in Baars' Global Workspace of Consciousness, and there is even more relevant evidence in the extensive review by Baars & Gage (2010<sup>[2]</sup>).

Both Pereira (2013a<sup>[59]</sup>) and Hirstein (2013<sup>[42]</sup>) raise detailed questions about this listing of correlates, and what they see as the need for more detailed specification of the neural basis of each correlate – and also what they see as too many coordinates of the general awareness state. What I believe they most fundamentally have in common with De Sousa and the driving ideology of the domain is as follows: The search for a neural explanation of consciousness. Hirstein (2013<sup>[42]</sup>) opens his Abstract referring to “One of the final obstacles to understanding consciousness in physical terms...” And Pereira (2013b<sup>[60]</sup>) cites his own “Triple-Aspect-Monism”, one aspect for the brain and two for consciousness, as well as Velmans (2009<sup>[74]</sup>) Reflexive-Monism – both monistically neutral in the sense of no commitment to ontologies of either materialism or idealism, but preserving brain-mind unity.

Singh & Singh (2011<sup>[71]</sup>) not only hold that “Mind” – including consciousness – “is the functional correlate of the brain” (p. 19), they view the progression of thought, whether simple or complex, as something that can be represented as a *lattice* of causal relations. In essence, “The initiator of the physical changes in [P<sub>i</sub>] is itself an earlier mental operation [M], which precedes it, which is in the form of a thought, emotion or activity which causes it, which itself is caused due to a physical activity in the brain [P]. That is  $P \rightarrow M \rightarrow P_1 \rightarrow M_1$ ” (p. 27). And the lattice can take various forms, which they illustrate (pp. 28-31).

## Consciousness Explained by Brain Processes?

### Resolving the classic mind-brain problem?

Even if this research had identified a particular neural state, mechanism, or network for every possible conscious state – and clearly it has not, this would not be selective evidence for any of the classical or modern positions on the mind-body (consciousness-brain) problem: Ontology – materialistic or ideational? Monistic or dual? And do conscious states and brain states move in parallel or interact? Or is consciousness only an epiphenomenal emergent?

Many today would say the research is consistent with *Dual-Aspect (Material) Monism*. Or consciousness is a *function* of the brain, or only a non-causal *emergent* of a *material* brain causing that emergence – as on modern computational views. *Monistic idealism*? Founder Wilhelm Wundt even held this view in 1911, a view that conscious states and brain states were both ideational – but without Bishop Berkeley’s slide into solipsism and grasp at a theistic exit (Blumenthal, 1975<sup>[9]</sup>). For some today, it has become a *Dual-Aspect (Idealist) Monism*. And some confront the intrinsic puzzle with *Dual-or-Triple-or-Reflexive-(Neutral) Monism*, holding that the mental is intrinsically inseparable from the brain whatever their ontological status. “Identity theories” vary. However, we could also see the evidence as consistent with *dualism*, perhaps Leibnizean *parallelism* of the material brain and ideational consciousness – the 1914 view of Wundt. Or consciousness could be viewed as an *ideational*, and non-causal, *emergent* of the *material* and causal brain. Some Cartesian *interactionist* could even see two ontologies *interacting*, and not at just one little gland, but at the neuroscientists’ growing number of “pineal analogues” all over the brain.

On these possibilities, neither correlation nor causality establishes ontology.

### Independence of theoretical and metaphysical assertions

We need to keep remembering this:

- a. *Metaphysical assertions*, by their intrinsic nature, are not subjected to empirical evaluation in science as we now know it – although science can in principle advance. For consciousness, ontological assertions are metaphysical assertions in the fundamental and distinguishing sense. Thus, this evidence does not provide an *explanation of consciousness* in the sense of selective support of any of these *metaphysical positions* on the mind-brain question.
- b. *Theoretical assertions* interrelating conscious states, brain states, antecedents, and/or action may, however, imply empirical assertions subject to evaluation with empirical data. On this fundamental distinction, too, theoretical

assertions causally interrelating conscious states and others do not in any way entail metaphysical assertions of a non-material ontology – or free will in the sense of indeterminism.

### Identifying specific conscious states with brain states?

This is the relevant and limiting question to be addressed, and it would be impossible here briefly – as it was even for the De Sousa’s monograph – to provide an extended overview of brain imaging studies. It can be our *working assumption* that conscious states and brain states are coordinated in some way, but I will concentrate on what I see as the limitation of this kind of *explanation of consciousness*. We know about the complexity of brain networks and the limitations of present assessment technology for this kind of explanation. We are all capable of an exploding “vocabulary” of conscious states – not only the modal forms among the senses but beliefs, values, intentions, wishes, expectations, and feelings that can range from annoyance to empathy, taking on all those contents that can be propositional or sub-propositional. The modes can also vary in degree, as in certainty of beliefs or strength of intentions. And they can vary from concrete as a cup on my desk to abstract as conceptions of justice and entropy.

The brain also has billions of neurons – and glial cells – and we could not pick the power to raise this for the number of possible interconnections and networks. As I see it, then, the most fundamental question is this: Is there any current, or even foreseeable, technology capable of reading the activations in these complex and extended networks, networks rich and variable enough for each individual’s “vocabulary” of specific conscious states? That would be the “*explanation of consciousness*” by Neural Correlates of Consciousness.

That question can be raised while acknowledging the large literatures in which various forms of brain imaging – especially fMRI, ERP, MEG, MRI have been revealing for loci and/or timing of various *general* cognitive phenomena.

### fMRI

Can we expect fMRI to identify *specific* conscious states? When Logothetis (2008<sup>[50]</sup>) published his influential paper in *Nature* – a paper on the possibilities and limitations of what had been and continues to be the most common form of brain imaging, approximately 1100 studies a year had been appearing using fMRI.

The neurons in a voxel? There are 20,000 to 30,000 neurons per cubic mm and the average voxel size is about 55 cubic mm (Logothetis, 2008<sup>[50]</sup>, p. 875). Others have come up with even higher counts, and added roughly 4 times as many glial cells. And voxels vary. So when fMRI registers a pattern of BOLD signals

over voxels, in reflection of that area's deoxygenated blood, we take that to be a selectively activated brain area — *but relative activation is not itself a reading of the nature of the brain activity within those voxels in that area.*

### *Classes of conscious states?*

The measure has been useful for identifying an area of activation for a *class* of conscious states — and we can manipulate that class with a class of stimulus values *we* identify. We have, for example, the well-known fMRI evidence associating greater activation around the fusiform gyrus with *facial* recognition (Kanwisher, McDermott, & Chun, 1997<sup>[45]</sup>) and in the parahippocampal area with *place* recognition (Epstein & Kanwisher, 1998<sup>[34]</sup>). For these classes of conscious states, activation is *regional* in the brain — but degree of voxel activation in some region lacks the neural complexity to be *semantically* facial or locational.

### *Specific conscious states?*

“Pattern analysers” have been used to distinguish stimulus inputs, for example, vertical or tilted grating, leftward or rightward motion, or even a blue jay or a sparrow, as in Kamatani & Tong (2005<sup>[46]</sup>). A programme is trained to discriminate linearly combined BOLD inputs for different presented stimuli, with weights determined by a statistical algorithm (incompletely described). Then the trained decoder discriminates those inputs. First of all, *discrimination is not identification*, and this is programmed discrimination of BOLD patterns, *not of the specific neural activity* underlying the specific phenomenal differences.

## **Other brain imaging measures**

We have long known that Evoked Reaction Potential, ERP, can be useful in identifying a particular brain response, the P300, with the general cognitive process of “context updating” (e.g. Donchin & Coles, 1988<sup>[22]</sup>). We now also know that the N400 can be identified with activation of a *meaning*, and there is recent evidence for that differential activation across the hemispheres (Wlotko & Federmeier, 2013<sup>[80]</sup>). Useful and revealing as this measure can be, it is clear that indices such as the maximum activation, positive or negative, within a 500 ms or 600 ms interval could not selectively identify each state within our vast range of specific conscious states.

There are others, such as magnetoencephalography (MEG), not so widely used at this time. MEG is described as providing a measurement of neural electrical activity by registering the resultant magnetic fields, with temporal specificity not provided by fMRI (Baniqued, Low, Fabiani, & Gratton, in press<sup>[4]</sup>). Gratton & Fabiani (2001<sup>[38]</sup>) have also used *event-related optical signals*, EROS, to reveal a change in light scattering in activated neural membrane. We can also recognize that MRI has had exceptional medical value — and has even been used to reveal increases in brain volume with a programme of aerobic exercise (Colcombe *et al.*, 2006<sup>[13]</sup>).



Although these and other brain imaging measures can be, and have been, valuable for learning more about brain activity and its relations to categories of mental activity, I see nothing here that would have the specificity needed for reading the “vocabulary” of *specific* conscious states.

### **An intrinsic challenge for studies with brain imaging**

What I have cited are studies performed under the more defensible and respected conditions. A challenge is that brain imaging data, compared with other data in psychology, are to an unusual degree “constructed.” With fMRI, for example, there are computer programmes, with adjustable parameters, that construct comparative pictures from the measure of BOLD outputs and their patterning over voxels, and over persons and times. The difference between the pictures is somewhat unlike the statistical significance of an *F test* and variance explained in responses or beliefs or evaluations in response to a manipulation with orthogonality of competing variables.

The now famous Vul, Harris, Winkielman, & Pashler (2009<sup>[75]</sup>) surveyed authors of 54 studies with correlations of fMRI and emotion/personality measures that were unreasonably high given known modest reliability of both measures. More than half acknowledged that overall computations were based only on mean values of those voxels that individually showed “acceptable” level of association. I find this analogous to selecting for a conventional statistical test only those subjects whose individual scores are consistent with the investigator’s hypothesis. Poldrack (2008<sup>[63]</sup>, 2009<sup>[64]</sup>) has identified other methodological problems, among them “reverse inference” when a locus of activation is identified with one function despite having been identified with others – a useful inference for advertisers who would use activation in the presence of a product to say that this is what the consumer really, really likes.

The Psychonomics Society journal *Cognitive, Affective, & Behavioral Neuroscience*, I should add, has a Summer 2013 online issue with the introductory article entitled “Improving the Reliability and Validity of Neuroimaging Findings”, Barch & Yarkoni (2013<sup>[5]</sup>). The issue was launched with this statement: “Alongside these advances (in understanding human brain function), there is a growing concern that many common practices within the neuroimaging community may not be conducive to the long-term replicability of reported findings.”

### **Neurohumanities**

Brain imaging has in some way been introduced at several university departments of English, art, music (Quart, 2013<sup>[65]</sup>). At Stanford, for example, students read a little Jane Austen with fMRI recording – as though it might pick out the relevant states of understanding and evaluation in their “conscious



vocabulary". One might even ask which pumps the voxels more – Fitzgerald or Faulkner, Monet or Manet, Mozart or Mahler? Several critics are quoted, among them Jennifer Ashton, University of Illinois, Chicago: "How your brain is firing won't tell you if something is ironic, metaphorical, or meaningful, or if it is not."

Nevertheless, professors in some humanities departments will finally be able to bring in grant money that is received with expressions of gratitude. Announcement of the 2013 European Society for Cognitive Psychology's (ESCP's) Preconference Event, August 28, entitled "Good Data Practices and Replicability," contains Axel Cleereman's Abstract with "...questionable data practices may stem from the progressive and ongoing transformation of academia into a business of sorts."

### General theory of conscious content construction by brain processes

I will sketch what is now the best known *theory* that addresses this question, how the brain constructs consciousness: Information integration theory, of Tononi (2008<sup>[73]</sup>). Put simply, consciousness arises when the neurally generated experience is a selection among the many possible alternatives, thus providing "information" in the classical information theoretic sense, and this comes from the integration of complexity and causality in neural structures. Thus, the theoretical constructs for the thalamo-cortical system consist of capacity to integrate,  $\Phi$  in bits, the complexity dynamics,  $C_N$ , and causal density,  $c_d$ . With theory omitting much of what is distinctive to neural activity, followers attribute consciousness to computers – and some, for example, Searle (2013<sup>[66]</sup>) with criticism, and Koch (2012<sup>[48]</sup>) with endorsement, see the theory as actually implying *panpsychism*.

In addition, the current status of brain imaging does not provide measures of these theoretical neural constructs – as generally agreed, for example, in Seth, Dienes, Cleeremans, Overgaard, & Pessoa, (2008<sup>[68]</sup>). I would add, too, that "information" in Claude Shannon's classical sense is not the same as the *representational* and *propositional* information carried by our conscious states.

### Construction and/or correlation of brain states as technology advances?

Science is in principle open to technological advance. With the neural and astroglial complexity of the brain, the richness and specificity of conscious states, and the methodological problems now recognized, we can see this as an extraordinary challenge: Specific answers to "where" and "when" would need to become augmented with more specific answers to "what" and "how." This challenge is, however, one that can be vigorously pursued, especially with the recently established and US federally funded BRAIN Initiative: Brain Research through Advancing Innovative Neurotechnology.

## The overall implication currently

Nevertheless, in absence of a classical metaphysical explanation, or even a successful explanatory theory of specific conscious states, I believe decades of evidence from brain injury and brain imaging permit us to say with confidence, and without inconsistency, this:

- a. *Brain activity and consciousness are coordinate in some way and to some degree* – a general principle covering a range of more specific possibilities.
- b. Consciousness as a carrier of symbolic representation must have had adaptive significance in our evolutionary history.

I also believe this is not inconsistent with what appears in Singh & Singh's (2011) medically, neurocognitively, and philosophically sophisticated review of the problem: *Mind is the functioning of the brain*.

We can also recognize that brain imaging, with rigorous controls, has been and can continue to be valuable in identifying a neural correlate of *categories of mental activity* – from the waking and altered awareness states to *classes* of conscious states, from sensory modalities to mental episodes such as recollection or even symptoms. Some are cited above. In a 2013 issue of *Perspectives in Psychological Science*, papers in the “Special Section: 20 years of fMRI,” argue the utility with which fMRI imaging has, and can, provide selective support for *mental process* theories. White & Poldrack (2013<sup>[77]</sup>), for example, point to evidence for the graded nature of fMRI images supporting the graded, rather than threshold, theories of recollection. Mather, Cacioppo, & Kanwisher (2013<sup>[51]</sup>), in their summation and conclusion, lay out four types of mental process issues on which fMRI could provide selective evidence for different mental activities. For example, with an interest in two *mechanisms* of voluntary forgetting, direct suppression and thought substitution, Benoit & Anderson (2012<sup>[8]</sup>) report their different loci of fMRI activation.

## Can anything else “explain” consciousness?

*Physics: From quanta to qualia*

De Sousa (Part 2, 4<sup>[17]</sup>) raises the significant question as to what sense and to what degree the mathematics of quantum theory could be applied in an explanation of consciousness. This is a wondrously complex matter, with a substantial literature, but the essence of the view, as in the ORCH model, from Hammeroff & Penrose (1996<sup>[40]</sup>) to Penrose & Hammeroff (2010<sup>[57]</sup>) is this: What is believed to be the best measure of waking consciousness, gamma synchrony with EEG at 30-90 Hz, is not adequately explained by classical physics. Rather than stochastic ion motion, on their view, there is a quantum account of the interaction of ions with surrounding protein. When consciousness arises, quantum computation is initiated in microtubules and spreads with thalamo-cortical synchrony.

But *quanta to qualia*? As I wrote earlier (Dulany, 2008<sup>[29]</sup>), “With the extraordinary gap in levels of explanation, temporal and spatial, between quantum processes and our complex mental activity, with its specific and variable conscious modes, contents, and sense of agency, we can only wonder whether there can ever be a specific quantum account of specific conscious states – something that would ‘bridge that gulf’” (p. 84). This is also essentially the conclusion of Baars & Edelman (2012<sup>[3]</sup>). Another common critique is that the theory is inconsistent with evidence for electric neuronal impulses releasing *neurotransmitters* at the synapses.

But perhaps we could wonder about some kind of *conceptual* “superposition” and “entanglement” when a student in class thinks that Occam’s Razor is a slasher movie!

### Computer science: Programme or machine? Or computational models?

De Sousa (Part 2, 2.2 through 2.7<sup>[17]</sup>) provides a useful scholarly review of efforts within a general field that have been termed variously: Consciousness in artificial intelligence, machine consciousness, synthetic phenomenology, and artificial consciousness. Obviously there is great value in the forms of artificial intelligence in the world today for the chores they are given.

I want to say here what I see as most relevant to the larger central issue raised here and above: An ideologically driven effort to “explain away” consciousness, a concept of consciousness believed to lead some into non-materialism and indeterminism. Suppose a programme functions in the machine the way consciousness is believed to function within the person – a commonality sought in the work of many. There are then two ironically contrasting interpretations that serve that effort: If a *machine* does what persons do with consciousness,

- a. The machine is conscious in the way humans are, and that has generally meant possessing the *phenomenological qualia* we readily introspect. But many argue that possession of phenomenological qualia by machines is too implausible. So,
- b. If we are to maintain the view that machines have our own consciousness, all we need to do is hold that the *phenomenological qualia* we so readily introspect are only an *illusion*. Consciousness, in the sense of phenomenological qualia, would be only physical in the computational sense or non-existent.

With a continuing sense of “*mysterians at the gate*,” Dennett’s (2005<sup>[19]</sup>) *Sweet Dreams* would move us from the first, as in Dennett’s (1991<sup>[18]</sup>) *Consciousness Explained*, to that second dismissive account.

A brief way to express the response to that is this – and it follows from empirical support of the view that *consciousness and brain processes are coordinate in some way and to some degree*:

- a. The programme that is “machine consciousness,” even what can do reprogramming, is *consciously* programmed by a *conscious* human programmer.
- b. What a human consciously experiences is coordinate with electro-chemical transmission within brain tissue, not the transmission of bits of information within silicon chips.
- c. What a human consciously experiences also depends upon electro-chemical input from other systems — for example, the digestive and respiratory systems.
- d. The consciousness of a human reflects a lifetime history of human experiences.
- e. In fact, the consciousness of a human reflects an evolutionary history.

In short, computers are not bred and computer science is not evolution. So simulation is not duplication.

Description of a computer programme or an abstract machine may be a useful *model* of consciousness. Baars & Franklin (2009<sup>[1]</sup>), for example, present LIDA as a *computational* model of consciousness in the Global Workspace Theory of Consciousness — but without any confusion of the model with what the model models.

## What Consciousness Explains?

Consciousness is after all the medium in which we live our lives — and it must have a special explanatory role in what it permits in mentation and action by virtue of the symbolic representations it can carry: With symbolic contents we represent the present in sensory and perceptual experience, the past in beliefs and recollections and senses of familiarity — and a possible future as intended or expected or wished or feared or only imagined. We can even symbolically represent our own past or future mental activity in higher-order awareness. The quality this experience has in our introspective experience is what has been meant by *qualia*.

### An explanatory strategy

Fuller presentation of a specific strategy and illustrative work has appeared in my earlier papers, (Dulany, 1991<sup>[25]</sup>, 1997<sup>[26]</sup>, 2004<sup>[28]</sup>, 2011<sup>[31]</sup>, 2012<sup>[32]</sup>):

- a. *A mentalistic metatheory*,
- b. Implied theories, in some cases refined with quantitative models,
- c. Experimental analyses, and
- d. A methodology of competitive support. This also calls for critiques of methodological biases in competing findings.

### Sketch of the mentalistic metatheory

We may begin with an intuitive conception — as this section did — a conception that can be elaborated and refined as a metatheory implying theories

of particular domains. Consciousness is a set of states. Each state is a *mode* carrying a *content* and the state may be held with a varying sense of *possession* – which can vary with circumstances, and more generally with psychiatric disorders. Contents may be *propositional*, in which case the modes are “believe that, perceive that \_\_\_ etc.” each quantitatively varying. And the propositions may vary in the predicate’s reference – as for example, frequency or value or ought. Or the contents may be sub-propositional, in which case the modes are “sense of, feeling of \_\_\_”, etc., which also vary in degree. And these contents may be attentional *identifications*, or only the *literal* contents of awareness that precede and surround what we attend to at the moment.

Most fundamentally, on this metatheory, conscious states are the *sole carriers of symbolic representations* – providing the *adaptive significance* of consciousness.

Our mental episodes, then, move among those propositional forms by non-conscious *deliberative operations (the explicit)*, and also move among those sub-propositional contents by non-conscious *evocative (associative-activational) operations (the implicit)*. And the episodes may be interrelated and interlaced in various ways described more fully in papers just cited. For example, a proposition in medical school such as “Symptom x implies Disorder y” with repetition can become an evocative episode, “Thought of Symptom x associatively activates thought of Disorder y”. An evocative mental episode can also be represented in higher-order awareness as a proposition. Ideas that simply “pop to mind” – activationally – can be propositionally expressed. In fact, our complex thought moves among our mental episodes in both of those directions.

More that is non-conscious and non-symbolic? The neural networks for memory, and the activation in sensory and motor transduction systems – both of which are involved in the automaticity that is non-symbolic. Despite a loose vernacular, “plans” and “beliefs” when outside consciousness are non-symbolic neural networks that may be established and activated – not something “stored” to be “retrieved”. Emotions and feelings will be conscious but sometimes symbolically representative, but often not. For models, we can sometimes write equations describing those mental episodes.

Although we still lack clear specification of “hierarchical systems” at the neural level – of the kind De Sousa (Part 2, 5.4<sup>[17]</sup>) sees as an objective – with one kind of automatization, actions become hierarchically organized, with conscious control at higher nodes, as described in Dulany (1997<sup>[26]</sup>).

A methodology for competitive support of mentalistic theories and mappings of these theoretical states is most fully described in Dulany (2012<sup>[26]</sup>) – and is needed where there is strong commitment to alternative views. On the *Duhem-Quine* thesis, theory, mappings, and auxiliaries jointly predict data. *Bayesian*

inference describes the rational revision of credibility in the light of data. And richness of the predicted data *network* reduces credibility of competing interpretations.

### Answer to the ideological objection?

In this context, we especially need to keep remembering this:

- a. Assertions of relations among theoretical states, prior conditions, and actions are theoretical assertions subject to empirical evaluation, and in no way entail metaphysical assertions of ontology.
- b. Assertions of volitional (intentional, decisional) control of action in no way entail the metaphysical assertion of "free will" in the sense of indeterminism or service to a metaphysical ontology. Volition has its own causal antecedents, and determinism may be probabilistic.

The belief that these theoretical assertions entail those metaphysical assertions is, I believe, a fundamental intellectual error that has been widely influential in the discipline.

### Evidence of causal control by conscious states

This must be brief – and there is so much out there in which conscious states are causal and explanatory, even in the absence of specific formulation of that kind of theory. In answer to their title, "Do conscious thoughts cause behavior?" Baumeister, Masicampo, & Vohs (2011<sup>[7]</sup>) summarise a range of studies readily interpreted in that manner. I can say the same for a range of studies I accepted in 20 years Editorship of the *American Journal of Psychology*. Morsella (2005<sup>[52]</sup>) also provided evidence from specific studies. What is needed in this range of paradigms is more *systematic theoretical* description of the forms and conscious contents of the mental episodes in mental activity.

### Example of decision and volitional control

De Souza (Part 2.1<sup>[17]</sup>) raises the interesting questions of "Self" and "Morality" – and I would say that both are vernacular terms, with the former varying theoretically and the latter varying socio-culturally. On the mentalistic metatheory, the "Self" at any time, is the collection of possessed propositions with "I", "me" or "my" in the subject or predicate, and occurring in any mode of conscious experience we may have – perceptual, remembering, feeling, anticipating, etc. Even that sense of Self varies over time for the person.

Morality or a sense of what is proper? Whatever the moral rules or expectations socio-culturally, they apply to the Self only if internalised – and that can be represented in a multiple Outcome, multiple Other *theory of propositional control* (Dulany, 1978<sup>[24]</sup>), used in Wilson & Dulany (1983<sup>[79]</sup>). In this study, with

carefully obtained approval, a subject was asked to provide *self-disclosure in a clinical analogue* – where there were four presented topics, such as “what I quarrel about with members of my family” and “guilt feelings about sexual behaviour”.

First of all, self-disclosure may have *outcomes* with *subjective probabilities* and *subjective values* that vary over outcomes. In this research there were six Outcomes, two on each side of three scales, such as “feel more relaxed” and “feel more anxious” – and “understand myself better” or “becomes more confused about myself.” So we might let one control of action be the sum of outcome probability-value products, the *Outcome Component*. In addition for some set of Others (other persons), there is some *degree of belief* as to what each would think we *should do* and some degree of *motivation to comply* with each. The Others were mother, father, spouse or boyfriend or girlfriend, best friend, therapist. So analogously, we might have a second component of control that is the sum of the products of Other expectations and motivations to comply, the *Social Component*. More internalised still for the Self would be a *Personal Component* – only one in an un-split personality, although it can vary over time and experiences.

Outcomes and Others varied over trials. Furthermore, to increase variance in these measures, three groups entered with three different *referral roles*: Self, Other, or Forced (legally). These subjective likelihoods and evaluation were assessed on each trial with phenomenal reports. The three components together strongly predicted conscious states of degree of *wanting to*, *intending to*, and the *acts of self-disclosure in that clinical analogue*. That is a prediction modelled by a linear regression equation, with regression weights that reveal the relative predictability – and degree of causal control of each component.

With the richness of this network of theoretical relations and data, this theoretical explanation has more Bayesian credibility than an alternative that would “explain away” volitional control as illusory. This intentional control has its own causal antecedents, and the theory and data in no way entail free will in the sense of indeterminism.

### Example of causal learning

Revision of conscious belief in a causal hypothesis should be governed by subjective *convincingness of the evidence*, itself the result of subjective beliefs – in contrast with an earlier focusing only on the association of causes and effects. We can think of this as applying to evaluation of evidence as implicating or absolving causal suspects in solving a crime – or evaluation of various tests and possible disorders given a challenging set of symptoms. This convincingness of some particular evidence should reflect the subjective degree to which

- a. That evidence (a clue) is associated with a possible cause (suspect),
- b. Implies a true cause (criminal), and also
- b. Implies the effect (the crime).



Where the theory is modelled, this convincingness of the evidence is provided by products of these transformed values. And this convincingness of the evidence then provides the parameters for a linear difference equation describing revision of belief in the causal hypotheses – in this case, toward guilt or toward innocence.

With phenomenal reports of these subjective belief values, the Theory of Propositional Learning (Dulany, 1978<sup>[24]</sup>) was strongly supported in Carlson & Dulany (1988<sup>[10]</sup>), Dulany & Carlson, (2012<sup>[33]</sup>). In this case, too, revision of belief described with linear difference equations is not credibly explained as a simple cause-effect associative learning. With variation in causal learning tasks, the formal causal models proposed have varied (for example, Griffith & Tennenbaum, 2009<sup>[39]</sup>), but these tasks also call for formation and revision of causal hypotheses on information consciously represented.

### Why consciousness as explanatory is especially needed now

Methodological constraints can relax to accommodate deeply entrenched meta-theoretical commitments, especially if they are ideologically driven. In papers of mine that I have cited here, there have been reviews of the many experimental critiques of the methodological and conceptual biases in claims for unconscious cognition in subliminal perception, implicit learning, problem solving, volition, memory, and decision, as well as in the “Libet lag,” “blind sight,” and prosopagnosia: There are other critical reviews, some well-known and early, for example, Perruchet & Vintner (2002<sup>[61]</sup>) and Shanks & St. John (1994<sup>[69]</sup>).

Recently there has been a detailed and important critical focus on three phenomena:

- A. Unconscious decision-making? According to Dijksterhuis & Arts (2010<sup>[21]</sup>), referring to this paradigm and others in the *Annual Review of Psychology*, “One way to approach this issue is to propose that, in principle, the operation of higher cognitive processes does not care much about the conscious state of the individual” (p. 475). When making a decision for a car or an apartment, in Dijksterhuis & Nordgren (2006<sup>[20]</sup>), “unconscious decision” was identified with a period of choice with distraction, and “conscious decision” with a period of choice and non-distraction, either of which would follow an initial decision. Distraction was reported to produce decisions superior to non-distraction. This quickly launched several multi-experimental critiques, with findings of failure to replicate, or replication when the initial and better decision was revised under experimental demand conditions. Lassiter *et al.* (2009<sup>[49]</sup>), for example, concluded that “Such judgments are ultimately a product of conscious rather than unconscious thought” (p. 361).

In Newell & Shanks (in press<sup>[53]</sup>), there is a detailed and important set of methodological critiques of research purporting to find “unconscious influences on decision-making” in three paradigms usually labelled multiple cue judgement,

deliberation-without-attention, and decision under uncertainty. The authors find a tendency to accept unconscious influences despite inadequate assessment of awareness and various ignored artefacts.

B. Unconscious social priming? There are revealing failures of replication for variants of the paradigm.

1. In one variant, some undergraduate participants were presented sentences consistent with *ageist stereotypes*, and some were not. This ageist stereotype was believed to unconsciously activate walking slowly down a corridor – and without any awareness of a causal relation to the prior information (Bargh, Chen, & Burrows, 1996<sup>[6]</sup>). Doyen, Klein, Pichon, & Cleeremans (2012<sup>[23]</sup>), however, found that participants showed more awareness of the nature of the prime than did controls. Significantly, too, they were also unable to replicate the walking speed effect when, in contrast to the original procedure, walking speed was recorded with the crossing of an automatic light recorder rather than by a member of the research team with a stop watch. Pashler, Coburn, & Harris (2012<sup>[55]</sup>) also failed to replicate social priming effects in analogous tasks. As they put it (p. 1 Abstract), “The results showed no hint of the priming effects reported by Williams & Bargh (2008<sup>[78]</sup>).”
2. In a second variant of the paradigm, Dijksterhuis & Knippenberg (1996<sup>[20]</sup>) obtained statements describing an “intelligent professor” in one group and statements referring to a “less intelligent soccer fan” in the other group. These procedures were believed to prime those stereotypes with an unconscious influence on expressions of “intelligence” on a general knowledge test. With “intelligence priming”, performance was better on the test. It is enough to say here, that with careful development of several procedures, there were nine failures of replication (Shanks, Newell, Lee, Balakrishnan, *et al.*, 2013<sup>[70]</sup>).

Of relevance, too, there has been a focus on replicability at a 2012 Psychonomic symposium, in *Psychonomic Bulletin and Review* (Francis, 2012<sup>[37]</sup>); and others in *APS' Perspectives on Psychological Science*, (Pashler & Wagenmakers, 2012<sup>[56]</sup>; and Spellman, 2013<sup>[72]</sup>); also still another at the August 2013 meeting of ESCOP in Budapest.

In fact, given the kinds of problems (and ideological biases?) in various related literature, a book by Hubert & Wainer (2013<sup>[43]</sup>), senior authored by former president of the Psychometric Society, could be especially helpful.

## Dual systems? or dual mental episodes?

How this distinction is formulated raises fundamental questions for the role of consciousness in theories of mental activity. It is the focus of a set of articles in the May 2013 *Perspectives on Psychological Science*, led by Evans & Stanovich (2013<sup>[35]</sup>)

that is discussed by De Sousa (Part 1, 5.4<sup>[16]</sup>), and is central to theories following from the mentalistic metatheory. Most generally, System 2 (explicit processing) is said to be slow, effortful, deliberative; and System 1, (implicit processing) is said to be fast, automatic, associative, and in the vernacular, “intuitive” (e.g. Kahneman, 2011<sup>[44]</sup>). It is also common, too, to characterise System 2 processing as “conscious,” and System 1 as “unconscious” — as in the many claims for an “intelligent unconscious.” Added to this by de Castro Bellini (2012<sup>[15]</sup>) is the idea that System 1 is especially influenced by the nature of the particular body and the particular environment: It is “embodied” and “embedded.”

The mentalistic alternative to these forms differs on the two aspects where there has been the most controversy in the literature:

1. Some question whether there are two *separate systems*. On the mentalistic metatheory, these are not two different *systems* but two different forms of *mental episodes* that can be interlaced in much of our thinking — the deliberative and the evocative (associative-activational). A scientific idea can be associatively activated by one or more other ideas, or a diagnosis can be associatively activated by one or more symptoms — but in both cases they are usually preceded and followed by deliberative thinking that can activate still more ideas. Commonly, too, an associative-activational mental episode can be represented propositionally in higher-order awareness, and a frequently repeated proposition can become an associative-activational mental episode.
2. On the mentalistic metatheory, too, *consciousness and the nonconscious* do not separate either systems or the mental episodes. Conscious states carry symbolic representation in both forms of mental episodes, for the propositional and sub-propositional, interrelated in one case by nonconscious deliberative operations and in the other case by nonconscious associative-activational operations. Formal theoretical representations of conscious states in implicit processing can be found in Dulany (1991<sup>[25]</sup> to 2012<sup>[32]</sup>), O’Brien & Opie (1999<sup>[54]</sup>), Perruchet & Vinter (2002<sup>[61]</sup>), and other studies.

At this stage, brain imaging can be complementary to a *theory of mental activity*, for example, in identifiable relations to *mental episodes*, and to broader categories of mental activity, from recollection and problem solving to psychiatric symptoms — as suggested in Dulany (2011<sup>[31]</sup>). That is consistent, I believe, with the view expressed by Mather, Cacioppo, & Kanwisher (2013<sup>[51]</sup>) in their positive summary statement devoted to “20 Years of fMRI.” With rigor in both of these complementary programmes, the discipline of psychology can avoid its historically third de-emphasis upon, and even evasion of, a rather central subject matter for the science of the mind — consciousness.

**Concluding remarks: Major points summary [See also Figure 1: Flowchart of paper]**

Theory of consciousness as explanation of consciousness?

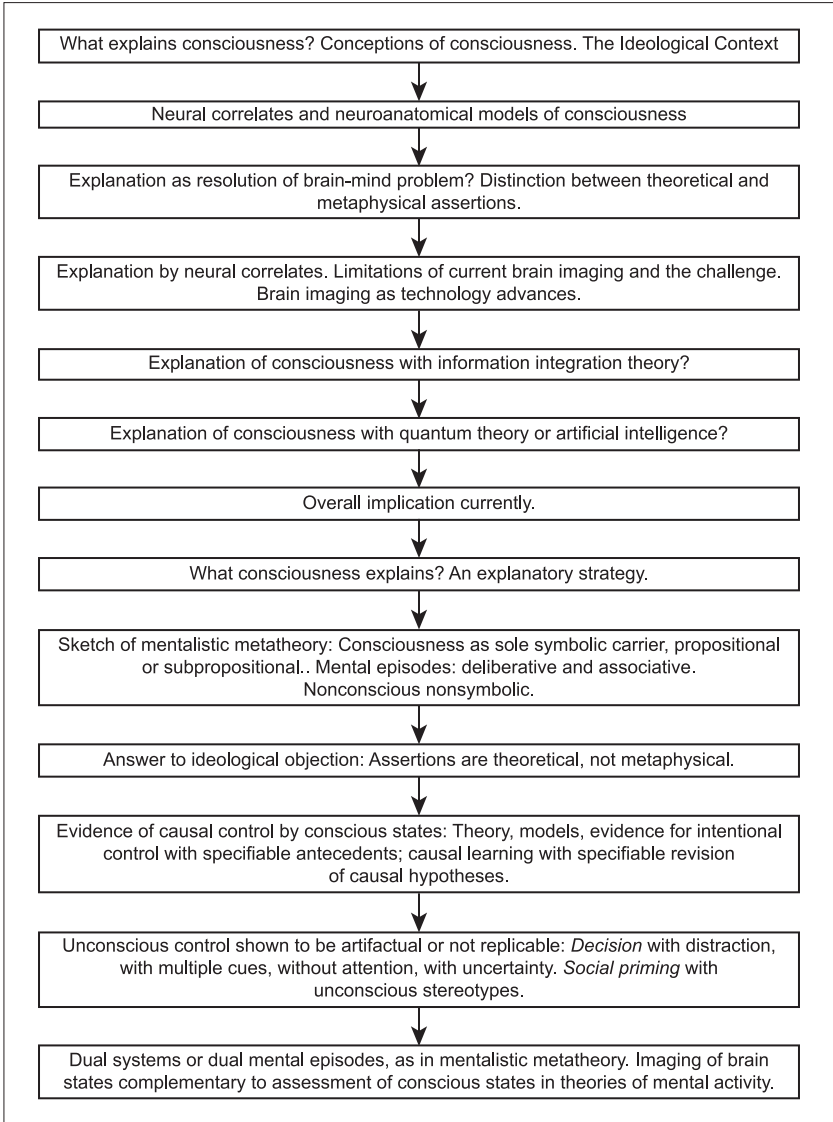


Figure 1: Flowchart of paper

- a. Some have held that a theory of consciousness, in the sense of *explanation of consciousness*, can be provided by a solution of the *classical mind-brain problem* – but this is a metaphysical question beyond the reach of empirical science as we now know it.

- b. Neither can an *explanation of consciousness* be provided by identification of neural correlates of *specific states of consciousness* given the present technology of brain imaging.
- c. Nevertheless, *present technology of brain imaging* does, with observance of methodological refinement, permit the *identification of categories* of mental activity.
- d. The evidence does, however, provide compelling evidence that *brain processes and consciousness are coordinate in some way to some degree*.
- e. Information Integration Theory of consciousness is limited in absence of suitable measures of the constructs, as well as failure of information theory to represent the symbolic information in conscious contents.
- f. The explanatory value of quantum theory is limited by the great difference in level of explanation.
- g. Computerised machines, too, cannot be said to explain consciousness by *simulation*. Simulation is not *duplication*.

Theory of consciousness in the sense of *what consciousness explains* calls for a *metatheory*, methodology of competitive support, and methodological critiques.

- a. Conscious contents have a distinctive role in carrying symbolic representations
- b. Conscious contents may be propositional or sub-propositional in forms of mental contents.
- c. Deliberative and associative-activational forms of mental episodes carry propositional and sub-propositional forms, respectively.
- d. Nonconscious deliberative and associative-activational mental operations interrelate mental contents within the mental episodes.
- e. The neural networks in memory and sensory and motor transduction systems are non-conscious and nonsymbolic – providing bases for automaticity.
- f. Where there is strong commitment to alternative views, acceptable support for mentalistic theories calls for a *methodology of competitive support*.
- g. Examination of what consciousness explains calls for *critiques of methodological bias* in studies purporting to show unconscious symbolic representation in various paradigms of perception, learning, problem solving, decision, and social priming – the latter two a recent focus in the literature.

Work in both areas has been impeded by the common confusion of theoretical assertions of conscious causal control with metaphysical assertions of idealistic or dualistic ontology and free will in the sense of indeterminism. Nevertheless, as we learn more about *what consciousness explains*, we will, paradoxically, be learning more about *what explains consciousness*: Its adaptive significance as the carrier of symbolic representations.

### Take home message

Asked for a “take home message”, I will briefly say this: With science as we know it, there is no “explanation of consciousness” in the sense of determination

of its ontology. With current brain imaging technology, there is no “explanation of consciousness” in the sense of neural correlations of specific conscious states. The field of “what consciousness explains” is open to venturing theories of causal relations among conscious states, actions, and prior stimuli, without entailing any metaphysical assumptions. Given ideological suspicions of a causal consciousness, however, this work calls for a methodology of competitive support — and critiques of methodological biases in reported evidence for varieties of unconscious control.

### Conflict of interest:

None declared.

### Declaration:

This is my original unpublished paper, not submitted for publication elsewhere.

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## Questions This Paper Raises

This paper raised and addressed questions throughout. In addition, I see these four as important:

1. How rapidly and effectively can we expect the technology of brain imaging to advance?
2. In particular, can we expect that advance to provide determination of the neural activity specific to specific conscious states?
3. Can we expect a moderation in the methodological and conceptual biases that seem to be meta-theoretically and ideologically driven?
4. To what extent might we expect investigation of a range of mental activity guided by mentalistic metatheory and derived theories?

### About the Author



*Donelson Dulany received his PhD in psychology from the University of Michigan and is now Professor of Psychology Emeritus at the University of Illinois where his teaching has included graduate courses in consciousness and the non-conscious, as well as in philosophy of science for methodology in psychology. From 1988 into 2009 he was Editor of the American Journal of Psychology. His research has consisted of experimental and theoretical analyses of the roles of consciousness in sources of intentional action, causal reasoning, and explicit and implicit learning. This has led to a meta-theoretical view, termed "mentalism," in which conscious states are the sole carriers of symbolic representation within mental episodes that can be deliberative or associative-activational. In 2010, he delivered a keynote address for the International Seminar on Mind, Brain, and Consciousness, organized by the Editors of this journal. He is a member of Association for Scientific Study of Consciousness and is a Fellow of American Psychological Association, Association for Psychological Science, and Psychonomics Society. He is also on the Honorary International Advisory Board of the Mens Sana Monographs. His listings include Marquis Who's Who in America and Marquis Who's Who in the World.*