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The Myth of Consciousness: The Reality of Brain-Sign

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Abstract

The physical sciences, as generally understood, are disciplines concerned with the characteristics and behavior of physical objects and states. What is evident about the current condition of consciousness is that: 1) It has no identified physical states; 2) There is no generally accepted vocabulary of its functioning, or its participant entities; and 3) No 'normal science' operative structure upon which a community of scientists agree (ref. T. Kuhn). The reasons are that consciousness is a prescientific concept persisting because there is no adequate physicalist theory to replace it, and because biology operates in a way 'invisible' to assumed mental processes and vocabulary. What is required is a plausible theory built on a biophysical base. A theory is being developed: it is termed the *theory of brain-sign*. Brain-sign replaces consciousness as an evolved neural operation in which brains communicate with each other in the collective action of organisms, so addressing the limitations of being an isolated individual. It depends upon neural signification (as brain-sign), in this case of the organisms' immediate *causal orientation* towards the world. Thus, multiple organisms are linked as one biophysical operation. Signs are biologically ubiquitous and inherently physical. Organisms are not subjective agents with transcendent (quasi-divine) powers acting in a perceivable world, but evolved organic objects with the ability to cooperate as one overarching biological process. It is anticipated this theoretical operation and vocabulary will explain brain function, which mind fails to do. It accounts for science from both its neural origins and its communal nature.

Key Words: brain-sign, collective action, consciousness, brain function, interneural communication, science *per se*

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Introduction

While we can assume the physical brain exists and is a generator of our actions, it is generally supposed that consciousness also exists. The problem is that consciousness is a quasi-divine concept: that is, it rises above the status of physical conditions offering knowledge of the self and world. For example, it is supposed the world can be seen, but 'seeing' implies the brain/organism is apprised of what lies before

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it as it really is and, moreover, that seeing has a causal impact on the organism's actions. There is no scientific account of such a state, nor how it could be established. Indeed, who or what is the seer who sees? Then again, pain informs a mental subject about the body's condition. But how could neural material generate pain or the feeling of it?

Science requires an account of the brain phenomenon to be a feasible and necessary physical condition susceptible to experiment. An obvious conclusion is that 'consciousness' names no established biophysical actuality, so no scientific definition of human being and its relation to its inhabited world exists. Even the editors of the journal *Neuroscience of Consciousness*, in their overview for a Special Issue (2021), say: 'There is much uncertainty and divergent opinions about what theories of consciousness in fact set out to explain; several theories are still to articulate clearly their core commitments and testable implications; there is a lack of clarity about the extent to which different theories can eventually be compared.'

This crisis is addressed in a recent paper by Matthias Michel titled: Consciousness Science Underdetermined: A Short History of Endless Debate (2019). His Conclusion states that 'The history of the study of consciousness [gives] the impression that the early science of consciousness was like a game whose rules could be changed at will, and… theories could be preserved 'come what may'. The contemporary science of consciousness does not reach consensus either, which might indicate that…contemporary theories [are]…similarly underdetermined by the evidence. Finally… debates over which detection rules to use could explain why underdetermination has been so persistent in consciousness science.'

There are two primary reasons for the persistent pursual of consciousness. The first is the supposition that consciousness has to exist, else how could anything be known – knowledge being a quasi-divine assumption. Even more intractable, the second reason is that, since consciousness is imprinted on human self-experience and understanding (so-called), it is very difficult to alter brain structures in an individual and thus reorientate their conceptual context of existence. As Heidegger puts it: 'Tradition takes what has come down to us and delivers it over to self-evidence' ((1927) 1962, p. 43).

Thomas Kuhn would likely characterize this crisis as a stage before a change of paradigm. Here is a familiar passage. '[The] gain was achieved only by discarding some previously standard beliefs or procedures and, simultaneously, by replacing those components of the previous paradigm with others' (1962, p. 66).

As categories of science, 'spirit' and 'soul' are generally discounted as prescientific – simply figures of speech. Similarly, 'mind' should be discounted, including consciousness. The gain will be a tractable basis for neuroscience as a wholly physical science.

This article outlines the *theory of brain-sign* which offers an alternative function for the brain phenomenon. It is a coherent, viable substitute for 'uncertainty, untestable implications and a lack of clarity' *and* 'underdetermination'. What it has in common with the theory of evolution is the rejection of a divine source. Consciousness is replaced by a biological account centering on brain control of the organism in relation to others, and communal action. This evolved phenomenon addresses the problem of organisms as isolated entities, and instead facilitates complex interneural communication. An account is offered of its adaptive origins and subsequent development. Science, as a discipline, is localized in the brain's biophysical operation and is not transcendent knowledge of what is.

But while the concept of 'consciousness' appears scientifically empty, it filled a nagging space in the explanation of our abilities, rather as God filled a space in the explanation of everything.[2] However the term 'explanation' requires an account of how language works neurobiologically, i.e. as a function of brain operation. Otherwise we simply presume the capabilities of explanation by accepting consciousness as the explanatory medium *when consciousness itself is the problem*. But before getting to that there is some road to travel.[3]

The Theory of Brain-Sign *Versus* Consciousness

For well over two thousand years human inquiry has been dogged by confusion about what we, and other creatures, are. It seemed obvious that many creatures inhabiting the earth are similar in having emotions, pleasurable and painful; feelings of affection and hatred; and the cognitive ability to obtain shelter, food or a mate. But it was evident that humans could do vastly more because they have language, and other features as upright stance and opposable thumbs.

Crucially, humans invent stories about themselves and the world. ('I'm so bad at remembering things.') While animal brains can adapt beyond instinctive behavior to how their world operates, by trial-and-error or copying others, humans additionally storify – create explanations about causality. For example, in dreams of unfamiliar worlds and actions; J-P Sartre's existentialism, where we explain ourselves retrospectively for our unforeseen actions (e.g. 1965); Michael Gazzaniga's left-brain interpreter in split-brain patients who invent accounts for what they say they cannot see (e.g. 2012). However, when one says humans do, or people do, the point is that the brain does. Attributing stories to a person is scientifically inadequate because the source is obscure. The organ doing the work is the brain, albeit dependent upon other body organs for input, and

[2] Not least, of course, Descartes' resort to God supporting his conclusions, He being 'no deceiver'. Meditation Six (1968, p. 168).

[3] Further types of problematic engagement can be found in Clapson 2020 and 2017.

operation, e.g. blood supply; and it has to transfer stories by acts of speech or writing. In other words, stories emanate from the human organism, but central to that is brain activity.

The reason for noting this obviousness is that one of the causes of frustration about the status of consciousness is that the literature can lack specificity (Michel above). Accounts of consciousness do not begin with a scientific investigation of *what the brain needs to do biologically*, which is a legitimate scientific approach: rather they storify about human functioning by a miraculous endowment, viz. consciousness. Indeed, the very possibility of science and its discourse supposedly depends upon humans being conscious.

Science is a triumph of human endeavor. But no scientist knows for sure anything about the world because no scientist has access to the world *per se*. Everything is filtered through brain functioning. In a sense this is what Kant concluded from the philosophy of earlier writers. His major work, *The Critique of Pure Reason* ((1787), 1933), was an attempt to explain how Newton could have generated workable scientific knowledge. This was because Kant (his brain) asserted that the world, *things in themselves*, was unreachable by human faculties.

Here is his later critique of Descartes. 'He who ponders natural phenomena, for example, what the cause of the faculty of memory may rest on, can speculate back and forth (like Descartes) over the traces of impressions remaining in the brain, but in doing so he must admit that in this play of his representations he is a mere observer…for he does not know the cranial nerves and fibers, nor does he understand how to put them to use for his purposes. Therefore, all theoretical speculation about this is a pure waste of time' ((1798) 2006, p. 3). From the eighteenth century this reflects underdetermination in essence, and consequent dualism.

Kant's book has the word 'Pragmatism' in the title. Because we do not know the cranial nerves and fibers let us make do with mind. But the *New Scientist* journal's banner headline claiming consciousness as 'the greatest mystery in the Universe' (10 July 2021) is, alternatively, to propose that myth is better than a science.

Brain-sign theory proposes there is a brain phenomenon, but not consciousness. Brain-sign is not knowledge (not con-science). It offers no certainty about itself (*contra* Strawson 2018). It is 'simply' an evolved means/mechanism for vertebrate creatures to communicate resulting in a significant increase in the power and fitness of those so endowed. In the history of the topic brain activity has been divided into the conscious and unconscious as a way of addressing the obvious fact that most control of the organism occurs non-consciously. Brain-sign theory supersedes this.

Sociality and Signs

There are various online introductory accounts of brain-sign theory. Although the fundamental structure will be briefly expounded here, the emphasis is on the conceptual contrast to 'consciousness' as folk psychology. The theory sets out to reposition the reader in relation to their own biological nature.

Evidence for consciousness is taken to be the various mental states we are supposed to have – our so-called experience. We see, and those who cannot are disadvantage by being blind. We hear and we are disadvantaged if deaf. Areas of the brain are identified associated with 'seeing'. According to Wikipedia (September 2022), 'The visual cortex is the area of the cerebral cortex that processes visual information. It is located in the occipital lobe. Sensory input originating from the eyes travels through the lateral geniculate nucleus and then reaches the visual cortex. The area of the visual cortex that receives the sensory input is the primary visual cortex, also known as visual area 1 (V1), Brodmann area 17, or the striate cortex.' But using the word 'visual' in the definition implies something else: that humans can see. And since there is no scientific account of this condition another explanation is required.

If the brain operated purely for the single organism acting alone in the world it might be supposed its physical states could do all the work required to get it around and survive. There would be no need to communicate with others. However, while there are creatures which reproduce without mating, i.e. parthenogenetically (e.g. Hogenboom, 2015), reproduction is biologically imperative for living things and requires mating-sociality often founded on appropriate bodily contact.

Features of sociality are widely reported and explored (e.g. Churchland 2019). But complex social interaction demands some advanced means of collective engagement beyond genetically predetermined interactions. When moment by moment responses are required – i.e. each individual organism has to do something not previously planned to keep the interaction going, as in passing a football back and forth before shooting for goal – there must be some means/mechanism to sustain it.[4] Obviously were the organism conscious, i.e. sees and understands what happens in the interaction, the problem is explained away. But since the brain is purely physical states, how could it see or understand anything?

The answer is not simply to say that brain states *just are* mental states or that mind states *just are* physical. Seeing and understanding imply knowledge. To see is to know what is there. But that would

[4] This contrast is made by Mercier and Sperber (2017). 'Human cooperation is exceptional not only by its scale but also by the open-ended form it takes. Other animals may have a few types of cooperative interactions in their behavioral repertoire with little or no place for creative improvisation' (p. 183). But the definition here is functionally more precise.

require the brain to be capable of generating interpretive vision from its physical states, i.e. being able to conceptually grasp the nature of situations and events mentally, and thereby act accordingly. (Which is proposed by the Giulio Tononi et al. Integrated Information Theory (IIT) (e.g. 2017), and Stanislas Dehaene's Global Neural Workspaces (e.g. 2016).) But if the brain cannot do these brain-to-mind ontological conversions, and given that it is isolated from the world and dependent on signals from sensory organs, how is what seems to happen explained?

Straightforwardly, it is the physical brain that selects the next action, or sequence of actions of the body. This does not result from a mental understanding, but from the brain's acquaintance with the world developed from infancy by causal interactions with it. (As György Buzsáki proposes: 'We connect to the world not through our sensors…but through our actions' (2019, p. 61).) In these processes the brain has constructed model states of world content – surfaces, hardness and softness, height and breadth, what consequences follow from what actions – by associating specific causal states of the brain towards the world and thus what the effect is of objects in the organism's causal activity. A likely account is that they originated in the brain from the process of exafferent/reafferent activity, which must now be explained.

The Origin of The Brain Phenomenon

There is a problem of action for the causal brain which is that when the motor system signals to eye muscles about a target in the world (*efference*) there is a possibility they may be confused as the result of the body's own concurrent movement in relation to the object. The brain deals with this, it has been proposed, by also sending a copy of the action signal (*efference copy* or *corollary discharge*) within the central nervous system (CNS) itself. From this a calculation can be made in the CNS for following action in relation to the object by comparing the brain's returning signals from the object location (*exafference*) with the result of the body's own movement (*reafference*) if that has happened.[5]

Thus 'the immediate world', as represented in the brain, together with the brain's responses to it, are continually generated in its physical structures and operations. However, these model constructs are not visible to a notional viewer of the brain because they inhere in the brain's operational fabric. More precisely, there are no notional viewers because the role of the eyes is not to facilitate seeing: their

[5] Cf. Jékely et al. (2021) 'A tradition of work on more neurally complex animals…has argued for a…view of the relationships between sensing and action…that makes central the concept of *reafference*: the effects of action on what is sensed.… Extending and redirecting these ideas, we develop the concept of reafference through the general principle that self-initiated action evokes sensory change, and then apply these ideas to early nervous system evolution.'

role, *via* transmission to the brain of electromagnetic radiation, is to activate its appropriate causality in relation to the world. (Thus saying 'I see', as in mentalist vocabulary, is a scientific mistake.)

A corollary is that brains do not employ the models in terms of their structural 'appearance', i.e. what is supposed in conscious seeing (as above), for brains do not (cannot) make a neural-to-mental transformation. The models serve the brain's causal action in the world *per se*.

However, brain-sign theory (a *scientific* story) proposes that in evolutionary development the forms of afference/reafference models *subsequently* became signs the brain employs in collective action. This was an evolutionary *exaptation* – using one feature for another function, as feathers for warmth becoming wings to fly. Their functioning is termed *dynamic* because what is enabled is reciprocal joint activity.[6]

As an example, the organism's survival in the world does not need a brain image of a tree. Its operative status at the moment of encounter is its causality in relation to the tree's neural assembly – to walk towards it or around it, or do nothing in relation to it for the brain's identification of the tree is already a neural action. But the tree assembly as image became the means of communication between organisms in joint action. It co-identifies that in the world towards which their causalities are directed. While the image is superfluous causally, it serves as an element of interneural communication with other brains.

The notion that consciousness, as causal knowledge, appears by neural accumulation. (e.g. from neuronal correlates of consciousness (NCCs), ref. Tononi, Dehaene) is to reify consciousness, as a concept, in the brain's fabric. Rather, the 'images' remain entirely physical, as are body patterns or shapes of many species employed as camouflage or for mating. Identifying how the brain does this is a future development for science,

For humans, consciousness is a story the (unknowing) brain invents to explain itself. A way of accounting for itself to others. But it is an erroneous simplification. To identify the 'reality' we must step out of the brain's consciousness-myth gravitational pull. Crucially, too, we must identify to whom the stories are being told, as will be explained.

[6] Acknowledgement is made here to a pioneering text concerning brain-to-brain coupling by Un Hasson et al.
(2012). They say: 'We call for a shift from a single-brain to a multi-brain frame of reference. We argue that in many cases the neural processes in one brain are coupled to the neural processes in another brain via the transmission of a signal through the environment. Brain-to-brain coupling constrains and simplifies the actions of each individual in a social network, leading to complex joint behaviors that could not have emerged in isolation.' Brain-sign theory was developed independently of this text. A crucial difference, however, is that brain-sign replaces consciousness *per se* by a biologically likely adaptation.

As an analogy to all this, the consciousness story can be paralleled with other primitive stories the brain generated, e.g. that when humans die they transform into another life beyond death. The modern world remains heavily populated by individuals who suppose (casually or determinedly) this happens (MacGregor, 2018). Thus the brain has solved the problem of death – biological extinction, personal annihilation – by inventing an alternative. Death is not the end of existence. Death, rendering human life futile, is thus resolved. (Elephants, who are supposedly responsive to their deceased companions (presumably) cannot tell stories for they have no adequate language ability.) If this parallel rings true – for many now do not accept life after death: their brains do not operate within that framework (Watson, 2014) – then a different story about the brain phenomenon is required which is scientifically likely.

Causal Orientation & Categories-of-the-World

If the brain operates by determining the body's next action, or sequence of actions, it requires communication with others with which it is cooperating. Signing between organisms to generate some outcome is ubiquitous and intrinsically physical – the lion's mane, the chameleon's varying skin pattern, the peacock's copious tail. The response of others to these creatures does not entail conscious knowledge about the sign; the reaction is biophysically determined. What kind of brain signing would be involved between human organisms in collective action?

It derives from the assumption that appropriately structured electrochemical brains, which continually determine the next action of the organism, generate a status of themselves termed *causal orientation*. Causal orientation means the brain is poised for action, potential or actual. To effect a cooperative action each brain generates a sign which is each brain's interpretation of the world towards which the causal orientation is directed – *brain-sign*. The interpretation has been established from infancy by the causal engagement of the brain/organism with the world (as discussed). In the example of football passing this would be the football itself represented, its trajectory and the cooperating companion. It would also involve the general surroundings in which the action takes place to which the brain is also causally orientated. So, while causality lies in the (unknowing) physicality of the brain, brain-signs signify the world-conditions of current causality, which is the *enabling link* of communal action. They are not epiphenomenal but the consequence of potential or actual cooperative action.

What 'appears to us' is the world seen, which precedes any action taken; indeed, it activates that action. By change of theory the brain's physical status controls the actions of the body; but to enable communal action its causality is expressed as images of the world

towards which it is directed. In this way brains co-express the world of their joint causality. 'Appears to us' is explained below.

Why would this be a likely mechanism? Because biologically the interaction is not of two or more isolated individuals. It is an intrinsic binding in one overarching process of multiple organisms. The 'images' themselves are not significant in the sense of mental representation, as in the philosopher's notion of *intentionality*. Brain-signs signify causality's linking expression of the world towards which multiple organisms are directed. To 'grasp' this entails the paradigm change discarding mentalist subjectivity – how we have taken ourselves to be in historical convention. Humans are complex biological objects which behave. And this is the case with other vertebrates.

Of course, we are often alone. But this does not alter the conditions of brain function. To 'us' it appears the world is around us. But should another become present then any interaction between us involves jointly activated images (*via* electromagnetic radiation) as which that interaction is signified. Indeed, by simply 'looking' at each other, in neural description, the context of potential joint action is manifest. Two brains are set in an environment which brains co-identify. However, as brain-sign the reality of the world is invisible; in practice our bodies may cooperate. And this is so between humans and dogs and cats, though the content of signification is not as that of one species.

Brain-sign is a foundational aspect of joint vertebrate functioning. Without it dynamic interaction would not occur. This is a new biophysical conceptual construct. It defines the nature of the body's active present in terms of brain function.

Experimental support exists in the sense that joint activity between brains has shown synchronization of oscillations in social interaction, with cooperation in tasks being key. E.g. Valencia and Froese (2020): 'A growing number of studies in social cognitive neuroscience reveal that phase synchronization…appears across brains during meaningful social interaction…. These findings challenge the standard view of human consciousness as essentially first-person singular and private' But the move to brain-sign theory has still to be appreciated for consciousness, here, is not explained but assumed.

Elements of the world represented as brain-sign are termed: *categories-of-the-world*. This terminology can be taken as scientific since it involves no causal representations to a mental subject, as proposed by Descartes/Kant and their current descendants.

As an historical aside, drawings of animals on cave walls tens of thousands of years ago occurred, not because each human (mentally) wished to please him/herself or others with scribed images: it was because brains had long been communicating by brain-sign and the representations exteriorized and confirmed a communication which

brains already effected in hunting or other social interaction. This is the biological foundation of pictorial art. The art expressed the jointness of human existence, but was 'unknowable' to the cave artists themselves. They acted from brain direction, perhaps 'surprising themselves' in what they had done (long since dissolved in social custom). That the world is apparent to us and manipulable by us as some fundamental property of our conscious existence is erroneous. In bio-operational terms we (as organisms) are enabled by brain-sign, but we have no sense of this. Scientifically, however, the problem of mental life is dissolved.[7]

The Biophysical Marker

The previous discussion uncovers the next basic characteristic of brain-sign as distinguished from consciousness. In his 2017 book Daniel Dennett complains about Thomas Nagel's bat hypothesis (1974) and David Chalmers' hard problem (1996). 'Some people cling to the view that consciousness is…an all-or-nothing property that divides the universe into two utterly disjoint classes: those things that *it is like something to be*, and those that it is not like anything to be' (p. 192). In other words, 'what it's like' to experience the self and world is a foundational property of existence, presumably arising from the brain, and alternatively there is pure brain activity for the organism, as with the information processing capability of computers.

But Nagel and Chalmers start their exposition from an unfounded assumption – that we already are what they defend, viz. conscious beings with knowledge capacities. As with the Heidegger quotation in the Introduction and subsequent commentary, simply to assume what appears to be, or is verbally handed down as the ground of a bioscientific approach is not adequate.[8] Scientific history is littered with overturning of what is 'obvious' or generally supposed, as for example the theory in which combustion emits phlogiston. Work is required which, in the case of phlogiston, made the discovery that burning material absorbs oxygen, thus becoming heavier not lighter. This resulted from chemistry developing in concepts and terminology. In comparison, brain-sign is a means/mechanism for inter-organism cooperation, not a neural emanation endowing experience and knowledge for a mental subject.

With brain-sign theory the seeming 'sense of I' identifies this particular organism in inter-organism communication and action. Its scientifically defined operation is to be conjoined with the represented world as the brain's presentation of this organism's immediate causal status toward the world. Thus, we are mistaken in supposing our

[7] There is an analogy here with Heidegger's (1962) notion of the 'forgetfulness of Being' by Western philosophy, particularly concerning consciousness as a theory. However, that obviously results from a different analysis.

[8] And see further Language below.

sense of ourselves is a primary element of our personal being. Or rather, the brain story that expounds this is false.

'But', a sceptic might say, 'you can't say that taste is not *my* experience. It is impossible that an itch doesn't happen to *me*. No one else knows them.' While no-one's taste may be identical to another's, brains being different, or the itch appears to invoke a scratch action, what the theory proposes is that organisms' brains generate adequately *the same* (co-referential) world, which is not the real world or an identical world, but a world of cooperative potential or actual action. The content of brain-sign is invisible to another I, but so is the world itself. What is generated functions as a mutual referential domain for communicating brains because that is how biology constructs us. Thus 'taste' *per se*, resulting from a causal orientation, is communicatively transportable.

Grasping this is difficult because being an I seems to press upon us constantly. 'Here *I* am' – Heidegger's Dasein (1962). But the 'sense of I' refers, *not* to our mental life of experience, the life of world-knowing and suffering. It identifies *this* organism's world-inhabiting state as *this* brain's communicative operation with other organisms about *this* brain's immediate neural causality. In adapting to this explanation 'we find ourselves' released from the onerous weight of being responsible for a state for which we have no explanation.[9] We 'grasp ourselves' in another dimension. We are what the brain represents its causality towards the world as. Everything about ourselves and our relation to the world is recast. Thus neural science, while concerned with the neurobiology of brain-sign, will not confuse it with the neurobiology of causation. The technical questions invoked are: What renders the brain's state of causality? What is its process of interpreting causality to generate brain-sign? and How is the brain-sign result coded in the brain?

The 'sense of I' is termed the *biophysical marker*. It is part of the brain's communicative sign and emerges during infancy.

It might seem that a complication arises because we are aware of ourselves and can reflect on our perceptions, thoughts and responses. There is a state A, then B follows which considers or reconsiders A and we are conscious of this activity. Brown et al., in their 2019 review of associated theories, say that: 'Subjective experience is the stuff of novels, poems, and songs, of our emotions and memories, the essence of being a human.' Followed by: 'However, there is no generally accepted theory of the phenomena being studied.' But as said, being

[99] As [Luigi] Pirandello said in his notebook of 1933-1934, two years before he died: 'There is someone who is living my life. And I know nothing about him.' Quoted from the Introduction to the play *Six Characters in Search of an Author* by Frederick May (1954, p. vii). This quotation also occurs in an essay by Richard Gilman (1984, p. 40), who says: 'Influenced…by Nietzsche, Bergson, and…Freud, Pirandello quickly takes his place among the masters of displacement and values and the reorganization of consciousness.'

human this way is not science. These assumptions come from a brain-generated construct which serves neural communication but is scientifically erroneous: Brown et al.'s article offers no explanation of how 'the phenomena' (consciousness) derives from the physical brain.

By contrast, the biophysical marker continually identifies this organism in neural communication, and the so-called 'inner world', open to hierarchical reflection and enquiry (Higher Order Theories), is replaced by sharable physical signing of the brain's causal orientations. Its *successive* nature (one upon another) is the mechanism of communication in time. For example, I may appear to see a fox and then realize it is a dog. The past fox seeing is considered while the current dog seeing occurs. But the apparent situation is not a reconsidering of my position (as mental subject) but a new causal orientation occurring successively one or more times with the old. The supposed self having the experience is actually the biophysical marker which persists in both states as the foundation of communication. One might ask: 'But surely we are aware of our self thinking about itself?' Again, this presupposes there is a self which thinks about things including itself. No such self exists. 'My past', as established neural structures, and 'the imagined future', as developing structures, are brain-signs which express the brain's immediate causality and are co-present with the biophysical marker.[10] Obviously, however, what is manifest is greater expressive complexity. And, as Brown et al. mention, this may be evident to some degree in other animals.

Categories-of-Interaction

To proceed further we need now a distinction between categories-of-the-world and what has been supposed the self's response to those categories. Consider Lisa Feldman Barrett's book: *How Emotions are Made: The Secret Life of the Brain* (2017).

She says, 'Pain, like emotion and stress, appears to be a whole brain construction.... The pathways sending nociception predictions down to the body and those bringing nociceptive input up to the brain, are closely related to interoception. (It's even possible that nociception is a form of interoception.) Overall, the body sensations that are categorized as pain, stress, and emotions are fundamentally the same, even at the level of neurons in the brain and spinal cord. Distinguishing between pain, stress, and emotion is a form of emotional granularity' (pp. 206-207).

At first sight we may consider these are bodily responses to the world. Indeed, she proposes a radically new *theory of constructed emotion*. 'Your brain models your world through simulation. [It] issues a storm of predictions, simulates their consequences as if they were

[10] This account transforms Kant's transcendental self (I) of the mind, which supposedly enables representational awareness, to a biological operation in wholly physical terms.

present, and checks and corrects those predictions against actual sensory input. [Cf. the afference/reafference effect.] Along the way, your interoception predictions produce your feelings of affect, influence every action that you perform, and determine which parts of the world you care about in the moment' (p.153). 'You are an architect of your experience' (p. 152).

Unfortunately, we are not told how the brain generates feelings which can have causal properties. Moreover, reference to 'you' or 'your' is not identified in the brain's activity. She says 'the self is part of social reality' (p.190), but then follows with 'It's not exactly a fiction, but neither is it objectively real in nature like a neuron' (pp. 190-191). Again, we are not told what constitutes social reality in a physical universe nor what the difference from a neuron indicates. It is, rather, a story a brain makes in trying to account for itself. However, elements merit exploration.

The term 'interoception' implies that one can look inwards and so access, or be aware of emotions. However, it is impossible we see inwards (where is that?) for no mysterious observer inhabits the body: the body is a physical organism. Moreover, the notion the brain predicts the reaction of the organism, qualified by sensory input, implies that the immediate world is not seen. Seeing, so-called, is largely prior constructs of the brain's causal orientations towards the world installed from infancy onwards. Categories-of-the-world.

A more coherent account defines pains, in particular, as categories-of-the-world, for they are the brain's interpretation of a world actuality, in this case in the body. In mentalist terms the normal response to this is unfavourable, or as John Locke (1997) would put it, 'bad'. But the organism's reaction to pain's badness, the supposed feeling, also occurs as brain-sign, and such are termed *categories-of-interaction*. Thus pains, stress and emotions are not to be grouped together.

Categories-of-interaction are not responses to categories-of-the-world. They are responses to the brain's causal orientation, and occur from the body itself. It is regularly proposed, from Descartes (1968) through William James (1890) to Antonio Damasio (1999), that pain is the body telling the mental subject that remedial action is required, on the supposition that mental life exists. But there is no scientific explanation for this, nor is one offered. By contrast the brain-sign account states that when the condition is communicated to others (locally or remotely present), their brain signification indicates they could, in principle, provide support or help. This is not because they know mentally what is happening; their brains signify because the common world of pain (so-called) is established in the communication. Sufferer and helper act by their causal brain, but their brains co-signify their reaction to the situation. (Hence the mentalist terms sympathy and empathy.)

This leads us further. Categories-of-the-world function to signify a brain's immediate causal orientation towards the world. What then of categories-of-interaction? They indicate, in principle, *biological fitness in relation to the future.* As Dennett says: 'The task of a mind is to produce future.... A mind is fundamentally an anticipator, an expectation-generator' (1996, p. 75). Not mind, but causal orientation and thence brain-sign, which is potentially sharable concerning future fitness. Fitness, in this context, is here defined as 'dispositional' (discussed by Triviño and Nuño de la Rosa, 2016) and is concerned with potential or actual action and, consequently, the means of survival.[11]

What is shared about 'pain'? It is the sign of future *unfitness*. So while repairing the cause of pain necessitates bodily action by the individual, communicating is social sharing of the immediacy of their unfitness. Other people signify its nature and impact, and this can be potential endorsement for support. The 'sense of unfitness' (as brain-sign) is biologically generated in relation to potential collective action. For others it is 'I could not do X as you'...and by generalized extension 'nor as anyone'; so, I may or will help. In other words, the model is necessarily self-referential because it derives from the individual's own action ontology.[12]

Moreover, this process may function in creatures who do not have the human language of Dennett's 'comprehension' (2017), which supports Churchland's position about animals having 'feelings' (2014), although not as such. Their brain-signs, as ours, are a kind of nonverbal language of biological communicative responsiveness to the state of others – not always with positive results of course. Lepers were socially banned, but that could change when a chemical cure was identified, and some animals attack.

The shared world of humans is filled with 'seeming' pains. Indeed, the medical professions result from a causality/signifying process which has hitherto been scientifically undefined. This is understandable because it is not evident in human 'experience'. We suppose our helpful responses are *because* we feel, because we are sympathetic. But recall the work of Benjamin Libet (1983). The brain's action initiation precedes the supposed human experience (which is actually brain-sign). Libet's findings endorse the structures of brain-sign theory. Creatures do not care, they act, even when that is inaction. This action (or not) entails a communicative brain modality, brain-sign.

[11] 'Fitness is a causal disposition resulting from the non-linear combination of environmentally relative functional dispositions oriented towards an effect (surviving and reproducing) which is reached once the combination of these dispositions exceeds a certain threshold.'

[12] This ontology locates the contrast with Heidegger, who stated that: 'The existential analytic of Dasein comes *before* any psychology or anthropology, and certainly before any biology' (1962, p. 71). But for brain-sign theory, biology creates the context of what exists, though it does not explain existence *per se*.

(Note Nietzsche's anticipation. 'The causal connection between thoughts, feelings, desires, between subject and object, are absolutely hidden from us – and are perhaps purely imaginary. The 'apparent *inner* 'world' is governed by just the same forms and procedures as the 'outer' world [i.e. neurophysical]…. 'Causality' [of the mind] eludes us.' (1967, p. 264))

By contrast to pain, 'feelings of pleasure' are a sign of fitness, which, however, does not necessarily mean the body is in good shape, for (for example) the impact of opioids on causal orientation can be deceptive. In misuse moments of a seeming 'high' can dissolve quickly and encourage addiction. Thus, the biological notion of pleasure is not a moral objective state which the human body employs in its good judgements, as Patricia Churchland (2019) seems to propose. It is simply biological in the sense of communicative effect.

Categories-of-interaction offer a wide field for classification. For example, envy, so-called, indicates there is unfitness in relation to future life because the immediate causal orientation cannot change to include a category-of-the-world as now identified: for example, a house, a talent, a style of living. It *appears* to us that we have an ache, a yearning, a resentment about our inadequacy or misfortune. But this is psyche-speaking – how the brain has accounted for itself in mental terms. The 'sense of deficiency' remains as brain-sign until causal orientation itself changes (i.e. our brains move to other things, so-called). On the other hand, of course, the cause of deficiency signification may lead to action in which the house or style of life is obtained – not because the brain cares (which is signification), but as a result of its relation to the world in causal terms.

Two further points concerning the quoted passages from Barrett. She says that the self is not 'objectively real like a neuron'. But that is because no mental self exists. The biological marker of brain-sign, by contrast, is completely biologically real in its brain-sign role. On the other hand, it certainly can be agreed that causal orientation and brain-sign functioning take place as 'whole brain constructions'.

Language

Language is supposed a means of communication in which words and sentences have a meaning which can be understood by ourselves and others in our minds. It is generally supposed that infants learn language by copying adults around them. Language is a mental tool which humans employ. In the history there have been various approaches. But brain-sign theory takes a different stance because it does not accept that humans are conscious and therefore know what they are doing. Returning to Kuhn: '[The] gain was achieved only by discarding some previously standard beliefs or procedures and, simultaneously, by replacing those components of the previous paradigm with others.'

In the cultural milieu of our upbringing it seems to us that we have learned language, and words and sentences occur to us spontaneously as we express ourselves. Sometimes we consider what we are going to say, but words occur mostly without deep consideration. We are guided by the circumstances of a conversation, and we know what we seek to achieve in the conversation. We are surrounded by others who comprehend what we say. But this floating spontaneity covers over the nature of physicality and neural accomplishment.

From a biological position language, as which humans understand themselves and the world, does not exist. Nor is it a mechanism for minds to communicate with each other about meanings. There is no scientific explanation of meaning or how it works (i.e. in terms of physical properties). More lucidly, language is a means/mechanism by which brains cause the *causal orientation* toward the world of another brain to be altered or controlled. When (as we say) one person speaks to another what actually happens is that the source brain generates compression waves which enter the other brain *via* the ears, and those transduced waves alter the receiver's brain's causal orientation. In the case of both the speaker and the recipient, words appear to be understood, their meaning known. But this is a communicative artifice, for the neural effect is that causal orientations now adequately complement each other. (Recall the findings of neural synchrony.) Neither speaker nor hearer has any sense this is the biological function of the transaction because the process effected by the brain is not accessible in the brain-sign they are. Heidegger (1962, p. 204) puts it thus, as glossed by Theodore Kisiel (2002, p. 93). 'Meanings grow into words. It is not the case that word-things are invested with meaning.'

This analysis is supported by recent experiments at Stanford University in which the brain of a paralyzed individual who cannot speak has implants which allow sentences 'thought' by the subject to appear on a computer screen (e.g. Sample, 2021). In fact, these 'thoughts' are a language subset from causal orientations accessed by the implants. The experimenters 'watching' the screen, while supposing they understand the words 'thought', in fact have t*heir* brains' causal orientations altered and thus their brains brain-sign the words. No mental understanding takes place in any participant: the brain works without mental intervention, though that is how it is described – by brains which, so far (apparently), have not had access to brain-sign theory.

The 'sense of understanding' *is* the neural communication (as with sight). Doubtless the Broca area in the frontal lobe of the left hemisphere plays a significant role, but it is not the sole producer. Buzsáki, in his 2019 book, states that 'Psychophysical, lesion, recoding, and transcranial magnetic stimulation (TMS) studies suggest that motor cortex and somatosensory cortex are involved in

linking action words to their direct meaning, whereas the inferior frontal cortex, temporal lobe, and inferior parietal cortex encode more abstract features of action words' (p. 137). The language process takes place across brain areas, which agrees with Barrett as quoted. (Buzsáki's 'direct meaning' phrase is reinterpreted by brain-sign theory, but is entirely sympathetic to his general position.)[13]

Indeed, an article by Buccino et al. (2022) proposes that 'embodiment foresees that processing observed objects and their verbal labels should share similar neural mechanisms.' They support this with experimental evidence.

So, for example, one can read a book, a tome like Tolstoy's *War and Peace*, and thoroughly enjoy the so-called experience. But what is significant to the brain's operation is the continual modification of its causal orientations to which the 'reader' has no access. The transmission between the pages and the reader's eyes is effected by electromagnetic radiation of which the reader (as supposed mental subject) has no immediate comprehension. We suppose we see the words, which are, of course, familiar. But that is not the biological impact. Our 'concentration' results from the engagement of our brain with the complexity of these shifting causal orientations towards multifarious details, brain-signing as love affairs, international relations, family life, war and death.

What rivets people sitting in the London Tube going to work and gazing into middle distance, apparently reviewing their lives or considering conflicts at work, is a series of words as, in principle, communicable to someone else. But it is the physical organization and structure of the brain changes in generating proto-specific actions in the causal orientations that rivet them. They may be considering: 'Why was it like that? or How has it happened? or What will I do about it?' – with categories-of-interaction which coincide. Indeed, since the brain is an action-generating organ not a comprehender of language, some action-result may emerge subsequently which can be communicated. But as the immediate 'experiencer', there is no sense this is a mechanism that determines the supposed experience. If asked we would say we are thinking. As Buzsáki says: 'Prefrontal cortex areas can be designated collectively as an internalized action system, and thus plans and thoughts can be conceived of as internalized neuronal patterns that serve as a buffer for delayed overt action' (2019, p. 239).

As with other aspects of brain-sign theory, the notion and language of mind covers over (obscures) the physical actuality of our existence and its mechanisms. 'We have learned' words, not because we have a mental dictionary in our heads that is gradually added to, but because our brains are causally orientated towards the world and words are associated with the fabric of those causal orientations as a

[13] György Buzsáki has conveyed to the author the judgement that eliminating reference to consciousness would be a 'major step forward to neuroscience' (2020).

means of communication. When words occur as brain-sign, they are pointing, not to the object of the words as mental symbols, but to the causal orientations toward the object which can be shared with others in communication. Thus, while the word 'table' appears to point to tables as such, the brain is causally orientated toward the actualities and functions of tables to which the brain/body can respond. (This is a fine eighteenth century example, or food is on it, or it needs cleaning.) To repeat, 'understanding words' *is* the communicative process to which brains have become adapted, whether any other is present or not. That is because words are an evolved shorthand for the complexity of the biological organism's causal neural structures.

Buzsáki quotes Yu and Smith (2012, p. 137). 'Infants do not simply look passively at the jumble of toys on the floor but rather use their body – head, hands and eyes – to select and potentially visually isolate objects of interest….' Matthew Cobb says this, of Buzsáki's position. 'The brain is not simply passively absorbing stimuli and representing them through a neural code, it is actively searching through alternative possibilities to test various options. His conclusion, building on the insights of Helmholtz and Marr, is that the brain does not represent information; it constructs it' (2020, p. 373). This concurs with brain-sign theory. But what the theory adds is the *function* of what is represented. Behind that is a bio-theoretical construct to explain why and how it does happen.

Conclusion

So, with language we find the same kind of biological role of brain-sign as with categories-of-the-world and categories-of-interaction: A means of interneural communication facilitating cooperative action, be it images of the world or feelings from our body or meaningful words. These are bio-communicative states concerning the organism's causality which can be shared with others even though, in the case of language, we might not be speaking out loud. We do not know this because the biophysical function is not available to 'us' as brain-sign. What is outlined here is a scientific theory which expresses it – a science of the possibility of science itself. Our brains function for action. What is communicated as brain-sign is a vast new field of study. The expectation is that the theoretical model will improve the foundations of neuroscientific investigation.

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