Phenomenal Experience and Qualia

We also maintain that previously argued categories such as selfhood and phenomenal experience can be explained biologically in terms of patterns of neural activity [63].

Qualia, or **"what it is like to have the experience**" of the color red, or "of being a bat" [64], have long been evoked as the major stumbling block for a physicalist theory of consciousness [14]. How is it possible to reduce the Qualia of the rich sonority of the Quartetto Italiano playing a Beethoven string quartet into mere physical representation? Consider a digitized recording of this performance of the music on compact disc. It does not reveal the phenomenological content of its information until it is played back on an appropriate system of digital to analog converters, amplifiers and speakers. Ramachandran [65] has pointed out that we will, of course, never have the experience of being a bat, "t*he qualia produced by the bat's radar (sic!) system along with everything else in its conscious life, which Nagel claims we cannot know", because our mental life is completely different from that of a bat*.
The authors go on to suggest a thought experiment involving a rod monochromat (color blind) scientist who studies the brain of a normal color perceiver and arrives at a complete understanding of physical events from the photoreceptors to that neural activity that generates the report "red." Despite his complete understanding of the molecular and neural events, the *scientist will not have the experience of "red" until he connects a cable from the area V4 of a normal color perceiver and connects it to the same area in his brain, bypassing his eyes (which are missing the appropriate cone cells). Therefore, it is in principle possible to experience another person's quali*a. This thought experiment was meant to drive home the point that an appropriate "play back" system is required to instantiate the phenomenal experience of sensory input and was not recommended for experimental verification by the authors.

However, we have come a long way since 1997 when this idea was published. Very recently a brain- to- brain interface (BTBI) has been described that enabled behaviorally meaningful real time transfer of sensorimotor information between the brain of two rats [66]. Patterns of cortical sensorimotor signals coding for a particular behavioral response were recorded by microelectrode arrays from the "encoder" rat and transmitted directly via intracortical microstimulation to the "decoder" rat. Pairs of rats fitted with this BTBI cooperated to achieve a common behavioral goal. The authors observed drastic changes in the behavior of the encoder and decoder rats as soon as they started to work as part of a dyad and concluded that operation of a BTBI by an encoder-decoder rat dyad allowed decoders to rely exclusively on neuronal patterns donated by encoders in order to produce the encoder's behavioral choice. Although we cannot verbally interrogate the rats involved in these experiments, we may hypothesize that the qualia, or "what it is like being a rat involved in the specific sensorimotor behavior", have been transferred from the encoder rat to the decoder rat by physical means.

Edelman (2003) naturalizes qualia and broadens their range from an evolutionary perspective by invoking the following sequence: *1.consciousness evolved in concert with the evolution of neural systems that are able to integrate a very large number of sensory inputs and motor responses occurring in parallel; 2 these systems connect sensory inputs with memory and*

imagery allowing thereby for learning and optimization future behavior and 3. consciousness consists of qualia, by which I mean not just isolated submodalities of red, warm, etc., but also complex scenes, memories, mages, emotions; indeed, the entire rich panoply of subjective experience. If, as I have suggested, the neural systems underlying consciousness arose to enable high order discriminations in a multidimensional space of signals (Edelman and Tononi, 2000), ***qualia are those discriminations***.

Differences in qualia correlate with differences in the neural structure and dynamics that underlie them. Thus, for example, olfactory neurons and their circuits differ from retinal neurons and circuits, and such differences seem sufficient to account for differences in their respective qualia. He counters the complaint that no scientific description can provide the actual phenomenological experience of qualia quite definitively: *to expect that a theoretical explanation of consciousness can itself provide an observer with the experience of ''the redness of red'' is to ignore just those phenotypic properties and life history that enable an individual animal to know what it is like to be such an animal*. *A scientific theory cannot presume to replicate the experience that it describes or explains; a theory to account for a hurricane is not a hurricane. Qualia have been considered "private" first person experiences and therefore assigned to an ontological class different from phenomena that can be studied with the quantitative methods of science*.

The experience of pain is often cited as an example of such private phenomenal experience. A recent study using fMRI has extracted a neurological signature primarily derived from thalamus, the insula, anterior cingulate cortex and periaqueductal grey matter that predicts pain intensity at the level of the individual person. It discriminates between pain and non-painful warmth with 93%sensitivity and specificity and between physical pain and social pain with 85% sensitivity and 73% specificity [67]. Other "private" mental states such as visual perceptions, covert attitudes and lying can also be decoded from multivariate analysis of fMRI data (Haynes and Rees, 2006). Continuous and subject- driven free streaming cognitive states [68] can now be "decoded" using whole brain functional connectivity analysis [69]. The content of visual imagery during dreams, perhaps the most private phenomenal experience, can be predicted by neural decoding using fMRI in association with machine learning strategies, demonstrating that visual experience during sleep shares brain activity patterns that are generated also by stimulus perception and allowing the uncovering of the subjective content of dreaming [70].

The Self and the Soul

David Hume:
Suppose the mind to be reduced even below the life of an oyster. Suppose it to have only one perception, as of thirst or hunger. Consider it in that situation. Do you conceive of anything but merely that perception? Have you any notion of self or substance? If not, the addition of other perceptions can never give you that notion [71].

The concept of self is used in many contexts, and its meaning covers a wide range of definitions and ideas. Hume (1888) approaches this confusion by atomizing the content of consciousness and in the process eliminating any notion of a reified self. The brain generates at set of illusions,

one of which is the experience of the self. Descartes first devised the thought experiment of the "evil demon" that creates a pervasive illusion that we mistake as our experiences and thoughts, anticipating The Matrix motion picture. The experience of the self may be the result of a "self-model" produced by the brain [72] suggesting that "no such things as selves exist in the world: nobody ever was or had a self." What we consider to be our Self appears to be the phenomenological manifestation of neuronal networks involved in the regulation of positive vs. negative emotional states which have evolutionary roots. We are able, however, to engage in self-referential mental activity.

When subjects are asked to evaluate whether a visual scene evoked a pleasant or unpleasant feeling, an increase in metabolic activity (and by inference neuronal activity) in their medial prefrontal cortex (MPFC) is observed [73]. This midline brain region is part of the default mode network (DMN) which is deactivated during non-referential goal-directed tasks [74]. Depressed patients show increased stimulus- induced activity in the DMN, and fail to down-regulate this circuit during reappraisal of the stimulus. This suggests that focus on the Self may have adverse consequences for emotional regulation and the ability to engage in cognitive tasks that require a deactivation of the DMN [75]. Conversely, treatment of depressed individuals with antidepressant medication normalizes the DMN [76]. Self-evaluation is fraught with illusional distortions which probably are adaptive, such as optimism bias and illusions of control (Taylor and Brown, 1988). The cognitive bias of "superiority illusion", judging oneself as being superior to average people in various desirable traits, may be evolutionarily selected [77] and has been linked to resting-state functional connectivity between MPFC and the striatum regulated by inhibitory dopaminergic neurotransmission [78].

The activity of the self-referential network can be down-regulated over time and its connectivity to other brain areas can be modified [79] by meditation, a form of meta-awareness used in Buddhist practice to loosen the grip of the illusionary self of the functioning of the mind/brain and thereby alleviating suffering. A much more rapid and dramatic decrease in DMN activity can be achieved by administration of psilocybin [80]. The soul, a concept intimately linked to the notion of the self and its existence, has also been questioned. Greene [81] says that *"we haven't seen the absence of the soul. Rather, we have inferred its absence, based on our background assumptions about what makes one scientific theory better than another. But to truly, deeply believe that we are machines, we must see the clockwork in action. We have all heard the soul is dead. Now we want to see the body. This is what neuroscience promises to deliver, and it is no small thing."*

Greene equates the soul's "core competence" with the ability to render moral judgments, while other competencies such as perception, memory and language production and perception have now been mapped onto the activity of specific brain circuits and thereby "outsourced "from the domain on the soul [81]. Brain imaging studies argue against the attribution of moral judgments to a "moral faculty" and rather suggest that these judgments are implemented by circuitry which is also involved in self- interested decisions which involve material rewards [82].

Summary

In this series of blogs, we attempt to challenge a set of long standing ideas that appears to support a natural mind/body dualism. Consciousness, Phenomenal First Person Experience (Qualia), Free Will, and the idea of the Soul have all been used to stake out an ontological domain that s seen as non-compatible with a unified physicalist view of the universe.
The result is a separation of mind and body which has an immediate impact on how we view psychiatric illness and on the way psychiatric residents perceive their identity as physicians.
We have reviewed recent findings from neuroscience to deconstruct the notions of mind/body and self, consciousness and the soul. The "explanatory gap" separating the brain from first person experience is rapidly closing.
Current studies are showing that the brain is constantly modified on time scales from seconds to decades by epigenetic modification of genes and modification of brain circuitry and brain connectivity. The challenge is to demonstrate how the profound plasticity of the human brain allows for a unitary, non-dualistic formulation of psychiatry.

There are implications of these findings for the training of young psychiatrists

1. Mind/Body Dualism continues to be pervasive in teachers and residents and leads to stigmatization of mental illness.

2. Mind/Body Dualism is buttressed by the exemption of first person phenomenological consciousness, free will, the self and its soul from scientific analysis and by assigning them a unique ontological status and locating them outside a unified physicalist reality.

3. An increasing number of converging studies demonstrate that consciousness and first-person experience can be studied by physical science and mapped to specific brain circuits.

4. A unified physicalist description of psychiatric diagnosis and treatment is now in reach. This will map brain changes in time scales ranging from minutes to decades produced by epigenetic changes of gene expression (social forces) and changes in brain connectivity by both psychopharmacology and psychotherapy.

5. Residents training in psychiatry can self-identify as brain specialists gaining increasingly refined insight into the potential of the plasticity of the human brain interacting with the world and will learn to apply these insights for the benefit of their patients.

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