DIMENSIONS OF EPISTEMOLOGY AND ONTOLOGY:

A MULTIDISCIPLINARY DUAL-ASPECT MONISM PERSPECTIVE ON PSYCHOPHYSICS

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Does the brain produce consciousness? Is consciousness "just" an emergent epiphenomenal property which is in principle reducible to specific complex arrangements of baryonic matter which are hitherto not completely understood? The question pertaining to the origin of consciousness is one of the most profound and important questions science can ask. Yet, the answer is still utterly elusive, despite the significant empirical progress neuroscience has made in the last decades. Regardless of our nescience in this domain, the non-evidence based (oftentimes implicit) consensus in the neuroscientific research community is that consciousness can ultimately be explained in a purely materialistic framework (e.g., in neuromechanical terms of electrochemical cellular signal transduction). This aprioristic postulate is rather predictable in the superficial and highly materialistic *Zeitgeist* of the 21st century (cf. the human being as an automaton). However, in its true quintessence science is not a culture bound, democratic, and group-consensus driven endeavour and it might turn out that the relationship between mind & matter (*psyche* & *physis*) is ultimately of a very different nature than the majority of neuroscientists *believe*. "Dual-aspect monism" provides a viable alternative to the dominant and mainly unquestioned dualistic conceptualisation. According to this non-dual view, mind & matter are complementary aspects of the *same* underlying substance (in the quantum physical sense). It is argued that the Möbius band provides a readily communicable geometrical metaphor for this non-dual perspective which combines psychology and physics (*psyche* & *physis*, epistemology & ontology; subject & object; the knower & the known; the seer & the seen) into a holistic gestalt. The Möbius band is a peculiar ancient (quasi-archetypal) geometrical figure and the symbolism has been documented across numerous cultures and vast epochs. The band is eponymously named after the German mathematician August Ferdinand Möbius who initially described it in 1885. It belongs to the class of ruled surfaces and it possesses the mathematical property of non-orientability (viz., a non-orientable manifold). A *Gedankenexperiment* facilitates an intuitive understanding of this property: Imagine you are walking on the surface of a giant Möbius band. If you walk long enough you end up at the starting point of your journey, only mirror-reversed. This process can be iterated *ad infinitum*. The geometry of the Möbius band has far-reaching interdisciplinary ramifications. The abstract axiomatic principles of its topology have been applied to a multifarious spectrum of scientific disciplines including mathematics, cosmology, physics, computer science, chemistry, biology, *etc*. Practical applications include, *inter alia*, superconductors, molecular engines, and bandpass filters. Furthermore, the Möbius band is a very intriguing visual percept in the context of perceptual psychology and psychophysics. Fascinatingly, nonduality is pivotal to various Indian schools of thought (e.g., *Advaita Vedānta*).

A prototypical Möbius band can be mathematically represented as a subset of three-dimensional Euclidean space via the subsequent equation which provides a geometric parametrization schema:

$$x(u,v) = \left(3 + \frac{v}{2}\cos\frac{u}{2}\right)\cos u$$
$$y(u,v) = \left(3 + \frac{v}{2}\cos\frac{u}{2}\right)\sin u$$
$$z(u,v) = \frac{v}{2}\sin\frac{u}{2}$$

where $0 \leq u < 2\pi$ *and* $-1 \leq v \leq 1$.

Illustration of a digital 3D model of the Möbius band virtually positioned in front of the Roland Levinski building of the University of Plymouth. The Möbius band provides a conceptual geometrical visual metaphor for dual-aspect monism à la Pauli-Jung, a theory which postulates that mind & matter (i.e., *psyche* & *physis*) are penultimately complementary aspects of the same underlying substance.

In classical Cartesian nomenclatures the dichotomous/dualistic conceptualisation of mind & matter is expressed by the Latin terms *res extensa versus res cogitans*, i.e., 'the extended substance' vs. 'the thinking substance'. In the neurosciences the enduring problem concerning the exact relationship between consciousness and the brain is known as "hard problem of consciousness" which is cognitional to the perennial "mind-body problem".

"The whole duality of mind and matter [...] *is a mistake; there is only one kind of stuff out of which the world is made, and this stuff is called mental in one arrangement, physical in the other"* (Lord Bertrand Russell, 1913). Other eminent proponents of the non-dual perspective are, for instance, William James (*1842;†1910), the Austrian-born quantum physicists and Nobel laureate Wolfgang Pauli (*1900; †1958), and the Swiss depth-psychologist/psychiatrist Carl Gustav Jung (*1875;†1961). Jung and Pauli had a long and voluminous correspondence which resulted in the "Pauli-Jung conjecture" of dual-aspect monism. Moreover, the œuvre of the great polymath William James (whom many regard as the founding father of American psychology) discusses the topic of mind-matter duality *in extenso*. *"Granted that a definite thought, and a definite molecular action in the brain occur simultaneously, we do not possess the intellectual organ, nor apparently any rudiment of the organ, which would enable us to pass by a process of reasoning from the one phenomenon to the other. They appear together but we do not know why."* (William James, 1890)

In this day and age the vast majority of contemporary mainstream neuroscientists assume *a priori* that the brain produces consciousness (perhaps somewhat analogous to the way the liver secretes bile). However, this is merely a provisional (though consensual) working hypothesis which has not been conclusively corroborated by empirical evidence (correlation≠causation). Fallacious logic, dogmatism, implicit attitudes, belief-bias, conformity, and groupthink are important factors in this socio-political context (the materialistic paradigm receives significant amounts of funding from the military-industrial complex). Furthermore, due to the prevailing narcissistic/egocentric and hypercompetitive neoliberal climate the scientific community oftentimes lacks intellectual humility (which should ideally be approximately proportional to our degree of nescience) as these virtuous character traits are not reinforced by the metric-oriented academic (behaviouristic) incentive structure. In his influential book 'The Astonishing Hypothesis: The Scientific search for the Soul' (published in 1994) Nobel laureate Francis Crick (*1916;†2004; co-discoverer of the double-helix structure of DNA and formulator of the central 'dogma' [?] of molecular biology) stipulated *a priori* that "*a person's mental activities are entirely due to the behaviour of nerve cells, glial cells, and the atoms, ions, and molecules that make them up and influence them*." Recently the prominent German neuroscientist Cristof Koch (who collaborated with Crick over several years in an attempt to solve the hard problem of consciousness in a materialistic reductionist framework) diverged from the mainstream 'reductive materialism' stance which he supported for a long time. Koch wrote the following in a 2014 'Scientific America' article entitled 'Is Consciousness Universal?'

"Yet the mental is too radically different for it to arise gradually from the physical. This emergence of subjective feelings from physical stuff appears inconceivable and is at odds with a basic precept of physical thinking, the Ur-conservation law—ex nihilo nihil fit. So if there is nothing there in the first place, adding a little bit more won't make something. If a small brain won't be able to feel pain, why should a large brain be able to feel the godawfulness of a throbbing toothache? Why should adding some neurons give rise to this ineffable feeling? The phenomenal hails from a kingdom other than the physical and is subject to different laws. I see no way for the divide between unconscious and conscious states to be bridged by bigger brains or more complex neurons." (Koch, 2014)

Koch alludes to the so called 'explanatory gap': How do qualitative experiences (*qualia*) arise from a quantitative material substrate (atoms)? How does the brain (a collection of neurons) produce idiosyncratic subjective experiences? This is the hard problem science is facing. Perhaps the time is ripe to cogitate alternative (non-dual) epistemological/ontological models in order to recast our most basic scientific assumptions in a completely new perspective. The Möbius band, semiotically perceived as an abstract geometric metaphor for dual-aspect monism à la Pauli-Jung, provides conceptual impetus to facilitate new thinking, motivate explorative research, and ultimately enable systematic scientific inquiry in this novel direction which connects psychology and physics at the most fundamental onto-epistemic level.

For additional information and an animated Möbius model visit the following custom-made websites: **www.dual-aspect-monism.cf** and **www.moebius-band.ga**