

Studi - Commenti

The “Material” and the “Mental” as Brain Constructs

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Abstract For most philosophers it is “inconceivable” that neural states could give rise to mind. However, as Nannini demonstrates, this argument is very weak, because modern physics is full of aspects that are radically opposed to conventional thinking. Furthermore, the qualia problem represents a pseudo-problem which arises, whenever we confound events in our phenomenal world (“actuality”) with events in the consciousness-independent world (“reality”). Everything we identify and measure as “material” brain structures and functions is a mental construct of a “real” brain inaccessible to us, and as such a mental construct it cannot be the true origin of mind. We have to accept that the alleged fundamental property differences of the material and the mental world are conventions of our mind. At the same time, we may hypothesize that “in reality” mind and consciousness are mental fields as emergent properties of cortical electromagnetic fields.

KEYWORDS: Brain-mind Relationship; Qualia Problem; Actual and Real World; Electromagnetic Fields; Mental Fields

Riassunto “*Material*” e “*mentale*” come costrutti cerebrali – Per molti filosofi è inconcepibile che gli stati neurali diano origine alla mente. Tuttavia, come Nannini dimostra, l’argomento cui fanno appello è molto debole poiché la fisica moderna contempla numerosi aspetti che contraddicono il modo di pensare convenzionale. Il problema dei qualia rappresenta inoltre uno pseudo-problema riconducibile al fatto di confondere gli eventi nel nostro mondo fenomenico (l’attualità) con gli eventi di un mondo indipendente dalla coscienza (la realtà). Tutto ciò che identifichiamo e misuriamo come strutture “materiali” e funzioni del cervello è un costrutto mentale di un cervello “reale” che è a noi inaccessibile. Come tale un costrutto mentale non può essere la vera origine della mente. Dobbiamo accettare che le supposte differenze nelle proprietà fondamentali del mondo materiale e del mondo mentale siano convenzioni della nostra mente. Allo stesso tempo, possiamo ipotizzare che in realtà la mente e la coscienza siano campi mentali che si danno quali proprietà emergenti di campi elettromagnetici corticali.

PAROLE CHIAVE: Rapporto mente-corpo; Problema dei qualia; Mondo reale e mondo attuale; Campi elettromagnetici; Campi mentali



PROFESSOR NANNINI’S ARTICLE ADDRESSES
the central topic of the “philosophy of mind”,

i.e. the possibility – or impossibility – of
bridging the “fundamental explanatory gap”

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between mind and brain. This gap is emphasized as being “insuperable” not only by dualists who believe that the immaterial mind and the material brain represent two ontologically different entities, but also by those who, like Nannini, accept the naturalistic view that mental states are strictly bound to brain states. In most cases these latter, as “monists”, believe that mental states and brain states are nothing but two sides of the same coin, a position called “dual-aspect theory” or “property dualism”.

Numerous philosophers as well as naturalists have adopted this position by calling the origin of mind and consciousness (at least) in human evolution a miracle, a case of “strong”, i.e. inexplicable emergence.¹ More recently the Australian philosopher David Chalmers has reiterated this position. On the one hand he accepts that there is much empirical evidence that under earthly conditions mental states are strongly linked to brain states, but at the same time this is no proof of universal necessity, because it is impossible to *logically deduce* that certain brain states lead to mental states. Therefore, it cannot even be conceived how mental states could be constituted by brain states.²

For Nannini as a mind-brain naturalist “inconceivability” is a weak argument. In the history of science, there are many cases where philosophers or scientists called certain problems “unsolvable in principle” while a little later on these problems had been solved or at least brought close to a solution.

In two famous speeches in 1872 and 1880, the eminent German scientist Emil du Bois-Reymond (of Huguenot origin), regarded “father of modern neurophysiology”, listed a number of problems, which according to him despite all efforts would never be solved: (1) The essence of matter and energy, (2) the origin of motion, (3) the origin of conscious perception, (4) the origin of life, (5) the goal-directedness of nature, (6) human thinking and language, and (7) free will. He put his skepticism into the famous statement: *ignoramus et ignorabimus!*³ Du Bois-Reymond

elicited much protest against his “skepticism”, for example by the great mathematician David Hilbert, and the great biologist Ernst Haeckel, who both expressed a positive epistemological view by stating “we *will* know”!

The question is, whether the seven “world-riddles” of du Bois-Reymond, or at least some of them, have been solved in the meantime. Today, the majority of scientists believe that the problem of the origin of life has been solved by accepting that life originated from non-living matter on our earth 3-4 billion years ago without the intervention of a mystical vital force, although they would admit that a number of problems still exist, e.g. whether some of the necessary pre-biotic components were likewise formed on earth or came to it via meteorites.⁴

In a similar vein, many philosophers and scientists nowadays believe that the problem of “free will” is a pseudo-problem inherited from theology, as is evident in Kant’s philosophy, and hold that what people really mean by freely-willed actions can be fully explained by insight from psychology and neurobiology. Similarly, the concept of “goal-directedness” in nature has been replaced by modern evolutionary biology by demonstrating that the impression of directional forces in nature results from an interplay between genetic variance and environmental selection (we have to admit that in evolutionary biology many secondary problems still await further clarification).

There remain two complexes of problems, where even today many philosophers and scientists would admit that there has been little, if any, progress, one addressing the fundamental physical principles regarding matter, energy, gravitation, motion etc. and the other one addressing the origin of conscious mind.

Nannini’s article tries to bind these two complexes together at least with respect to the “inconceivability” argument. He argues that there needs to be a “paradigm shift” in the mind-brain discussion very similar to

what had happened when Einstein developed his Special Theory of Relativity (STR) first and his General Theory of Relativity (GTR) later.

Einstein was brought to STR by the fact that Maxwell’s theory of electromagnetism contradicted two fundamental assumptions of classical physics, namely that there is an absolute time running at the same pace in all possible physical systems, and that there is an absolute, isotropic space against which velocities of all possible physical systems can reliably be measured.

The result of the famous Michelson and Morley experiment of 1887 that light travels at an absolute speed irrespective of the speed of all possible physical systems led Einstein to his space-time theory and to the abandonment of absolute simultaneity of events. While STR had been developed for inertial systems and “flat” geodesics (or flat space) only, Einstein extended it to the GTR by generalizing the STR principles to accelerated systems and curved geodesics as a consequence of mass and demonstrating that gravitation is a consequence of curved space-time.

As illustrated by Nannini, STR and GTR were made possible by two facts, namely first by the fundamental discrepancies between new empirical findings (e.g. properties of electromagnetic fields, non-existence of an ether as a motionless carrier medium as demonstrated by the Michelson-Morley experiment) and classical physical assumptions, and second by *radically abandoning* deeply rooted physical concepts regarding absolute time and space and gravitational “forces”. It was indeed “inconceivable” for most physicists and philosophers of Einstein’s time that time is not absolute, that space is not isotropic and that the speed of light was both limited and not linearly additive. Accordingly, even eminent physicists and mathematicians had a hard time to accept STR and even more GTR.

However Einstein’s theories provided an explanation for why under conditions, where velocities are far below the speed of light,

STR and especially GTR phenomena such as time dilation or length contraction are negligible. While STR was experimentally confirmed relatively soon, most of GTR remained unproven for a long time until more and more observations were made that were consistent with the predictions of GTR like gravitational time delay, gravitational lenses, black holes, etc.

More and more previously skeptical people became convinced because of the fact that the phenomena and laws of classical Newtonian physics could be demonstrated as *special cases* of more general principles described by STR and GTR. The illusion created by classical physics consisted predominantly in the belief that the way things happening in ordinary life and on earth holds for all circumstances in the entire universe. To what degree is this situation found in classical vs. relativistic physics (let alone quantum mechanics) applicable to the situation found in philosophy of mind and cognitive neuroscience?

In his article, Nannini emphasizes a strong similarity between the two fields. In a certain sense, this is correct. In the same way, as physicists and philosophers of Einstein’s time stated that the claims of STR and especially GTR were “absurd”, “inconceivable”, “mentally insane”, etc., in these days brain scientists and physicalist-naturalist philosophers proposing a naturalistic explanation of the origin of mind and psyche in the brain or of free will are attacked by other philosophers using more or less the same words. Their arguments are based on the same belief, i.e. that things are the way we perceive them.

Their main argument goes: We are unaware of neurons, while we are thinking, and we experience no limbic activity while we are in love. Conversely, when neurobiologists carry out measurements, they don’t see thoughts, romantic love – what they see are firing neurons, the release of transmitters, hormones etc. Generally speaking, they may most accurately study brain processes, but

they will never encounter phenomena that appear exclusively at the level of self-experience (thoughts, emotions, decisions etc). When there is mind, there is no brain, and when there is brain, there is no mind.

Under favorable conditions I may be able to demonstrate a *strict correlation* between brain states and mental states. If I am lucky, I may even predict the occurrence of certain mental states (experienced by myself in a self-experiment or on the basis of report from others) based on certain brain activities – sometimes 10 seconds before the appearance of the mental states. In an impressive experiment, electric stimulation of a certain brain region (the pre-SMA region of the cortex) had the consequence that the subject or patient executed a movement (e.g., raising his/her arm) and explained that he/she just *wanted* to do this.⁵ Thus the subjective feeling of free will can be elicited electrically in the brain.

All this might convince a skeptical philosopher that contrary to classical dualism mental states are inseparably bound to brain states. He might even refrain from the position of *interactive dualism*, because this concept cannot be reconciled with the fact that brain activities *precede* mental activities in a systematic way. Will he/she then become an adherer of *functional reductionism* in the sense that mental states are reducible to functional states, and that these functional states are reducible to brain states, as described by Nannini?⁶

Not necessarily. On the basis of an immense wealth of evidence, we may assume that every mental state is preceded and accompanied by identifiable brain activities. However, whether we are allowed to speak in this context about a *functional reduction* of brain states is an open question.

We may state that thinking is impossible without activity in the prefrontal cortex combined with synchronization of the neurons involved and oscillatory phenomena within the gamma band, etc. (as stated in Nannini's article), but at present we must admit that with

respect to synchronization and oscillation phenomena we do not know to which degree they are really necessary for thinking, and certainly they are not sufficient.

The same holds for activity of the thalamus, the reticular formation, the release of neurotransmitters and neuromodulators. If we block one of these processes (e.g. by applying anesthetics), we may even abolish conscious thinking, but at present there is no universally accepted theory of such effects. In all these phenomena, there may be hitherto unknown factors. Thus, a *functional* reduction of consciousness is at least incomplete at present.

What we can firmly state, however, is that in all cases where we find a close relationship between mental states and brain states, physical laws, e.g. regarding the conservation of energy and impulse, are fully obeyed. Consciousness is metabolically very expensive, because it requires fast changes in synaptic coupling and fast restitution of certain transmitters and modulators. This tells us: however difficult it may be to understand the relationship between mental states and brain states, this relationship occurs within the framework of physical principles.

Thus, we can safely adopt a *physicalist* stance by stating that mental processes are some (even strange) sort of physical processes, because by definition processes that underlie the laws of physics are physical ones.⁷

But can we arrive at a true *reductionist* physicalism? I don't think so, because the "fundamental explanatory gap" as mentioned above, appears to remain. The best we can reach is an operational explanation of mental states: a given mental state will arise, if certain neurobiological events occur. However, did we explain how it *feels* when we have that mental state (thoughts, emotions, decisions)?

Certainly not. Even if we identified all neurophysiological and neuropharmacological factors leading to being in love plus all interactions of the brain with its body and with the environment, we would not explain the *feeling* of that state, the qualia, as having properties

that apparently are fundamentally different from anything else in physical nature.

We may object that such “fundamental” differences in properties are not exclusively found in the brain-mind relationship, but occur as “emergent properties” at all levels of nature, especially when we proceed from the level of quantum mechanics to the macro-physical world on earth and within our solar system and finally to large-scale conditions of relativistic physics. But even when passing from non-living to living nature, phenomena occur which for thousands of years had been regarded as “fundamentally different”. Thus, consciousness may be understood as an emergent, albeit not a metaphysical property of the physical brain.

However, our skeptical philosopher could bring forward a seemingly ultimate argument to demonstrate that the brain-mind relationship is indeed fundamentally different from anything else in the world. The emergence of new properties at the transition from quantum mechanics to macrophysical and finally to relativistic levels can be – and in many cases has been – demonstrated empirically either by observations or experiments, for example when we study the properties of elementary particles or of objects moving at near-light speed.

By carrying out such observations or experiments, we remain within the domain of physical observations, how different they may appear, and we can demonstrate under which conditions relativistic processes turn into processes where classical Newtonian physics are approximately valid. This however, is impossible when relating the properties of the brain and properties of our mind. They appear to belong to two fundamentally different, i.e. non-overlapping domains, with no conceivable transition between them.

This line of arguments, however, is based on a fundamental *epistemological* error. This error consists in the following: There is little doubt that all conscious perceptual, cognitive, emotional states result from the activity of neurons and neuron ensembles under very

specific conditions. Therefore, they must be regarded as *constructs* of the brain constituting what I have called “actuality” (*Wirklichkeit* in German),⁸ and in numerous cases neurobiologists are able to demonstrate how these constructs occur in the brain.

However, if we accept that our conscious acts are brain constructs, their properties should not be mistaken as properties of the “*real*” *external world*. This is commonly accepted in the case of colors, where everybody is willing to admit that colors “do not exist in the outside world”, but are constructs of the brain. But this is equally true for the perceived difference between “mental” phenomena (thoughts, memories), bodily sensations (moving my arm) and “material” events of the outside world (stones, tables, planets), i.e. these phenomenal differences likewise are constructs of the brain, and the neurobiologists may demonstrate that different brain regions are involved in the representation of events in the outside world, of our body and of our mental acts.

The different representations of these three worlds (environment, body, mind) develop slowly during the development of brain and mental functions. The first fundamental distinction a brain has to make is between body, which can be controlled directly and gives sensory feedback, and environment, which as “non-body” cannot be directly controlled and does not give sensory feedback.

At a subsequent stage, the child learns that there are states that are neither environment nor body and are called thoughts, ideas, memories, imaginations, acts of will etc. by the adults. It is very important for the child not to confound these mental states with “real” things, and the step from a magic world view to realism is important for the intellectual development of the child. The distinction between a material world (including – with some problems – the body) and an immaterial, mental world again is a construct of our brain.

As a consequence, we have to accept that those brains which I study as a neurobiologist

are likewise constructs of my brain which like all objects that can be seen, heard, touched, smelled or tasted belong to the “material” world, are strictly separated by the brain from “immaterial” mental events. As brain constructs, these neurons when *perceived* under the microscope or in an electrophysiological experiment trivially do *not* give rise to mental states (constructs do not construct!), rather this is done by “real neurons”.

Accordingly, when a philosopher asks the question how mind could originate from neurons that can be perceived, he/she asks a question that is based on a *category mistake*. Since the brain, over years of development of the infant brain, has put much effort into a clear distinction between “material” and “immaterial” things (both being constructs), later it must appear fully enigmatic to our mind how those neurons could give rise to the mind (which they don’t!). When a philosopher states that there is a fundamental gap between the properties of brain states and of mental states, he/she falling into an epistemological trap the human brain has built while developing a phenomenal (“actual”) world.

Thus, the epistemologically correct question would be how “real” neurons existing in a world independent of our mind give rise to mind. However, together with Kant, we have to accept that the “true” nature of the world including the real neurons is inaccessible to us. We may hope that the properties of these “real” neurons are not far from those we perceive and investigate in our phenomenal world, but their relationship with mental states must remain undefined.

In humans (and probably in some animals), “real” brains and neurons may be assumed to have properties from which mental states originate, as we experience them. In that sense, mind can be regarded as an “emergent property” of “real” neuronal structures like the primate/human cortex.⁹

Summing up, based on neurobiological evidence we recognize that mental states are inseparably bound to brain states, and that

specific brain states not only parallel, but precede specific mental states. Furthermore, we need to treat mental states as “physical”, because their appearance strictly obeys the fundamental laws of physics. This explains why brain states influence mental states, and vice versa.

Finally, despite all progress in the neurosciences, subjective experience as something “immaterial” opposed to the “material” world, seems to persist. However, this turns out to be a fallacy of our brain, because what our mind considers to be material and immaterial are brain constructs. Brains and neurons as physical entities can be considered neither material nor immaterial, because these are distinctions created by the brain for practical reasons. Expressing it in Kant’s terminology: neurons are “material” and mind “immaterial” *for us*.

Since in our “actuality” we empirically and consistently discover that some brain states give rise to conscious mental states, it is most reasonable (although can never been proven objectively) that under very specific circumstances “real” neurons possess the ability to produce consciousness as basis of our actuality.

Notes

¹ See, e.g., K. LORENZ, *Behind the Mirror. A Search for a Natural History of Human Knowledge*, Mariner Books, 1973; K.R. POPPER, J. ECCLES, *The Self and Its Brain*, Springer, Heidelberg/ Berlin/New York 1984.

² See D.J. CHALMERS, *The Conscious Mind. In Search of a Fundamental Theory*, Oxford University Press, Oxford/ New York 1996.

³ “We don’t know and we will never know”.

⁴ See G. ROTH, *The Long Evolution of Brains and Minds*, Springer, Dordrecht/Berlin/Heidelberg/ New York 2013.

⁵ See M. DESMURGET, K.T. REILLY, N. RICHARD, A. SZATHMARI, C. MOTTOLESE, A. SIRIQU, *Movement Intention after Parietal Cortex Stimulation in Humans*, in: «Science», vol. CCCXXIV, n. 5928, 2009, pp. 811-813.

⁶ See S. NANNINI, *Time and Consciousness in Cognitive Naturalism*, in: «Rivista Internazionale di

Filosofia e Psicologia», vol. VI, n. 3, pp. 458-473, here p. 466.

⁷ See G. ROTH, *The Long Evolution of Brains and Minds*, cit.

⁸ See G. ROTH, *Das Gehirn und seine Wirklichkeit*, Suhrkamp, Frankfurt a.M. 1994.

⁹ For details see G. ROTH, *The Long Evolution of Brains and Minds*, cit.