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Emergentist Monism, Biological Realism, Operations and Brain-Mind Problem

Reply to Comments on "Natural world physical, brain operational, and mind phenomenal space-time" by An.A. Fingelkurts, Al.A. Fingelkurts, C.F.H. Neves

Andrew A. Fingelkurts, [a,1] Alexander A. Fingelkurts [a] and Carlos F.H. Neves [a]

[a] *BM-Science – Brain and Mind Technologies Research Centre, Espoo, Finland*

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We would like to thank all the commentators who responded to our target review paper [1] for their thought-provoking ideas and for their initially positive characterization of our theorizing. Our position provoked a broad range of reactions, from enthusiastic support [2-4] to some kind of opposition [5,6]. Regardless of the type of the response, one common factor appears to be the plausibility of a presented attempt to apply insights from physics, biology (neuroscience), and phenomenology of mind to form a unified theoretical framework of Operational Architectonics of brain-mind functioning.

Indeed the most unresolved theoretical issue of greatest human significance about which scientists might hope to gain some clarity of understanding is *consciousness* (the entity that none can easily define, but all know exists [7]), its neural constitutes, and its place and role in physical world. The focus of the target review essay was to discuss how

[1] Tel: +358-9-5414506, Fax: +358-9-5414507;
E-mail: andrew.fingelkurts@bm-science.com
Url: http://www.bm-science.com/team/fingelkurts.html

space and time dimensions are implemented in the physical world, in the brain, and in the mind through hierarchy of space-time patterns. The main hypothesis was that via the brain operational space-time the mind subjective space-time is connected to otherwise distant physical space-time reality. It seems to us that all commentators but Walter Freeman [4] failed to grasp this paradigmatic nature of the target review paper and instead concentrated on either their own paradigmatic assumptions (Gerhard Werner [5] and Wolfgang Tschacher [6]) or on some important but private aspects, isolating them from the whole context of the review essay (Johnjoe McFadden [2], Robert Kozma [8], and Giorgio Marchetti [3]).

This Reply paper does not challenge commentators' opinions; rather it aims to clear up several misunderstandings and misrepresentations of the target review paper. We begin this Reply by elucidating some of the general aspects that have been raised by commentators. While replying, we take up the individual commentaries in an order that, we hope, serves to be coherent to clarify our own views.

Two commentators name our theoretical approach as 'dualistic'. McFadden [2] calls it 'scientific dualism', which claims that the mind is indeed made of different stuff than the brain. According to this view the brain is made of matter, while the conscious mind is made of the electromagnetic fields generated by the neural activity of the brain. Tschacher [6] calls our framework "an interesting dualist framework of the physical and phenomenal space-time domains" without giving any reasons why he thinks so. We could not agree with both of them; especially with the Tschacher's articulation, which suggests that we maintain the 'Cartesian mind-body distinction'.

Generally, we do not assume that the experiential component of consciousness is ontologically separate and distinct from the physical mechanism by which it is instantiated. The central claim of the target review paper [1] is the '*ontological monism*'. However, unlike '*dual-aspect monism*', which argues that the mental and the physical are two different ways to characterize the one and the same phenomenon, we rather speak about '*emergentist monism*' according to which the relationship between the mental and the physical (neurophisiological) is hierarchical and metastable [9]. According to this view, emergent qualities (conscious mind) necessarily manifest themselves when, and only when, appropriate conditions are obtained at the more basic level (brain). A formal

definition of emergence states that *P* is an emergent property of *S* if (a) there is a law to the effect that all systems with this same micro-structure have *P*; but (b) *P* cannot, even in theory, be deduced from the most complete knowledge of the basic properties of the components C_1, ..., C_n of the system *S* [10]. Here we would like to make several clarifications to what has been stated in the target review paper.

In the target paper [1] it is stated that: "the operational (OST) level of brain organization intervenes between internal physical brain architecture (IPST) on one side, where it literally resides, and experiential/subjective phenomenal structure of the mind (PST), to which it is isomorphic, on the other". Thus the operational level ties these two (neurophysiological and subjective) domains ontologically together. At this level of brain organization all OST phenomena reside and interrelate – in other words, the OST level constitutes consciousness, rather than 'emits' it in any mysterious way. It might be not completely clear in our target paper that in the proposed model *emergentism* allowed between brain (IPST) itself and its electromagnetic field (OST), while operational level of brain organization (OST) is related to phenomenal level (PST) though *supervenience*, which suggests a more strict relations between higher (mind) and lower (operational level) phenomena in comparison with emergentism [11]. These dependences are highlighted in the Fig. 1, which is the modification of Fig. 11 of the target review paper [1].

The supervenience might be taken to mean that there cannot be change in the arrangement of higher-order phenomena without changing their underlying microphysical properties [12]. Within the context of the brain-mind problem conceptualized within our Operational Architectonics framework, this means that mental spatial-temporal patterns should be considered supervenient on their lower-order spatial-temporal patterns in the operational level of brain organization. Emergentism on the other hand, usually allows for changes of higher-order phenomena that need not possess a one-on-one, direct linkage with changes at any underlying lower-order levels [10]. Thus, the mental is ontologically dependent on, yet not reducible to, the physical (neurophysiological) level of brain organization. However it is reducible to the operational level, which is equivalent to a hierarchically organized local electromagnetic brain fields and is constituent of phenomenal level.

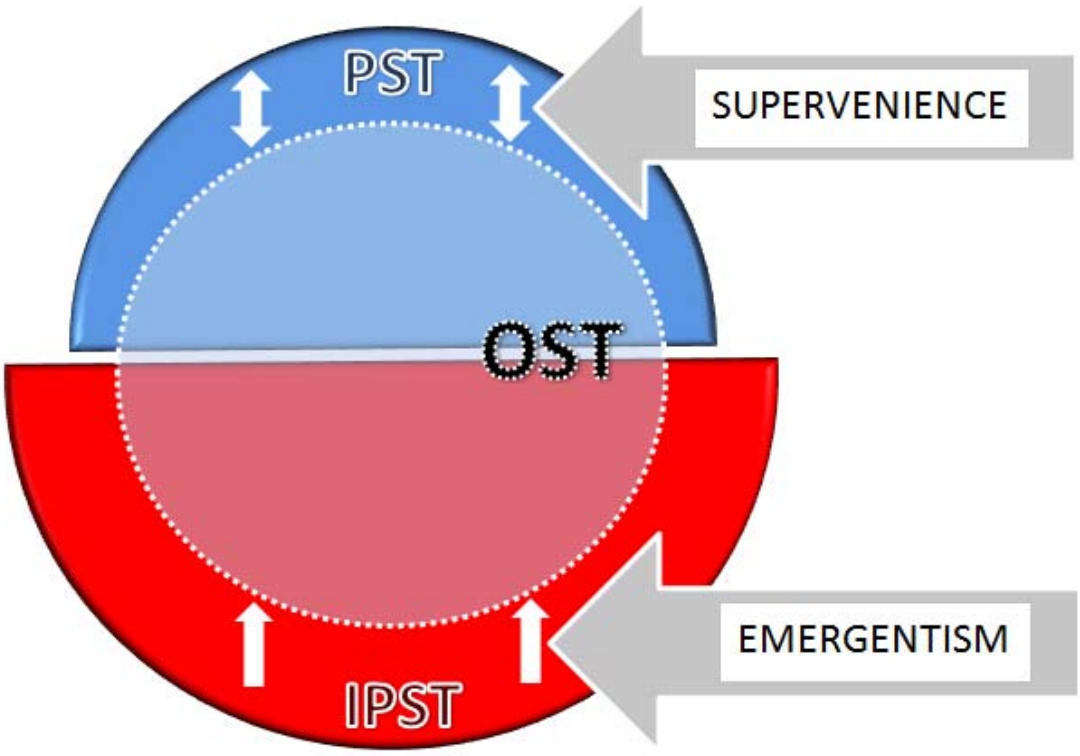

Figure 1. Different levels of the brain-mind organization and their relation to emergentism and supervenience. Electromagnetic brain field (OST level) is the emergent property of brain itself (IPST level). Phenomenal level (PST) supervenes on operational level of brain organization (OST). IPST indicates the internal physical space-time of the brain (red color); OST indicates the operational space-time of the brain (indicated by white puncture line); PST indicates the phenomenal space-time of consciousness (blue color). In this model the OST level represents the constitutive mechanism of phenomenal consciousness; it ties the phenomenal (subjective) and neurophysiological (physical) levels together.

Scientists therefore need a science or mode of scientific program that considers a theoretical structure adequate to the described level of complexity. We think the proposed by Antti Revonsuo [13] 'Biological Realism' that directly studies the interface between neural and mental phenomena perfectly suits this purpose. As it is stated in our target review assay [1], Biological Realism has several assumptions: (a) consciousness exists in its own right; meaning that it is separate from other cognitive functions and can be independent from external physical reality (for example dream experience; see target

article for the appropriate references) and thus should be studied as an independent variable in its own terms (for the argumentation, see the target article), (b) it is a natural phenomenon, (c) it has some causal powers distinct from purely neurophysiological (non-phenomenal) realm; recent neuroimaging and cognitive studies have demonstrated that mental processes or events do exert 'downward' causal influence on brain plasticity and the various levels of brain functioning and that the conceptual representation of an ambiguous perceptual stimulus biases sensory processing (see target article for the appropriate references), and (d) it ontologically depends on brain – the spatial location of the mental phenomenon in the natural world.

Here we come to the concerns raised by Werner [5]. Most of his criticism relating to the fact that he, from one side, denies the ontological dependence of consciousness on the brain and, from the other side he does not support the existence of 'downward' causal influence on the brain. We believe that there are epistemological difficulties with such position. If a subjective experience does not related to the brain, and is located anywhere else but in the brain, then it is a spatial-temporal structure that exists, but does not exist in any space known to modern science. This makes Werner's position a spiritual or mystic because the experienced images or objects are in principle beyond detection by scientific means, and therefore it is a theory which is impossible to disprove.

Perhaps such position of Werner leads him to raise another concern about our usage of the notion of 'complimentarity'. In relation to this he asks: "Does 'paralleling' mean psycho-neural identity? If not, what drives the emergence of phenomenal features from the physical dynamics of neuron assemblies?" [5]. It is somehow unexpected that Werner fails to catch the answers to these questions which are discussed in much detail in the target review paper. Here, constricted by the limitations of the space we could give only very brief comment. These questions are all mistaken from the standpoint of Biological Realism, since there are no repetitions of the 'subject-object' relation inside the phenomenal level. As it is stated in the target review assay [1], the phenomenal level constitutes the space where phenomenal experiences 'springs' to life through organized spatial-temporal patterns of lower-level of brain organization – Operational Modules (operational level). It is important to keep in mind that neither the whole phenomenal level, nor its parts are somehow perceived by themselves or by some other mental

processes. It is the phenomenal level as a whole that constitutes the subject. It is precisely for these reasons that the nature of phenomenal objects is regarded as self-presenting (see the target review article for details).

Werner is certainly right in claiming that the term ‘isomorphism’ is a polysemous word, with different meaning in different contexts. It is exactly because of that we dedicated quite a long paragraph to the meaning of the isomorphism notion in the target review paper. We believe that our description of ‘*second-order functional isomorphism*’ leave no doubt about the precise meaning of that term in the context of target paper. We redirect the interested reader to the footnote 61 of the target review article [1] for a discussion of this issue.

Werner concludes that there is a need for a different framework for viewing the relation between phenomenal and neural domains, where metastable neural processes obeying physical laws, while the alleged mental counterparts are symbolic processes following their own laws. He proposes adopting Nonlinear Dynamics as a more hospitable framework for examining qualitative mappings between the two domains [5]. This suggestion is puzzling for us since our Operational Architectonics theory utilizes the nonlinear dynamics as an important part. Consider only one example from the target review article [1]: “…we propose that it is both possible and instructive to consider phenomenological structure of consciousness in non-representational terms. Clearly, this structure appears sufficiently stable (quasi-stable) in the short term (experienced ‘now’) and this property allows it to be described in symbolic terms. However, if we wish to tackle the issue of emergent properties that lie at the core of the phenomenology, the symbolic description will benefit from an explicitly non-symbolic account which can be derived from nonlinear dynamics. Taking a step in this direction means reconciling the symbolic description as follows: The dynamic spatial-temporal brain organization (IPST) does not represent information to any mental faculty but, rather, directly presents it within the operational structure (OST) which in general case refers to the outside physical world.” At the same time, the apparent lack of Nonlinear Dynamics terminology usage in our Operational Architectonics is due to the following: (a) we do not use Nonlinear Dynamics tools for analysis of EEG field and (b) it is difficult to give meaningful and noncontroversial neurophysiologic interpretations to many of Nonlinear Dynamics terms.

Another alternative approach to interpret the experimental findings discussed in the target review article was proposed by Kozma [8]. He suggests to use the concept of complementarity. We have argued along these lines in the past [9]; however, as it is discussed in the target review assay, complementarity is not contradictory to isomorphism, which serves as so-called 'glue' in the brain-mind metastable continuum. This brain-mind unity, in our view, has hierarchical organization and, therefore, the isomorphism is necessary. To be accurate, isomorphism is only one aspect of our much more general framework of Operational Architectonics, which utilizes the complementarity as well. At the same time we are in complete sympathy with Kozma claim [8] that "…the phenomenology of the neurophysiological processes in cortical tissues requires tools which go beyond the mathematical and physical theories used for characterizing processes in non-living substances." In this context we hope that discussed in the target review paper [1] framework of Operational Architectonics of brain-mind functioning will stimulate new mathematical modeling approaches.

The central notion of our Operational Architectonics theory is 'operation' and it is the whole subsection dedicated to this notion in the target review paper [1]. However, Tschacher states in his commentary [6] that our usage of the concept of 'operation' is too general. To support his claim he quotes our statements out of context, such as: "everything that can be represented as a process is an operation", or "there is always a more complex operation/operational act that subsumes the simpler ones". These attribute to us over-generalized, categorical claims that do not well represent the view that we in fact hold. In the target review paper the mathematically accurate definition of the notion of 'operation' is provided and analyzed. The mentioned generalizations have sense only in the light of such definition. Marchetti in his commentary [3] has expressed in an admirably clear and sensible way the essential justifications for our usage of term 'operation' and elucidates its role for the scientific program of brain-mind research.

Tschacher further claims that it remained opaque to him how 'operational modules' (OM) mediate between the physiological and phenomenal domains. As an alternative he offers 'resource economies' properties that as he states would help unite mental and physical space-time [6]. Tschacher's pessimism about OMs seems unjustified since in the target review paper [1] there is extended discussion and analysis of how OMs are

emerged and what their nature is. Different phenomenal features are presented in the brain by local fields/operations generated by different transient neuronal assemblies. Temporal synchronization of these local fields/operations produces complex brain operations. As a result, metastable brain states emerge that accompany the realization of such brain complex operations, whereas each of them is instantiated by the volumetric spatial-temporal pattern in the electromagnetic field. We call these metastable spatially and temporally organized patterns in the electromagnetic field as OMs. It is exactly within this context the OMs are no longer arbitrary. Their form (spatial aspect) and temporal dynamics (time aspect) reflect certain patterns/objects/scenes that they represent. Since an OM has a defined spatial-temporal structure, this opens the possibility for the phenomenal manifestation of infinite complexity of the physical world patterns/objects/scenes. The economy of resources has sense also only within this context, since many transient OMs can coexist at the same time but within different temporal scales, thus presenting several unrelated patterns or objects (for the detail discussion see [1]).

Due to electromagnetic field nature of OMs, the whole Operational Architectonics theory can be considered as one variant of the 'field theory of consciousness'. The earliest scientific statements about field theory of consciousness can be found in 1929 in writings of Aron Gurwitsch [14] (see also his more modern publication [15]). The whole view was abundant until the last decade, when, as pointed by McFadden in his commentary [2], the idea that the brain's electromagnetic field could be the seat of consciousness has been gaining new interest and reinvigorated ground [16-18].

The commentary of Freeman [4] presents an exciting and extremely interesting extension of the Operational Architectonics theory presented in the target review article [1]. Based on the Freeman's data [4] we could suggest that OMs, expressed as multivariate feature vectors, are connected not to microscopic sensory information, but instead to the history, context, and significance of the information for the subjects. Freeman stresses that these global patterns are the best available candidates we have for connecting neural activity to thinking.

Concluding, we would like to stress that our target review article [1] was physically, biologically (neuroscientifically), and phenomenologically motivated. It is obvious that in

any review that impinges on so many different fields, it should go without saying that commentators are unlikely to agree with everything presented. Nevertheless, all of them express their interest in our Operational Architectonics theory and recognize its credibility to possess sufficient levels of description and explanation to help account for a unified framework of physical, operational, and phenomenal space-time of brain-mind organization.

Once again we would like to acknowledge with gratitude all commentators for the attention and effort they put into reading and responding to the target review article.

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