The Most Optimal Dual-Aspect-Dual-Mode Framework for Consciousness: Recent Development

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Abstract

Previously (Vimal, 2009b) in Whitehead Psychology Nexus Studies, we discussed (i) the dual-aspect-dual-mode proto-experience (PE)-subjective experience (SE) framework of consciousness based on neuroscience, (ii) its implication in war, suffering, peace, and happiness, (iii) the process of sublimation for optimizing them and converting the negative aspects of seven groups of self-protective energy system (desire, anger, ego, greed, attachment, jealousy, and selfish-love) into their positive aspects from both western and eastern perspectives. In this article, we summarize the recent development since then as follows. (1) In (Vimal, 2009e), we rigorously investigated the classical and quantum matching and selection processes for precisely experiencing a specific SE in a specific neural-network. (2) In (Vimal, 2009i), we unpacked the quantum view of superposition related to the *superposition*-based hypothesis H_1 of our framework in terms of subquantum dual-aspect primal entities (*bhutatmas*) and addressed the related explanatory gaps. (3) In, we developed alternative hypotheses of our framework, namely, the *superposition-then-integration-emergence* based H_2, the *integration-emergence* based H_3, the *intelligent mechanism* based H_4, and the *vacuum/Aether* based H_5. We concluded that our framework with H_1 is the most optimal one because it has the least number of problems (Vimal, 2009j). (4) In, we found over 40 different but overlapping meanings attributed to the term 'consciousness' and suggested that authors must specify which aspect of consciousness they refer to when using this term to minimize confusion (Vimal, 2009f). (5) In, we proposed definitions of consciousness, qualia, mind, and awareness (Vimal, 2009h). (6) In, we investigated

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the *necessary* ingredients for *access* (reportable) consciousness: wakefulness, re-entry, attention, working memory and so on (Vimal, 2009g). (7) In, we discussed Nāgārjuna's philosophy of dependent co-origination with respect to our PE-SE framework (Vimal, 2009a). (8) In, we linked dynamic systems theory and fractal catalytic theory with standard representation theory using our framework (Vimal, 2009d). (9) In, we introduce the PE-SE aspects of consciousness in theoretical classical and quantum physics including loop quantum gravity and string theory (Vimal, 2009k). (10) In (Vimal, 2009c), we proposed that the SE of subject or 'self' in self-related neural-network is tuned to the self-related SEs/PEs superposed in other innumerable entities during *samadhi* state via matching and selection processes. This leads to bliss, ecstasy, or exceptionally high degree of climax at *samadhi* state. We conclude that, so far, the dual-aspect-dual-mode PE-SE framework with hypothesis H_1 is the most optimal framework for explaining our conventional reality because it has the least number of problems.

Keywords: Evolution of consciousness; Internal representation; Sensorimotor interaction; Dual-aspect model; Subjective experience; Proto-experiences, Explanatory gap; Mind-brain problem; *Purusha; Prakriti*; Eastern and Western perspectives; Yoga; Sublimation process; Whitehead; *Process and Reality*; Occasions of experience; *Superposition*; Subquantum dual-aspect primal entities (*bhutatmas*); *Superposition-then-integration-emergence; Integration-emergence; Intelligent mechanism; Vacuum/Aether;* qualia; Mind; Awareness; Nāgārjuna; Classical and quantum physics; Loop quantum gravity; String theory.

Introduction

Previously in Whitehead Psychology Nexus Studies (Vimal, 2009b), we proposed a dual-aspect-dual-mode proto-experience (PE)-subjective experience (SE) framework of consciousness based on neuroscience. This consists of four components: (1) dual-aspect primal entities; (2) the *neural-Darwinism*: co-evolution and co-development of SEs and associated neural-nets from the mental aspect (that *carries* the SEs/proto-experiences (PEs) in *superposed* and unexpressed form) and the material aspect (mass, charge, spin and space-time) of fundamental entities (strings or elementary particles), respectively and co-tuning via sensorimotor interaction; (3) the "matching and selection processes: interaction of two modes, namely, (a) the non-tilde mode that is the material and mental aspect of cognition (memory and attention) related feedback signals in a neural-network, which is the cognitive nearest

past approaching towards present; and (b) the tilde mode that is the material and mental aspect of the feed forward signals due to external environmental input and internal endogenous input, which is the nearest future approaching towards present and is a entropy-reversed representation of non-tilde mode; and (4) the *necessary* ingredients of SEs (such as wakefulness, attention, re-entry, working memory, stimulus at or above threshold level, and neural-net PEs). This framework leads to structural and functional coherence between the mind and the brain, bridges the explanatory gap (the gap between SEs and their neural-correlates), and leads to our mundane subjective experiences. This dual-aspect-dual-mode PE-SE framework could be the fundamental basis of various religions and philosophies. This is a Western perspective. On the other hand, Eastern perspectives emphasize the practical methods for achieving *altered* experience at *samadhi* state. An important corollary of these methods (such as yogic method) is the sublimation of negative aspects of seven groups of self-protective energy system (desire, anger, ego, greed, attachment, jealousy, and selfish-love) into their positive aspects. Their negative aspects create war and suffering, whereas their positive aspects advance science and technology, family values, peace, and happiness. Here, the Western perspective framework is extended to include the concepts of the sublimation process to encompass Eastern perspectives. The four elements (war, suffering, peace, and happiness) are ubiquitous in both space and time because they are essential contributors to the variations for natural selection in our evolutionary system. The sublimation process optimizes the system: minimizes war and suffering, maximizes peace and happiness, and enhances family values and individual progress. This is consistent with both Eastern and Western perspectives" (Vimal, 2009b). Here, we list the recent development in our framework and provide our current conclusion related to the working hypothesis H_1 of our framework.

1. Matching and Selection Processes

In (Vimal, 2009e), we incorporated "the dual-mode concept in our dual-aspect PE-SE (proto-experiences - subjective experience) framework. The two modes are: (1) the non-tilde mode that is the material and mental aspect of cognition (memory and attention) related feedback signals in a neural-network, which is the cognitive nearest past approaching towards present; and (2) the tilde mode that is the material

and mental aspect of the feed forward signals due to external environmental input and internal endogenous input, which is the nearest future approaching towards present and is a entropy-reversed representation of non-tilde mode. We propose that (i) the *quantum conjugate matching* between *experiences* in the mental aspect of the tilde mode and that of the non-tilde mode is related more to the mental aspect of the quantum microtubule-dendritic-web and less to that of the non-quantum pathways, and (ii) the classical *matching and selection* processes to the mental aspect of the non-quantum pathways (such as classical axonal-dendritic neural pathway). In both cases, a specific SE is selected when the tilde mode interacts with the non-tilde mode to *match* for a specific SE, and when the *necessary* ingredients of SEs (such as wakefulness, re-entry, attention, working memory, and so on) are satisfied. When the conjugate match is made between the two modes, *the world-presence* (*Now*) is disclosed. The material aspects in the tilde mode and that in the non-tilde mode are matched to link *structure* with *function*, whereas the mental aspects in the tilde mode and that in the non-tilde mode are matched to link *experience* with *structure* and *function*" (Vimal, 2009e).

2. Subjective Experience Aspect of Consciousness: Integration of Classical, Quantum, and Subquantum Concepts

Originally in (Vimal, 2008b), we hypothesized that (1) strings or elementary particles have two aspects (material and mental) and are *carriers* of subjective experiences (SEs)/proto-experiences (PEs) aspect of consciousness in their mental aspect in superimposed form, and (2) a specific SE is selected by the matching and selection processes in a neural-net (Vimal, 2009e). This closes the Type-1 explanatory gap (how SEs can *emerge* from non-experiential matter). Furthermore, we discussed phenomenal time and its biological correlates based on our PE-SE framework (Vimal & Davia, 2008a, 2008b). In (Vimal, 2009i), we unpack "the quantum view of superposition in terms of subquantum dual-aspect primal entities (*bhutatmas*). This also integrates eastern and western perspectives, but leads to another type of subquantum Type-2 explanatory gap: how it is possible that our SEs (such as happiness, sadness, painfulness, and similar SEs) were already present in the

primal entities, whereas there is no shred of evidence that such SEs were conceived at the onset of universe. To address both gaps, the previous working hypothesis (H_1) is extended, which is proposed as follows: (1) String, elementary particles, and inert matter are the *carriers* of superimposed fundamental (not derived) SEs/PEs (Vimal, 2008b). (2) *Neural Darwinism* and the matching and selection processes assist in embedding and selecting a specific SE in a neural-net (Vimal, 2009e). (3) Some of the SEs (such as happiness, sadness, and the like) that entail Type-2 explanatory gap can be derived from the fundamental SEs/PEs (such as emotion-related PE) and the stimulus-context (such as emotional stimuli). (4) To eliminate any the residual Type-2 explanatory gap, (a) we assumed that fundamental SEs/PEs follow the principle of the *emergence* of SE and anti-SE (or *bhutatma* and *anti-bhutatma*) in a dual-aspect vacuum at the onset of universe, which is similar to the principle involved in the *emergence* of matter and anti-matter in vacuum; and/or (b) the cycles of universe (that may have memory) might have preserved irreducible fundamental SEs/PEs in the mental aspect of primal entities. And (5) SEs *occur/emerge* in neural-networks when essential ingredients of SEs (such as wakefulness, attention, re-entry, working memory and so on) are satisfied" (Vimal, 2009i).

3. Subjective Experience Aspect of Consciousness: Integration of Classical and Quantum Concepts for Emergence Hypothesis

Previously, we proposed a *superposition*-based hypothesis (H_1) in the dual-aspect-dual-mode PE-SE framework to address the Type-1 explanatory gap (how subjective experiences (SEs) aspect of consciousness can *emerge* from non-experiential matter) as follows: (1) fundamental entities (strings or elementary particles: fermions and bosons) have material and mental aspects and are *carriers* of SEs/proto-experiences (PEs) in their mental aspect in superimposed form (Vimal, 2008b), and (2) a specific SE is embedded in a neural-net via *neural Darwinism* and is selected by matching and selection processes (Vimal, 2009e). Then, we unpacked the quantum view of superposition in terms of subquantum dual-aspect primal entities (*bhutatmas*) and discussed Type-2 explanatory gap: 'how it is possible that some SEs (such as

happiness, sadness, painfulness, and similar SEs) were already present in primal entities, whereas there is no shred of evidence that such SEs were conceived at the onset of universe' (Vimal, 2009i). To address both gaps, we extended the working hypothesis H_1 as summarized above in the premises (3)-(5) of Section 2. In (Vimal, 2009j), "we propose two alternative hypotheses (*superposition-then-integration-emergence* based H_2, and *integration-emergence* based H_3 where superposition is not required) in addition to other speculative hypotheses: (H_2) fundamental entities and inert matter are the *carriers* of superimposed fundamental PEs (not SEs), which are *integrated* by interaction processes and *neural-Darwinism* (co-evolution via the evolutionary process of adaptation and natural selection, co-development, and sensorimotor co-tuning). In H_3, a string or an elementary particle has its own PE; a matter is not a *carrier* of PE(s) in superposed form as it is in H_2, rather it is a proto-experiential entity and has two aspects at every level; this is a dual-aspect panpsychism. In H_2 and H_3, a specific SE *emerges* in a neural-net from the interaction of its constituent neural-PEs, namely, from the interaction between the feed forward stimulus-dependent neural signals and the fronto-parietal feedback attentional signals, in analogy to water *emerges* from the interaction of hydrogen and oxygen. In all hypotheses, (a) interaction processes and *neural-Darwinism* are active, (b) there is a PE attached to every level of evolution (such as atomic-PE, molecular-PE, genetic-PE, bacterium-PE, neural-PE, neural-net-PE, and so on), and (c) SEs *emerge/arise* when essential ingredients of SEs (such as wakefulness, attention, re-entry, working memory and so on) are satisfied."

4. Meanings Attributed to the Term 'Consciousness'

In (Vimal, 2009f), we describe the "meanings (or aspects) attributed to the term consciousness, extracted from the literature and from recent online discussions. Forty such meanings were identified and categorized according to whether they were principally about function or about experience; some overlapped but others were apparently mutually exclusive – and this list is by no means exhaustive. Most can be regarded as expressions of authors' views about the basis of consciousness, or opinions about the significance of aspects of its contents. The prospects for reaching any single, agreed definition of

consciousness thus appear remote. However, much confusion could be avoided if authors were always to specify which aspects of consciousness they refer to when using the term. An example is outlined of how this can be done (using a 'PE-SE' framework)."

5. The Definition of consciousness, qualia, mind, and awareness

In (Vimal, 2009h), we proposed the definition of consciousness, qualia, mind, and awareness based on our framework: "The *optimal* definition (that has the least number of problems) of consciousness is: '*consciousness is a mental aspect of a system or a process, which has two sub-aspects: conscious experience and conscious function*.' A *general* definition (that accommodates most views) is: '*consciousness is a mental aspect of a system or a process, which is a conscious experience, a conscious function, or both depending on the context'*, where *experiences* can be conscious experiences and/or non-conscious experiences and *functions* can be conscious functions and/or non-conscious functions that include qualities of objects. The term *context* refers to metaphysical views, constraints, specific aims, and so on. Based on this investigation, (i) *qualia* are properties of *conscious experiences* and/or *qualities* of objects, (ii) *mind* includes *experiences, functions*, or both, and (iii) *awareness* includes *experiences, conscious functions,* and/or pre- and sub-conscious *functions*. These are *a posteriori* definitions because they are based on observations and the categorization."

6. Necessary Ingredients of Consciousness: Integration of Psychophysical, Neurophysiological, and Consciousness Research for the Red-Green Channel

One of the aspects of visual consciousness is the visual subjective experience (SE) or the first person experience that occurs/emerges in the visual neural-network of thalamocortical system (which includes

dorsal and ventral visual pathways and frontal cortex) during dynamic interactions among widely distributed neuronal groups (Vimal, 2009f). In (Vimal, 2009g), however, consciousness and SE are interchangeably used unless noted. "Consciousness can be either *access* (reportable) or *phenomenal* consciousness. For *access* consciousness, the interactions are between feed forward stimulus dependent signals and fronto-parietal feedback attentional signals. The *necessary* ingredients for *access* (reportable) consciousness are (i) wakefulness, (ii) reentrant interactions among neural populations, (iii) fronto-parietal and thalamic-reticular-nucleus attentional signals that modulate consciousness, (iv) working memory that retains information for consciousness, (v) stimulus at or above threshold level, and (vi) neural-network proto-experiences (PEs) that are superposed SEs embedded in a neural-network. Attention and the ability to report are not necessary for *phenomenal* consciousness. The neural source for the arousal system is the ascending reticular activating system in the brain stem, which brings the thalamocortical neural networks to wakeful state as a baseline for consciousness to occur. Reentrant interactions among neural populations bind stimulus attributes (such as location and features) and entail consciousness. Attention could be the results of reentry and competitive interactions, and modulates the stimulus related feed forward signal and consciousness. The 'sources' of attention may be thalamic reticular nucleus for bottom-up or frontal cortex for top-down direction. The 'target' of visual attention is 'V4/V8/VO' for Red-Green (R-G) channel. The neural correlates of the psychophysical entity R-G channel appear to be 'V4/V8/VO'-neural-network (retina → LGN ↔ V1 ↔ V2 ↔ 'V4/V8/VO', and areas for attention, memory, and wakefulness). The psychophysical Red-Green Channel, its neurophysiological correlates V4/V8/VO-neural-network, and related experience (such as *redness*) are integrated. The dual-aspect-dual-mode PE-SE framework (Vimal, 2008b) was used to address the explanatory gap problem of materialism. Neural-network and related SEs are the results of the co-evolution and co-development of the material aspect (mass, charge, spin, force, quanta, and space-time) and the mental aspect of fundamental particles (strings or elementary particles (fermions and bosons)). Their mental aspects are considered as the *carriers* of superposed multiple possible *experiences* (SEs/PEs) in unexpressed form. These possibilities are actualized when neural-networks are formed via *neural Darwinism*, and a specific SE is selected by a *matching* process when the *necessary* ingredients of consciousness/SE are satisfied. A simple experimental design is

suggested to address the *necessary* and *sufficient* attributes of consciousness" (Vimal, 2009g).

7. Dependent Co-origination and Inherent Existence

In (Vimal, 2009a), we found that "Nāgārjuna rejects 'inherent existence' or 'essence' in favor of co-dependent origination, and that is also why he rejects causality. Causality is a major issue in metaphysical views; for example, one could argue that consciousness causes/affects our brain/behavior/function/matter or vice-versa. My goals are as follows: (i) which entities lack 'inherent existence' or 'essence' and which ones inherently exist? (ii) Do the entities that lack inherent existence dependently co-arise and hence can we reject causality as in Nāgārjuna's philosophy? (iii) Do the entities that exist inherently cause entities that lack inherent existence? (iv) Do structure, function, experience, and environment cause each other? And (v) we critically analyze, extend, and examine Nāgārjuna's philosophy of dependent co-origination with respect to the dual-aspect-dual-mode PE-SE framework (Vimal, 2008b). Our analysis suggests that: (i) all conventional entities lack inherently existence, except subjective experiences (SEs)/proto-experiences (PEs) that are fundamental and irreducible and hence inherently exist; (ii) the entities that lack inherent existence dependently co-arise, and hence causality for them can be rejected but instead *conditions* (such as efficient, percept-object, immediate, and dominant conditions) might be necessary, as in Nāgārjuna's philosophy; (iii) it is not clear that SEs that exist inherently cause entities that lack inherent existence, but one could argue that (a) Nāgārjuna's rejection of causality needs to be reconsidered and (b) superposed PEs/SEs in the mental aspect of stings or elementary particles might be the motivation for the evolution to form neural-nets to realize a specific SE; (iv) It is not clear that structure, function, experience, and environment cause each other, but they might be linked via *conditions.* (v) Furthermore, (a) an entity has double aspect: mental and material aspects, (b) string is a dual-aspect entity that dependently co-arises from string-vacuum or *brane*, and (c) the dual-aspect-dual-mode PE-SE framework is consistent with these premises. For example, PEs/SEs inherently exist and are in superposed form in the mental aspect of (a) string-vacuum and/or *brane* before Big-Bang, (b) strings, elementary particles (bosons and fermions) and all evolved entities after Big-Bang, and (c) entities

before and after Big-Freeze/Big-Crunch or entities in cyclic universe as in the big bounce/quantum-bounce (Loop Quantum Gravity) framework. However, the selection of a specific SE has dependent co-origination (and hence not inherently existent, consistent with Nāgārjuna), i.e., a specific SE occurs in brain when (i) relevant neural-net is formed via *neural Darwinism*, (ii) the specific SE is selected via matching and selection mechanisms, and (iii) the *necessary* ingredients —such as wakefulness, re-entry, attention, working memory, stimulus at above threshold, and neural-net PEs— are satisfied. If this is true, then only experiences (PEs/SEs in superposed form) are inherently existent and other entities have dependent co-origination" (Vimal, 2009a).

8. Linking Dynamic Systems theory and Fractal Catalytic Theory with Standard Representation Theory using PE-SE framework

Previously (Bruzzo & Vimal, 2007; MacGregor & Vimal, 2008; Vimal, 2008a, 2008b), to address the explanatory gap of materialism, it was hypothesized that strings or elementary particles (fermions and bosons) have material and mental aspects, which act as the *carriers* of superimposed fundamental subjective experiences (SEs)/proto-experiences (PEs). In addition, neural Darwinism and (conjugate) matching process help in generating and selecting a specific SE in a neural-net. We proposed that this PE-SE framework is complementary to all materialistic models and has the capability to integrate such models. In (Vimal, 2009d), "we integrate three competing models that strive to address structure, function, and experience: (i) Standard Representational Theory (SRT) and (ii) Dynamic-systems theory (DST) and (iii) Fractal Catalytic Theory (FCT) (Carpenter, Davia, & Vimal, 2009; Vimal & Davia, 2008a, 2008b). The SRT proposes that *functions*, such as perception (such as detection and discrimination) and action, are because of the representations of objects and events in brain, and SE *emerges* when feed forward stimulus dependent signals interact with cognition related feedback signals in relevant neural-nets. DST proposes that perception, action, and SE arise/*emerge* from some kind of unspecified interaction between the environment and organism, which is not reducible to the components. The FCT is a non-representational model linked with DST, which proposes that *functions*

are catalytic processes and SE is a fundamental entity that *emerges* as an organism mediates/catalyzes the transitions in its surround/environment. Here, we will show that the data related to structure and *function* can be explained by both models: some data better by SRT and some better by DST-FCT. Some DST is compatible with and complementary to some SRT. Moreover, both models use *emergence* hypothesis (SE component of consciousness is an *emerged* entity) to link SE with structure and *function*. In addition, we argue that both types of *emergence* are *equivalent* because (i) external environment in DST-FCT is *equivalent* to external stimulus-signal input to the feed-forward pathway in SRT and (ii) the organism in DST-FCT is *equivalent* to organism's feedback signals in SRT. It is argued that SRT and DST are *equivalent* because both can explain most of the same data, and hence they can be *linked*. In addition, FCT could also be linked with DST and also SRT. When the term *emergence* is further unpacked in terms of elemental SEs/PEs, we get the PE-SE framework, from which both SRT and DST-FCT can be derived, and hence both can be *linked*."

9. Towards a Theory of Everything: Unification of Consciousness with Fundamental Forces in Theories of Physics

In (Vimal, 2009k), we investigated if the superposition of SEs/PEs in the hypotheses $\mathbf{H_1}$ and $\mathbf{H_2}$, of our dual-aspect PE-SE framework is consistent with the mathematics of theoretical physics such as classical physics, quantum physics, loop quantum gravity, and string theory. We found that the material aspect of the behavior of system remains invariant with the introduction of mental aspect in physics under the PE-SE transformations. We concluded that it is possible to unify consciousness with all four fundamental material forces by the introduction of (i) SEs/PEs (as in $\mathbf{H_1}$) or PEs (as in $\mathbf{H_2}$) in superposed form in bosonic and fermionic strings or elementary particles or (ii) the bosonic-PE and fermionic-PE based on the *integration* principle (as in $\mathbf{H_3}$). This leads us towards the theory of everything.

10. Interpretation of Empirical Data of *Samadhi* State

In (Vimal, 2009c), we discuss the empirical data related to *samadhi* state and explain it in terms of various frameworks. We conclude that our dual-aspect framework is the most optimal, which implies that the SE of subject or 'self' in self-related neural-network is tuned to the self-related SEs/PEs superposed in other innumerable entities during *samadhi* state via matching and selection processes. This leads to bliss, ecstasy, or extraordinarily high degree of climax at *samadhi* state.

11. Discussion and Conclusion

The problems of various views are discussed elsewhere (Vimal, 2009h). For example: **(1) materialism/emergentism** has major problem is the Levine's explanatory gap (Levine, 1983): the gap between experiences and scientific descriptions of those experiences. In addition, it has the 'brute fact': qualia/SEs are assumed to mysteriously *emerge* or reduce to (or *identical with*) relevant states of neural-nets. In addition, it assumes that (i) material is the ultimate reality, and (ii) material reality is essentially objective and non-experiential (Skrbina, 2009). **(2) Idealism** has explanatory reverse of materialism, namely, how matter can emerge from mind. In addition, it proposes *intelligent mechanism*, which has never ending explanatory gaps. **(3) Substance dualism** has (a) the association or mind-brain interaction problem, (b) the problem of mental causation, (c) the 'zombie' problem, (d) the 'ghost' problem, and (e) neurophysiological problem of many-many correspondence. **(4) Panpsychism** has 7 problems (Vimal, 2009h): (i) the combination problem, (ii) the no sign or not testable problem, (iii) the inconclusive analogy or not-mental problem, (iv) the physical emergence problem, (v) the implausibility problem, (vi) the eternal mystery problem, and (vii) the restricted panpsychism problem (Skrbina, 2005). Each of the above views has it's own *brute fact* (that's just the way it is).

Since it is hard to prove scientifically any metaphysical view, we need to investigate which view has the least problems. So far, the dual-aspect-dual-mode PE-SE framework with hypothesis H_1 passes this

'litmus test' because it has only one problem: its own *brute fact* that each primal entity has dual-aspect.

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Pages 16-100 are for future development