Antishielding the Explanatory Gap

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This paper, in support of a route across Levine's Explanatory Gap, will propose an analogy between the "effective theories" of physics and physicalist "solutions" of Chalmers' Hard Problem. The equations of Newton and Hamilton merely approximate the accuracy of quantum mechanics and relativistic dynamics by making more or less adequate predictions under highly restricted experimental conditions. It will be argued analogously that physicalism, as a philosophical perspective which is "effective" only within the limited physical reference frame of neuroscience, merely approximates a larger metaphysics spanning both physically and psychologically real domains. In furtherance of this proposal's metascientific implications for psychophysical epistemology, the causal completeness of physics will be reinterpreted as an epistemically mediated rather than an ontologically grounded issue. A metaphysical model delineating structural features of the "virtual" shield blocking direct neuroscientific measurement of qualia's causal ontology will be proposed. The model's details will draw upon ideas abstracted from and isomorphic with the confined behavior of quarks and the deformation of shifts in physical states.

Key Words: Antishielding, beable, asymptotic freedom, causal completeness, coherence, effective theory, Explanatory Gap, flux tube, gluon, haecceity, Hard Problem, meta-problem, noncommutation, observable, panprotopsychism, perturbation technique, psychophysics, q-deformed algebra, quark, renormalization, strong force, uncertainty principle, virtual particle.

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Introduction

Physicalism is the monistic interpretation of consciousness as a wholly physical process. The late philosopher Jaegwon Kim (2005; 2006) considered physicalism to be "near enough" to a metaphysical solution of the mind-body problem.

Kim's position admitted the non-physical existence of conscious qualia, theoretically justifying dualistic metaphysics. However, Kim devalued qualia as a causally negligible residue demarcating the practical "limit" of metaphysical discourse. His perspective implied that the causal completeness of physics renders physicalism sufficient for - and hence makes dualist expansions irrelevant to - the practically effective even if not theoretically complete pursuit of metaphysics.

Yet appearances can be deceiving: epistemology and ontology do not necessarily align with one another. Evaluation of Kim's claims must take into account the possibility that physics only *seems* to be causally complete, that qualia nevertheless possess their own sort of causal clout, and that some counterintuitive kind of epistemic barrier – reminiscent of the opacity conjured by the Hindu/Buddhist veil of Maya or by Schopenhauer's "cunning of the will" (Mender, 2013a) – systematically conceals from direct view the ontologically real causality attached to qualia. This mysterious epistemic barrier may comprise

the basis of Levine's (1983) vexing Explanatory Gap.

If so, the barrier's indirect elucidation would offer possible insights into Chalmers' (1995) "Hard Problem." One might begin an indirect inquiry into the nature of the epistemic barrier by clarifying Kim's terms "near enough" and "limit" through translation into the mathematical language of convergent series.

Any summed infinite series converging to a function susceptible to approximation may be expected eventually, after addition of a sufficient finite number of consecutive terms, to grow "near enough" to that function as a "limit." Practical use of the series in place of the function should then be warranted.

A familiar example from classical physics is Fourier-transformed digitization of acoustical waveforms. The resulting CDs and MP3 files, unlike analog musical recordings, can be practically manipulated (scratching noises and static cleaned out, etc.) though their sound still lacks the warm fullness of vinyl records, whose content without digital truncation retains the entire infinite series of summed "terms."

In quantum field theory, perturbation techniques, expressing suitable functions as summed infinite series, are similarly employed. However, there have been difficulties in finding series that converge to the finitude of a desired function rather than diverging to infinite magnitudes.

Perturbative renormalization techniques, where they have worked, have involved "shielding" - or in some cases "antishielding" - of infinities by the counter-intuitive introduction of "negative infinities." Physicists have concretely linked these abstract negative infinities, enabling subtractive cancellation of problematic positive divergences, to so-called virtual particles, bubbling into transient existence through statistically obligatory energy debt and imbuing quantum vacuum states with non-zero energy. Virtual particles have been understood to surround and "dress up" more durable particles, such as electrons and protons. A stealth "costume" of "infinitely negative" virtual particles enveloping electrons and protons thus "shields" from external detection the positively infinite components of charges possessed by the longer lived particles. "Antishielding," applied to quarks instead of electrons and protons, is a variation on the theme of shielding (Georgi, 1989; Taylor, 1989).

This paper will argue that a philosophy of mind commensurable with the established quantization of physics would do well to enlist abstractions of perturbation techniques in the service of a quantized psychophysicalism.

Let us suppose that Kim's ontology is wrong, i. e. that qualia do in fact have ontologically significant albeit epistemologically hidden causal attributes. Let us further suppose that "quantization" of mind-body metaphysics offers advantages, elaborated later in this paper and elsewhere (Mender, 2017) by this author, over non-quantized approaches. These suppositions would then lead us to two interrelated conclusions.

First, we would conclude that physicalist monism may be comprehended as not, in Kim's parlance, "near enough" to a solution of the Hard Problem insofar as pertinent perturbative series on approach to their limits are problematically divergent.

Second, we would conclude that the germane quantitative infinities generated by dualistically divergent series might be renormalized by a new, counterintuitive sort of negatively infinite shielding and/or antishielding, epistemically hiding through subtraction any unwieldly infinities bearing the ontologically causal imprimature of qualia. The architecture of such psychophysical shields and/or antishields might be specified using metaphysical concepts abstracted from isomorphic

physics. Architectural criteria for preferring either shields or antishields as the chosen physical template for metaphysical adaptation might thereby be clarified.

This paper will attempt such clarification as a means of conceptually probing the internal structure of the Explanatory Gap. Physicalism, thus penetrated and illuminated, may thereby indeed prove to be merely an "effective" metaphysical field theory, offering an epistemologically serviceable surface within the constraints of neurophysics but failing to contact the deeper ontological foundations of a psychophysicalism informed by quantization.

1. Physical Observables, Qualia, and Epistemology

We can begin an exploration of the foregoing ideas with a temporary working assumption, adapted from neutral monism (Westphal, 2016). That is, we can assume that physical observables appear epistemologically, if not ontologically, to be qualia-like and hence give an impression of equivalence to qualitative psychological "observables," insofar as everything, including physics, known to consciousness is filtered through sensoria (von Baeyer, 2016).

It seems likely that primitive qualia prefiguring the physical observables of Newtonian and Hamiltonian paradigms guided the behavior of intelligent protohuman ancestors, whose embodied sentience struggled to cope with existential demands imposed by hostile natural environments. The human beings of prehistory invented ever-improving gambits to secure food and oxygen. Hunter gatherers became viscerally canny quasiphysicists in their lifelong practical struggles to wrest survival from surrounding landscapes and embedding food chains. Early homo sapiens, while hunting and gathering, had to trek definable distances from point A to point B, employed the energy of muscular exertion to build up momentum against the inertia of cargo, and endeavored to avoid spinning into vertiginous falls.

Aristotle and his medieval heirs succeeded hunter gatherers as conceptual midwives antedating the mathematical formalizations of Newton and Hamilton. With the coming of post-medieval physics, metrical distance mathematically abstracted the intuitive feeling of corporeal translation in space; linear momentum mathematically abstracted the somatic feeling of bodily inertia; energy mathematically abstracted the muscular feeling of manual labor; angular momentum mathematically abstracted the otic feeling of vertigo; clock measurements of time mathematically abstracted the circadian feeling of temporal progression. Einstein as the intuitive-scientific thought experimenter par excellence further refined classical dynamics. Quantum innovators took formalization of "qualia" applicable to physics beyond raw visceral intuition to the current status of qualia as abstracted observables represented by mathematical operators.

The notion, rooted in the abovementioned historically traced parallels, that physical observables indeed seem to be qualia-like has been enlisted as an epistemological map, projected across the Explanatory Gap between subjective reference frames and objects while bracketing ontological consideration of any substantial bridge between mind and matter. Allied insights have inspired empirical efforts, at first without and then with quantization, to quantify introspectively accessed "non-physical" qualia in a language compatible with the observable aspects of physics.

The first such program was initiated by Weber and Fechner (Johnson et al, 2002), who formally construed qualia as

intrinsically non-probabilistic observables expressed in prequantum fashion via passive noun-like variables following the Newtonian (Margenau, 1977) example. The Weber-Fechner version of a sensory psychology formally modeled on nineteenth century physics attempted, through such parameters as the "just noticeable difference," assignment of quantitative measurement values to reports of sensations qualitatively experienced by subjects. At least one rigorous perceptual "power law," relating stimulus and perception, emerged from related research (Stevens, 1957).

Recently, quantum cognitivists including Pothos and Busemeyer (2013) have cast the psychology of qualia in quantum probabilistic terms. The "grammar" of quantized qualia-observables, expressed mathematically through active verb-like operators (Margenau, 1977) instead of passive noun-like variables employed by the quasi-Newtonians Weber and Fechner, extends agency implied by the operator formalism of quantum physics into measurement of psychologically relevant, perceptual observables (e. g. sweetness, pain, redness, itching, etc.). Psychological qualia, thus quantized, thereby become commensurable with the active verb-like quantum mechanical representation of physical observables (e. g. distance, momentum, time, energy, and spin) as mathematical operators. Further apparent commensurability is achieved by assigning to algebraic relations between psychological observables the same non-commutative rules that govern crucial sets of physical observables; more will be said shortly concerning strengths and weaknesses associated with this important rule driven aspect of the Pothos-Busemeyer model.

In the foregoing ways, assays advocated by Pothos and Busemeyer might be epistemically likened to a quantum psychological scattering device imposing repeated measurements upon aggregates of mental phenomena in order to reveal broadly patterned statistical cross sections. However, the quantization of psychology proposed by Pothos and Busemeyer and other quantum cognitivists within the past decade is not yet true psychophysics, because the observables thus quantized do not extend beyond the qualia of psychology to include also physical observables. In that sense, authentic quantum psychophysics, founded upon quantum psychophysicalist metaphysics tunneling through an Explanatory Gap reimagined as an Explanatory Barrier, still awaits creation, to which this paper hopes to contribute.

Such a new, quantized kind of dualism would offer several advantages, regarding both philosophical and empirical issues, over its nonquantum predecessors. The mind-body problem's "inconsistent tetrad" of axioms, following philosophers Keith Campbell and Jonathan Westphal, might be rendered internally cohesive through quantum superpositional logic. Both the causally problematic Cartesian cut and Leibnizian parallelism's requirements for insertion of initial conditions "by hand" into metaphysics might be remediated through dualistic analogs of quantum tunneling between materialistic and idealistic monisms. The verb-like grammatical character of quantum observables might allow logicians to heed Ludwig Wittgenstein's warning against misclassifying qualia as reified, noun-like "states" and thus to avert category mistakes (Ryle, 1949; Westphal, 2016; Wittgenstein, 2002). Entangled quantum holism might provide a uniquely compact model of empirically correlative neurocognitive binding. The quantum no-cloning theorem might furnish a systematic framework for the non-repeatable aspects of conscious experience noted by William James (James, 1981; Mender, 2017).

2. Quantum Ontology and the Causal Completeness of Physics

Beyond merely formal, empirical, and epistemological considerations, however, we must also confront the persistent argument that there remains something ontologically distinctive about physics in comparison to psychology. Evidence for such a difference is grounded primarily in the presumption that physics is causally complete (Vincente, 2006; Westphal, 2016).

The presumed causal completeness of physics must necessarily present a hindrance both to any quantized psychology along lines suggested by Pothos and Busemeyer and to any direct psychophysical extrapolations from purely psychological quantizations. The hindrance stems from sharp algebraic differences, which quantum cognitivists have hoped – so far in vain - to reconcile, between quantized physical observables and psychological observables.

This last statement is based on the restricted sorts of quantum observables governed by Heisenberg's uncertainty principle. Only a few combinations of physical observables, such as the "canonical conjugates" position and momentum or energy and time, properly lead to mutually "incompatible" measurement outcomes; i. e., if one observable within a set of incompatible observables is measured with a high degree of exactitude, then the precision with which other observables in that set can be simultaneously assayed experimentally will be compromised. In algebraic terms, mutually incompatible observables interrelate "noncommutatively"; that is, switching from px to xp the order in which observable-operators p and x are multiplied changes the magnitude of their product. Other groupings of observable-operators, including an essentially limitless variety of psychological observables like sensations of colors, noises, pains, odors, and flavors, carry with them no law-like order effects and hence no principled limitations on the exactitude with which multiple observables in any grouping can be assayed.

For these reasons, the putative causal completeness of physics should prevent ostensible quantum cognitive order effects among psychological observables from altering detectable outcomes of any physical experiments, including quantum probes of brain matter, that depend upon the standard model of quantum physics (Mender, 2013b). The perspective of quantum "beables," defined not in terms of empirical observability (or of actualized reality) but rather as theoretical elements corresponding to possibly real entities (Bell, 2004), raises even more explicitly ontological implications for causal completeness in physics.

Beables constituted by the potential reality (Von Baeyer, 2016) of quantum wavefunctions call into question, as Max Tegmark (2000) famously argued 20 years ago, the plausibility of macroscopically quantum coherent brain states under in vivo thermodynamical conditions. Firm evidence of quantum coherence at scales applicable to in vivo molecular processes has been adduced for photosynthesis (Collini, 2010; Engel, 2010), and there are arguments making plausible the extension of photosynthetic findings to superpositions of dipole spins in hydrophobic chromophore-like regions of tubulin (Hameroff and Penrose, 2017). Nevertheless, whether and how the wavefunction coherence of the physical microcosm might scale all the way up to macroscopic neural correlates of molar consciousness without causally abrogating closed laws of physics has resisted clarification.

3. Psychological Causation and the Q-deformed "Knob"

Causally reconciling the observables of psychology with those of quantum physics (and also reconciling pertinent sets of beables) is necessary if the metaphysics undergirding a quantized psychophysics is to 1) directly address problematically Cartesian causal relations between the mental and the physical, and 2) avoid Leibnizian detours into dualistic parallelism. The challenge of reconciliation between psychological and physical observables may be engaged by formalizing the quantization of psychophysics in a step building on the incomplete point of departure pioneered by quantum cognitivists like Pothos and Busemeyer.

Such formalization entails variations on a concept called gauge curvature, a mathematical construct well known in workaday physics; physicists routinely employ the quotidian version of gauge curvature to describe each of nature's four fundamental physical forces. Gauge curvature interrelates global and local symmetries, which may both be grasped visually through a simple geometric example.

Consider the surface of a sphere. Each point on the sphere's surface has its own tangent plane. Within every tangent plan, any inscribed figure whose constituent points all migrate the same distance and in the same direction across that single flat surface will maintain its own shape and thus demonstrate "global" symmetry. However, because the sphere's surface is curved, projection of the inscribed figure's flat shape into a second tangent plane tethered to some different point on the sphere's surface will yield a distorted figure.

A gauge can be configured to compensate for the curvature of the sphere's surface in order to correct for such distortion. This compensatory correction, whose variable extent must be recalibrated for the particular degree of separation between each specific projecting and targeted tangent plane, yields a shift from global symmetry to "local" symmetry. An aggregation of all possible corrections applicable to the sphere can be regarded as a restricted kind of gauge field.

More generalized formulations of gauge fields represent gravitation, electromagnetism, and the strong and weak nuclear forces as corrective reshaping of subtler curvatures also arising in shifts from global to local symmetries. These gauge fields are sometimes expressed in the topological language of fiber bundles.

Correction of abstract curvature has been further refined for use in second quantization, which deals not with absolute quantum states but with transitional changes between them. In this context, gauged warping of relevant curvatures does not create new forces. Instead, a specialized q-deformed algebra (Tuszynski, 1993), acting as a curvature-adjusting "knob," warps the alignment between second-quantized observables. Toward that end, the amount of multiplicative non-commutation between second-quantized observable-operators, and hence the degree of their yoked governance by the uncertainty principle, is "dialed" upward or downward by the "knob."

Such gauged adjustment of uncertainty relations may provide formal means to align the algebraic rules governing the commuting qualia-observables of quantum psychology with the non-commuting properties of standard physical observables.

In this regard it is noteworthy that the q-deformable observable-operators of second quantization are generic quantities – namely, phases of waves and numbers of created/annihilated particles – rather than qualitatively particular observables. Numbers are sufficient to specify phases of waves and numbers of created/annihilated particles, whereas other quantized observables - such as energy and time in the

first quantization of physics or sweetness and pain in the quantum psychology of Pothos and Busemeyer, explicitly entail qualities. Q-deforming gauges may permit arbitrarily chosen qualities, including selections from the unlimited "palette" of phenomenal qualia, to serve as grist, engrafted on to the numbers of second quantization, for isoqualitative adjustment of psychophysical observables toward Heisenberg-commensurable non-commutation.

Q-deformation appears well suited to quantized psychophysicalism in another, more specific way. To the extent that second quantization is applicable to transitions between and not absolute values of quantum states, q-deformed psychophysicalist observables may track habituative and dishabituative changes (Steiner and Barry, 2014) intrinsic to the ever-shifting phenomenology of consciousness (James, 1981).

In summary, this section has just made the case that q-deformation, gauging not physical forces or absolute physical states but interrelations between observable numbers associated with quantized changes of state, may be useful in formalizing a quantum psychophysicalism that extends the pioneering lead of Pothos and Busemeyer. This case is supported by three lines of argument.

First, the pertinent gauge may serve as an isoqualitative "knob" or "dial," able to warp commutation by the qualia-observables of quantum psychology into commensurability with non-commutation by standard physical observables. Second, the numerical character of second-quantized observables amenable to q-deformation is qualitatively generic and hence potentially open to a boundless array of possible qualitative operators, including psychological qualia-observables. Third, applicability of second quantization to state changes may exhibit isomorphisms with the dynamic habituative and dishabituative flow of consciousness.

The isoqualitative gauge construct described above may indeed represent a useful tool for formalizing unification of physical and psychological observables under a single principle of non-commutation, governing not only the standard conjugate observables of physics but also the protean qualia-operators of psychology. Gauged q-deformation may thus lend needed rigor to the aims of Pothos and Busemeyer and make those tendencies explicit.

Yet *by itself* such formalization still does not address the Pothos-Busemeyer model's principle deficiency, a central concern, specified below, for any quantized take on the Hard Problem and the Explanatory Barrier. That is to say explicitly: extending non-commutation from standard conjugate quantum mechanics to psychological observables, with or without the formalisms of a q-deformed gauge, imbues the notion of qualia with some of the ontological causality attached to quantum mechanical order effects (as in the famous quantum double slit experiment), but only at the price of blatantly violating the alleged causal completeness of physics.

However, the rigor of formalizing quantum psychophysics by means of a q-deformed gauge also paves the way for a formally rigorous currency, alluded to in this paper's introduction, through which to cancel the price of violating the causal completeness of physics. The gauge formalism, pressed into the service of an isoqualitative metaphysics, may give rise to an epistemic antishield, which can systematically mask the reality of psychology's causal ontology. The next two sections will develop this idea.

4. Effective Psychophysics, Shielding, and Antishielding

Gauges, which create fields that compensate for transitions between global and local symmetries, are physically mediated by vector bosons (Taylor, 1989). The main types of vector bosons mediating fundamental physical forces of the standard model are: photons, mediating the electromagnetic force and subject to the U(1) symmetry group; W- and Z- bosons, mediating the weak nuclear force and subject to the SU(2) symmetry group; and gluons, mediating the strong nuclear force and subject to the SU(3) symmetry group.

A question thus arises: what specific kind of physical q-deforming gauge boson might best be formally abstracted to serve a goal of configuring the metaphysical architecture of a quantized psychophysicalism with the crucial ability to subsume physicalism as a merely "effective," albeit apparently causally complete, theory? One can prepare to answer to this question by first defining in more detail the concept of an effective theory (Georgi, 1989).

For physicists, effective theories are theoretical constructs whose empirical predictions "adequately" approximate experimental results under limited conditions. That is, effective theories, prefiguring in physics the parlance of Jaegwon Kim's qualia-marginalizing metaphysics, work "well enough," but only as "limiting cases" of more comprehensive theories, which are better able to yield empirically accurate predictions outside the "margins."

The pre-eminent example of an effective theory in classical physics is Newtonian mechanics. Newton's equations predict experimental results close to the more accurate predictions of special and general relativity for phenomena with low velocities, accelerations, masses, and energies but predict less satisfactory results in fast moving, intensely gravitating, massive, and highly energetic systems.

For the standard model of quantum physics, effective field theories have grown from two related sources. Those sources are 1) Feynman's perturbative method of approximating the superposed Lagrangian "paths" of particle reactions and 2) virtual particle tunneling as the result of Heisenberg-uncertain energy debt.

As mentioned in this paper's introduction, when quantum electrodynamics first quantized electromagnetism in perturbative terms, a vexing mathematical feature became evident: the pertinent perturbative series approximating a relevant function yielded a divergently and intractably large sum on approach to the limit for an infinite number of terms. However, it was then happily realized that virtual particles attracted to real electrically charged particles serve as "shields," reducing nonsensically infinite magnitudes to sensibly finite quantities and masking infinitely divergent nuclear charge effects at the relatively large distances maintained between such real particles as nuclear protons and orbiting electrons. The perturbatively "renormalized" model of the "shielded" charge, which matched measurements under appropriately distanced conditions, came to serve as an effective field theory, standing in as a pragmatic workhorse for the mathematically much less tractable but more comprehensive model of quantum electrodynamics extending outside the margins of physical practicality.

Later, analogous effective field theories with varying details were formulated for other forces, not just electromagnetism, within the standard model. In the case of the strong force, virtual quarks were postulated to comprise a quantum chromodynamic ("QCD") "antishield," maximally effective for real quarks in close mutual proximity and contrasting with the peak effectiveness of quantum

electrodynamic "shielding" for electrons and protons widely separated across space. At very small interquark distances, unworkably large gluon field values binding real quarks together are now understood to be masked by antishields composed of virtual quarks, loosening charged constraints upon real quark movement and thus permitting bag-like "asymptotic freedom" of actual quarks within hadrons. Skyrocketing attractive values at larger distances, spanned by string-like, nonlinearly scale-free gluon fields extending beyond the effective range of antishielding, prevent experimental observation of any real free quarks outside hadrons.

With all this in mind, it is possible to consider potential epistemological and ontological implications of enlisting metaphysical "vectors" analogous to physical gluons, rather than metaphysical analogies to photons or to W- and Z-bosons, as the preferred specific form most aptly adapted into a q-deforming "knob," dialing up isoqualitative imposition of noncommuting uncertainty relations upon commuting psychological qualia among the observables posited by quantum psychophysicalism. A choice of gluons over other physical vector bosons as formal templates for metaphysical abstraction would point, among other implications, to analogues of antishielding, rather than shielding, as the epistemological mask best able in physical contexts to cloak ontologically real metaphysical causation by psychological observables.

5. Q-Deformed Gluons and the Explanatory Barrier

For our purposes, then, what exactly are the several reasons for us to bite the bullet by choosing gluons - with their attendant antishielding - among all possible vector bosons? To answer this question, let us start by making the major metaphysically analogical features of quarks and gluons precise.

We can achieve precision through the novel concept of metaphysical "proximity," to be distinguished from the spatial metric of standard physics. It is crucial here not to conflate degrees of physical locality, necessary for calibrating both spatially propagated causality and non-local physical entanglement, with the more abstract notion of metaphysical proximity.

Gross conflation of physical locality and metaphysical proximity might obscure the productive potentialities of systematic mapping between them. A rigorous map may be drawn between a) the metaphysical proximity of energy-consuming brains to energy-providing photosynthesis, notwithstanding spatially dispersed food chains and cycles of atmospheric oxygen and CO_2 turnover, and b) small spatial distances separating physical quarks confined within a physical hadron.

The principle behind a) is that metaphysical proximity between neuronal respiration and the green Z-scheme does not require either spatial proximity or quantum mechanical entanglement between the germane organelles, one kind (neural mitochondria) being located in animals and the other kind (chloroplasts) in plants. Metaphysical proximity, instead, entails only the dwelling of relevant entities on the same side of the Explanatory Barrier. Both chloroplasts and neural mitochondria, as well as the physically causal energy dissipatively propagated between them across spatial distances of arbitrary magnitude, lie together snugly within the realm of physics rather than psychology; that fact marks their relations as metaphysically proximate. Metaphysical proximity of a brain to its green biophysical energy sources holds true despite the relation being not quite an identity (Westphal, 2016), insofar as brains, uniquely among material objects, display correlations, albeit causally obscure, with

purely subjective and hence metaphysically more remote qualitative experience.

In a q-deformed psychophysicalist analogy with gluon dynamics, the ontologically tight (in Kim's terminology, "near enough") proximity of grey and white brain matter to photosynthetic plant matter may be rigorously mapped to the physically tight confinement of asymptotically free quarks within bag-like hadrons. This mapping is rigorous to the extent that energy-consuming neurons and energy-harvesting chloroplasts, linked together by energy flow within the "confined bag" of a physically instantiated biosphere, share palpably material ontologies.

Gluon properties predicted not only for small spatial distances between quarks confined within hadrons but as well for large distances between quarks also demonstrate crucial isomorphisms, unique among vector bosons, with key features of quantized psychophysicalism. The unconfined gluon formalism, but not formalisms of photons or W- and Z-bosons, generates string-like scaling, isomorphic with phenomenally fractal aspects of consciousness including bifurcations in optical illusions, motivational sensitivity to initial conditions, perceptual power laws across much broader domains, and cognitively self-organizing chaotic attractors (Guastello, 2001; Mac Cormac and Staminov, 1996; Stevens, 1957). Moreover, at theoretically large interquark distances, stretched hadrons resemble minds not only in their string-like scale-free field conformation but also, like the privacy of first person mental perspectives, in their physical undetectability.

It is important at this juncture for the reader to remain firmly cognizant of distinctions between physical and metaphysical distance in considering mapped analogies not only between spatially confined bag-like hadrons and brain energetics but also between 1) the strong force's string-like physical gluon field configuration, theoretically attending spatial separation of physical quarks beyond the confines of physical hadrons, and 2) string-like "stretching" of metaphysical "distance."

One possible means of conceptualizing psychology's physically undetectable though radically "stretched" and string-like nonlinearity is the unvetted concept of nonlinearly self-reinforcing quantum "autotunneling." This construct is potentially applicable to the phenomenal domain of infinitely many qualia-operator sets, all q-deformed into mutual incompatibility.

Autotunneling by qualia is a postulated nonphysical analogy to autocatalysis, a classically physical positive feedback loop whereby the end product of a chemical reaction catalyzes its own synthesis.

Autocatalysis was originally conceived by Stuart Kauffman to explain nonlinear self-organization in biological systems. Autocatalytic models describe nonlinear dynamics, chaotic attractor states, and fractal phase spaces in germane enzymatic processes.

A more complicated generalization of such positive feedback loops, instantiated by the collectivity of autocatalytic sets, involves entire sequences of reactions whose aggregate intermediate products together with a final product catalyze a whole biochemical cascade. Autocatalytic sets can themselves be nested into yet further metalevels of autocatalysis (Hordijk, 2013; Kauffman, 1986; Sherman, 2017).

In quantum physics, particles fueled by energy debt grounded in the uncertainty principle are known to tunnel through wall-like barriers. A credible parallel may be drawn between quantum mechanical tunneling, which accelerates subatomic reactions, and catalysis, which speeds up chemical reactions. An additional parallel might be drawn between spatiotemporal tunneling, borrowing via Heisenberg uncertainty the physical observable called

energy, and metaphysical tunneling, entailing q-deformed phenomenal qualia-observables borrowing from one another.

The above parallels make it tenable to postulate 1) metaphysical autotunneling as positively fed-back facilitation of metaphysically tunneled acceleration by products of metaphysical tunneling itself and 2) both metaphysical auto-tunneling and metaphysically autotunneling sets as mediators of psychology's radical nonlinearity.

Lack of empirical evidence for autotunneling in the qualitatively restricted domains of physical observables, despite a plausible role for autotunneling via cascades through an unlimited variety of psychological qualia, should not be surprising. Virtual quark-like "antishields" in gluon-like q-deformed psychophysics should be capable of serving as stealth-promoting epistemic camouflage against corporeal detection of autotunneling by phenomenal qualia into the physical side of the Explanatory Barrier. Camouflage by way of antishielding should be able to screen out the autotunneled reach of metaphysically "distant" subjectivity into purely physical manifestations of causality metaphysically "near" material ontology approximated by the brain. Any nested noncommuting intrusions by q-deformed sets of autotunneling qualia-observables upon the causal completeness of the standard model's ontological expressions in neurophysics should be obscured by the masking functions of virtual quark-like antishields. This is the basis for hypothesizing that metaphysical antishielding can reduce physicalism to an epistemologically "effective" ontological field theory of quantum psychophysicalism.

Analogies between the quantum chromodynamical physics of the strong nuclear force and the metaphysical architecture of quantum psychophysics may be summarized by the following itemized list:

1) Spatial proximity between quarks confined within a hadron is analogous to the "close" metaphysical distance, endowed with the putative causal "completeness" of physics, between quantum-photosynthetic energy sources and physical energy consumption by the brain.

2) The spatial distance between separated quarks, theoretically boosted beyond hadron confinement and thereby pulled apart as "ends" of extended string-like fields, is analogous to a metaphysically though not spatially "stretched" conduit of isoqualitatively gauged, phenomenally autotunneling causality between mind and brain.

3) Virtual quarks are analogous to the Explanatory Barrier. Virtually quark-like epistemic antishielding gives a false picture of physics as causally complete by masking the isoqualitatively gauged stamp of autotunneling mind upon brain matter.

4) Item 3) is the theoretical step that makes physicalism an "effective" metaphysical field theory of quantum psychophysicalism.

6. Contrasts with Other Theories of Psychophysical Relations

The foregoing model's quantum-operationalistic dualism should not be misconstrued as panpsychist. Panpsychism is an ontology, intrinsicially weaving qualia as noun-like "things" or adjectival properties of "things" into the universe. Prior to any ontological considerations, this paper's metaphysics begins with a performative epistemology, wherein qualia are verb-like operators which, like physical quantum operators (Margenau,1977), enact observations.

The theory advanced by this paper should also not be misinterpreted as panprotopsychist. Panprotopsychism posits that a restricted collection of primitive protoqualia embedded in the physical microcosm somehow scales up to

very many kinds of phenomenal experiences embedded in the physical macrocosm. Without an explanatory mechanism for this proliferative differentiation of microscopic protoqualia into macroscopic qualia, panprotopsychists are left with the so-called "combination problem" (Westphal, 2016), whose proposed solution by the well-known quantum brain paradigm called Orch OR speculatively cites expansive processes of evolution over cosmological time (Hameroff and Penrose, 2017).

This paper differs from panprotopsychism by avoiding the need for arbitrarily exclusive ad hoc insertion only of protoqualia into any "microlevel," whether the pertinent micrometric of proximity is taken to be physical or metaphysical. Instead, the full palette of qualia-verbs as possible epistemic acts, naturally possessing formal resemblance to physical quantum operators, are non-exclusively assumed to be primary constructs at every postulated level - though not, in the reified manner of panpsychists, added to "existence" as noun-like hypostases. In the domain of molar awareness, the entire phenomenal range of qualia in general is understood to be completely available for active evocation. In the physical domain of the brain, just the restricted subset of qualia known as physical observables seem to be perceivable, but only because other qualia-observables, though "real" insofar as they may actively operate, are shielded from experience.

No form of emergentism, either panprotopsychist or otherwise, and no form of simple or supervenient physical causality should be inferred from this paper. Unidirectionality of a metaphysically causal arrow running exclusively from physics to phenomenology and thus ontologically reifying the causal completeness of physics is rejected.

Specifically, this paper dismisses the idea of a metaphysically fundamental microcosm of physics "giving rise" to a phenomenal macro-scale through nonperturbative (Delamotte, 2007) symmetry-breaking instantiated by the block-spin renormalization semigroup. Since their creation by Kenneth Wilson (1979), block-spin renormalization techniques have proven to be immensely successful in modeling coherence emerging across many spatial scales in a wide variety of physical phase transitions. This success has been followed by efforts to capture consciousness as a unidirectionally emergent property of classical harmonic resonances and coherences across neural networks (Atasoy, 2018). However, nonperturbatively renormalizable properties, whether "fundamental" or emergently scaled, must remain purely physical correlations and not explanations of qualitative experience: block-spin renormalization, applied to physics at a "fundamental" level, cannot be configured to reach past physics into subjective phenomenology at some crucial "higher" level. Other essentially physical models of brain dynamics at many spatial scales, including dissipative quantum approaches (Vitiello, 2009) are also metaphysically limited.

This paper circumvents the metaphysical limitations of physical block-spin renormalization and forthrightly rejects, as a merely illusory residue of metaphysical antishielding, any apparent arrow of emergent, supervenient, or simple causality, pointing exclusively from physics to phenomenology and hence seemingly preserving the causal completeness of physics. There are two justifications for this circumvention and rejection.

First, in contrast to the "semi" aspect of the symmetry-breaking block spin renormalization semigroup, there is nothing unidirectionally "semi" about the SU(3) symmetry group isomorphic with the isoqualitative gauge fields through which mind can metaphysically influence matter,

albeit without anomalously detectable energy propagation.

Second, while nonperturbative block-spin renormalization across many spatial scales in physics preferentially "integrates out" only particular wavelengths, metaphysical antishielding of quasi-vitalistic effects at the receiving end of mind-to-matter causation involves perturbative symmetry-breaking analogies that non-preferentially cancel all physical detection of isoqualitative gauge symmetries.

This paper takes care to avoid Rylean (Ryle, 1949; Westphal, 2016) mistakes which metaphysically miscategorize isoqualitatively nonspatial degrees of freedom as spatially size-delimited "particles," hypostatized by one critic as nonvirtual "pheno-quarks" and their interactions through "pheno-gluons."

Metaphysical causality entailed by the isoqualitative field construct and its q-deformation of qualia-operators must be distinguished from physically causal propagation of energy across physical space through any of the undeformed gauge fields mediating the four fundamental forces of physics.

When pivotal ontological categories are properly indexed, the Explanatory Barrier may be plausibly grasped and succinctly summarized as a simple if abstract metaphysical breakage of isoqualitative gauge symmetry.

Consequently, the isoqualitative gauge itself, though epistemically effaced by metaphysical antishielding, can be understood to unify physical and psychological ontologies by tunneling between categories of observables and hence imbuing this paper's overall model with conceptual cohesion.

7. Tests: Knotted Meta-Mind and Analogies to the Strong Nuclear Casimir Effect

Further inferences may be drawn from stretching of the q-deformed isoqualitative gauge, beyond confinement within the bag-like metaphysics of neuroscience, outward to span the ontologically "distant" domain of qualitative "mentality," structurally resembling (Guastello, 2001; Mac Cormac and Staminov, 1996; Stevens, 1957) stringy, rubber-band-like, metaphysically scale-free "flux tubes." The array of possible knots into which such "rubber bands" can be tied might be exploited to generate a taxonomy of meta-mental "haecceity," i.e. topologically "natural kinds" of meta-consciousness, each kind in its own distinct fashion justifying or contesting the existence of the Hard Problem.

Such a nosology might be constructed by sorting variegated semantic paradoxes according to distinguishable ways that the diverse philosophical self-references of phenomenally autotunnelling sets fold back upon themselves. Explorations attempting to systematize Chalmers' "meta-problem" of consciousness in this manner would integrate Chalmers' own analysis (2018), HOT models (Rosenthal and Weisberg, 2008), and Russell's ramified theory of types (Kleene, 2009) by finding overlapping areas and disconnections among adjacent and disparate metalevels of discourse about relations between mind and matter. Meta-continuities and meta-discontinuities thereby discovered and tabulated might then be correlated with all possible homeomorphically inequivalent configurations into which string-like psychological "flux tubes" can be knotted.

The foregoing topological correlations, construed as one possible empirical test paradigm for this paper's proposed constructs, would circumvent any issues related to the apparent causal completeness of physics.

However, this convenience would result in a drawback as well: only string-like, phenomenally autotunneled domains, either unknotted or meta-consciously knotted, could be assayed, and thus testing would remain divorced from the question of metaphysical antishielding at the boundary between stringy mind and hadron-like brain. A more deeply targeted test might be developed by through analogies between the Explanatory Barrier itself and the strong nuclear Casimir effect (Lamoreaux, 1997; Plunien, 1986) manifesting virtual quarks.

Conclusion

This paper, seeking a tunnel through the Explanatory Barrier, has endeavored to construct an expansively quantized psychophysics that, under restricted conditions, reduces physicalism to a merely effective approximation of unified quantum psychophysicalism. It has been argued that such a metaphysics, configured through a mathematical "knob" governed by a gluon-like q-deformed gauge, can enlist antishielding analogies to meet the metaphysical requirement of epistemologically apparent consistency with the causal completeness generally attributed to standard quantum physics on ontological grounds. Corollary inferences point toward tube-like architectures of knotted "mentality" with the taxonomic potential to elucidate topologically "natural kinds" of meta-consciousness.

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