

Original Research

Processual relational geometry: generative unfolding and self-intending closure constituting consciousness—a transscale ontophysical framework

Roman R. Poznanski^{1,*}

¹Bion Institute, Stegne 21, SI-1000 Ljubljana, Slovenia

*Correspondence: romanrpozanski@gmail.com

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Abstract

The intrinsic realization of conscious actuality is objectively unobservable, presenting a fundamental explanatory challenge: *how can consciousness be physically embodied without being ontologically exhausted by objective physical description?* Processual Relational Geometry (PRG) addresses this challenge by proposing the self-consistency condition of reciprocal realization through which constitutive realization and physical realization become reciprocally realized manifestations of the same physically embodied transscale ontophysical continuity. This constitutive basis is organized as physically embodied transscale ontophysical continuity whose relational unfolding persists across successive regimes of relational organization and is therefore not reducible to processes confined to particular spatial or temporal scales of brain activity. Rather than treating neural repertoire, information processing, or selection as constitutively primary, the framework takes physically embodied transscale ontophysical continuity as primary, while process denotes the relational unfolding through which this continuity is constituted, physically realized, operationally stabilized, and sustained. To account for the relational organization of this continuity, PRG is presented as a transscale ontophysical framework that articulates the Quasipolaritonic Process Geometry (QPG)-derived generative constraints governing admissible relational organization through which non-Shannon intrinsic information becomes dispositionally organized. The constitutive basis is realized within Embedded Quantum Physicalism (EQP), where a critical relational organizational transition provides the physically embodied mechanism that establishes the self-consistency condition of reciprocal realization. Substrate-specific poststructural dynamics instantiate constitutive realization, thereby specifying the intrinsically informational organization of the constitutive basis. Within PRG, what is commonly described as neural integration is reconceptualized as closure: the stabilization of admissible transscale relational coherence into unified relational regimes rather than the aggregation or integration of information. Stabilization proceeds through Q_{neg} -mediated admissibility bias toward coherence, yielding coherent dispositional regimes. These dispositions are constituted through reflexive relational unfolding in which intrinsic information acquires directional coherence as intrinsic intentionality through reflexive-projective closure within the Self-Intending Projective Framework (SIPF). At the critical relational organizational transition within EQP, physically embodied relational unfolding becomes self-consistently constrained, enabling constitutive organization to acquire intrinsic realization and thereby providing the basis for conscious actuality. Conscious actuality is therefore the intrinsic realization of physically embodied transscale ontophysical continuity, while phenomenality is its intrinsically realized manifestation. Perception, cognition, and memory are interpreted as downstream dispositional manifestations of conscious actuality rather than its constitutive basis. Consequently, accounts restricted solely to objective observability are not ontologically exhaustive, since objective descriptions characterize only the substrate-specific physical realization of the constitutive basis underlying conscious actuality. Finally, transscale consciousness consists in the intrinsic realization of physically embodied transscale ontophysical continuity through self-intending projective closure. This constitutive progression from reflexive-projective operationalization through reflexive-projective closure to self-intending projective closure establishes and operationally maintains intrinsic intentionality under QPG-derived admissibility constraints. Through this progression, transscale closure operationally maintains physically embodied transscale ontophysical continuity, while transscale unity denotes the coherent constitutive organization preserved across successive regimes of relational organization. PRG is presented as a foundational constitutive realization theory of consciousness, extending contemporary accounts beyond computational, functional, and supervenience-based approaches by grounding conscious actuality in the intrinsic realization of constitutive organization.

Keywords: Consciousness, reciprocal realization, nonstandard constitutive physicalism, constitutive organization, transscale, self-intending projective closure, physical embodiment, ontophysical continuity, intrinsic realization.

1.Introduction

Understanding the nature of consciousness in dispositional terms requires a novel theoretical framework, since existing approaches (e.g., [Mudrik et al., 2025](#)) are grounded in metaphysical assumptions that are too simplified to accommodate disruption of resonance-related processes by anesthetic agents associated with loss of consciousness ([Hameroff, 2006](#)). Accordingly, the proposed framework extends beyond standard quantum-mechanical descriptions of consciousness ([Bohm, 1990](#); [Hameroff & Penrose, 2014](#); [Fisher, 2015](#); [Rovelli, 2021](#); [Kent, 2021](#); [Zhi & Xiu, 2023](#)). While these approaches have highlighted the potential relevance of quantum processes, coherence phenomena, and nontrivial quantum effects in neural systems ([Adams & Petrucione, 2020](#); [Swan et al., 2022](#)), they generally remain focused on quantum states ([Escola-Gascón, 2025](#)), coherence dynamics ([Prentner, 2026](#); [Planat, 2026](#)), multiscale coordination ([Strom et al., 2024](#)), or quantum information ([Georgiev, 2025](#); [Gassab et al., 2025](#)).

Inference-based frameworks, including predictive coding, variational Bayesian models ([Parr & Friston, 2019](#); [Rudrauf et al., 2023](#)), neural network approaches ([Grossberg, 2017](#)), and related systems-theoretic accounts ([Aru et al., 2020](#)), treat cognition within an epistemic framework of hidden states, generative models, probabilistic inference, and information processing. These hypermodels typically assume one descriptive level while inferring relations across others (see, e.g., [Laukkonen et al., 2025](#)) are computationally powerful through recursive embedding ([Hempel, 2011](#)), their explanatory scope therefore remains confined to objective descriptions of information processing rather than the intrinsically informational organization of physically embodied transscale ontophysical continuity. Consequently, recursive, self-referential, and hierarchical architectures may explain functional organization, but they do not explain how constitutive organization becomes intrinsically realized as conscious actuality. In so far as active inference treat consciousness within an epistemic framework of hidden states, generative models, and probabilistic inference, within such computational and information-theoretic frameworks, ‘phenomenology’ is treated as the outcome of a specific neural information-integration mechanism associated with informational organization. When implemented biologically, consciousness is effectively reduced to informational organization; however, informational organization is a descriptive abstraction of stabilized processes rather than their constitutive basis. It characterizes how processes are organized but does not, by itself, constitute

the ontological conditions from which conscious actuality is intrinsically realized. The usual notion of informational closure (e.g., [Chang et al., 2020](#)) limits the extent that Reason’s theorem ([Reason, 2024](#)) targets explanations formulated solely in terms of objective physical structure and dynamics, the explanatory commitment of the theorem prevents to describe the system in terms of fixed ‘structure’ as in phenomenological or information-theoretic accounts. In biologically implemented versions of such theories, that explain consciousness solely through information closure (e.g., [Chang et al., 2020](#)), remain committed to an objectively characterizable informational organization. Consequently, if Reason’s theorem established limits on explanations formulated entirely in terms of objective informational organization, then those theories remain vulnerable.

Conscious thought, understood as intrinsically intentional disposition prior to cognition and representation, has been linked to reflexive processes ([Allen et al., 2013](#)); however, its constitutive basis, physical realization, and operational mechanism remain largely unresolved. Contemporary neuroscience of consciousness continues to confront a persistent explanatory gap concerning the relation between objectively characterizable physical processes and conscious actuality ([Noë & Thompson, 2004](#); [Koch et al., 2016](#); [Froese, 2023](#); [Zhao et al., 2025](#); [Gibbons et al., 2026](#)). Neural-correlate approaches relate consciousness to measurable brain activity but remain constitutively incomplete, since correlation alone cannot specify the constitutive basis through which conscious actuality is intrinsically realized.

The brain may be described as a multiscale dynamical system, but multiscale organization alone does not account for the persistence of physically embodied transscale ontophysical continuity across successive regimes of relational organization, where *trans-* denotes persistence across realization regimes without localization to any particular spatial or temporal scale. This paper introduces Processual Relational Geometry (PRG) as a foundational constitutive realization theory of consciousness. Physically embodied transscale ontophysical continuity constitutes the constitutive basis of PRG, whereas relational unfolding denotes the processual continuation through which this continuity is constituted and sustained. Here, the ontophysical denotes the organizational dynamics of relational unfolding through which physically embodied transscale ontophysical continuity is constituted and sustained.

In the PRG framework, generative constraints govern relational unfolding, the constitutive process through which relational organization is continually constituted, reorganized, and sustained. A critical relational organizational transition establishes the self-consistency condition of reciprocal realization, through which constitutive organization attains the ontological status of intrinsic realization. Subsequent stabilization by self-intending projective closure operationally maintains this intrinsically realized constitutive organization as conscious actuality. As the enabling stabilization mechanism, self-intending projective closure maintains constitutive organization through intrinsic intentionality, thereby preserving physically embodied transscale ontophysical continuity. Conscious actuality is therefore neither purely physical nor merely experiential, but constitutively realized.

PRG proposes that conscious actuality requires a critical transition enabling constitutive organization to undergo intrinsic realization and subsequent stabilization through self-intending projective closure. Constitutive organization satisfying the self-consistency condition of reciprocal realization attains the ontological status of intrinsic realization, through which conscious actuality is realized. Phenomenality is the intrinsically realized manifestation of conscious actuality, sustained through self-intending projective closure without requiring representation, inference, or symbolic processing. Perception, cognition, and memory are therefore understood as downstream dispositional manifestations of conscious actuality rather than its constitutive basis. Phenomenality, as the intrinsically realized manifestation of conscious actuality, is sustained through stabilized intrinsic intentionality established by self-intending projective closure. Its role therefore remains constitutive rather than classically causal. This account requires a constitutive basis irreducible to localized physical descriptions alone, which PRG identifies as physically embodied transscale ontophysical continuity.

Reciprocal realization is the self-consistency condition established at the critical relational organizational transition through which constitutive realization and physical realization become reciprocally realized manifestations of the same constitutive basis. Consequently, PRG is distinguished from standard physicalism because the constitutive basis is not ontologically exhausted by objective physical description, even though physical realization remains indispensable. Here, *constitutive* refers to the ontology of the constitutive basis rather than to one member of the reciprocal pair. Accordingly, PRG is not a supervenience theory because reciprocal realization replaces an asymmetric dependence relation with a constitutive relation grounded in a common constitutive basis.

Through constitutive realization, the constitutive basis is specified as intrinsically informational organization whose relational unfolding proceeds through ontophysical organizational dynamics and is instantiated by substrate-specific poststructural dynamics. Constitutive realization and physical realization thereby become reciprocally realized manifestations of the same constitutive basis, while embedded quasipolaritonic dynamics provide its substrate-specific physical realization.

The PRG framework introduces the conception of physically embodied transscale ontophysical continuity, addressing what McGinn (1995) characterized as the apparently “nonspatial” nature of consciousness. Physically embodied transscale ontophysical continuity is spatially instantiated through substrate-specific physical realizations while remaining constitutively nonlocalizable to any individual realization regime or organizational scale. Consequently, consciousness is neither localized to a specific physical structure nor detached from physical embodiment. In this respect, PRG aligns with the view that conscious unity is constituted through the continuity of relational organization across successive realization regimes rather than being localized within any particular level of spatiotemporal organization (Northoff, 2024).

Physically embodied transscale ontophysical continuity is constitutively nonlocalizable, meaning that it is not confined to any particular spatial or temporal regime of relational organization. As the constitutive basis underlying conscious actuality is neither localized to a specific physical scale nor reducible to processes occurring at any individual level of organization, it is operationally maintained across successive realization regimes through transscale closure and grounded in the reciprocal realization. Consequently, disruption of this continuity would compromise the constitutive basis itself rather than merely altering activity at a particular scale.

Within PRG, phenomenality is not an additional property imposed upon physical processes but the intrinsically realized manifestation of conscious actuality. Without physically embodied transscale ontophysical continuity, a unified consciousness spanning multiple regimes of relational organization would be insufficient to account for conscious actuality. Accordingly, transscale ontophysical continuity is not equivalent to multiscale continuity. The latter denotes the coordination of processes across different spatial and temporal scales, whereas the former constitutes the constitutive basis of PRG as a constitutively nonlocalizable continuity that persists across successive realization regimes without being confined to any particular regime of relational organization.

PRG explicitly departs from biological naturalism (Searle, 2017) that consciousness is caused by neurobiological processes by arguing that consciousness is constitutively rather than causally realized through physically embodied transscale ontophysical continuity. Consciousness is therefore understood as the intrinsic realization of constitutive organization grounded in the constitutive basis, rather than as an emergent property of objectively describable physical processes. PRG is thus a constitutive essentialism grounded in a nonstandard constitutive physicalism.

Accordingly, consciousness is constituted by physically embodied transscale ontophysical continuity rather than caused by physical processes. Causality pertains to the substrate-specific physical realization of relational unfolding, whereas constitution concerns the ontological realization of the constitutive basis underlying conscious actuality. Self-intending projective closure does not generate consciousness but functions as the enabling stabilization mechanism through which constitutive organization is operationally maintained, preserving physically embodied transscale ontophysical continuity through transscale closure and transscale unity rather than through emergent complexity or biological computation. Consequently, conscious actuality may be ontologically efficacious without constituting an additional causal force in the classical sense (Coseru, 2022). Such efficacy is grounded in the self-consistency condition of reciprocal realization, whereby constitutive realization specifies the intrinsically informational organization of the constitutive basis through substrate-specific ontophysical organizational dynamics realized by poststructural dynamics, while physical realization specifies its substrate-specific embodiment.

Whereas Edelman's neuroscientific theory of consciousness operates at the level of neuronal dynamics governed by evolutionary and developmental selection principles (Edelman, 1979; Edelman et al., 2011), PRG extends these principles through a framework of intrinsic constitutive principle. Rather than viewing the brain as an information-processing system, PRG interprets it as a constraint-governed system in which admissibility determines which relational configurations become dispositionally stabilized through intrinsic bias in relational unfolding. Neural "repertoires" are therefore reinterpreted as admissible relational possibilities (relational regimes) rather than populations of competing neuronal states, while "re-entry" is reconceptualized as reflexive-projective closure of the intrinsic informational organization of physically embodied transscale ontophysical continuity, thereby grounding intrinsic intentionality. Accordingly, PRG replaces selection as the primary explanatory principle with permissibility and admissibility under generative constraints, grounding

intrinsic intentionality in the intrinsically informational organization of physically embodied transscale ontophysical continuity rather than as a functional outcome of neuronal dynamics. In this respect, PRG extends Edelman's neuroscientific framework by relocating the explanatory emphasis from neuronal selection to the constitutive organization of physically embodied transscale ontophysical continuity.

Consciousness likely did not arise through a simple gradual accumulation of neural complexity (Bayne et al., 2020), but through an evolutionary novelty associated with the emergence of cortical neuropil microcavities once specific threshold conditions were realized within neuropil organization (Alemdar, 2025). Importantly, volatile anaesthetics seek out hydrophobic pockets across the amphipathic structure within the neuronal membrane has been recently shown to occur at sites directly associated with channel gating, where volatile anaesthetics modulate voltage-gated sodium channel (Hollingworth et al, 2026). Within these microcavities, endogenous electromagnetic (EM) activity may contribute to the physical conditions necessary for sustaining quasipolaritonic dynamics, which in return may play a role in facilitating energy transfer and helping to focus photon energy in specific ways. Consistent with this possibility, that resonance-dependent embedded quasipolaritonic dynamics participate in the substrate-specific physical realization through which conscious actuality becomes possible.

Quantum delocalization of π -electrons associated with resonance stabilization (Poznanski et al., 2022) may contribute to the substrate-specific physical realization through which physically embodied transscale ontophysical continuity is operationally maintained, although these dynamics are neither conscious nor identical to conscious actuality. Within PRG, embedded quasipolaritonic dynamics are embedded within cortical neuropil microcavities rather than propagating as free EM waves, thereby providing the substrate-specific physical realization within dynamic organicity through which physically embodied transscale ontophysical continuity is operationally maintained and dispositionally expressed through perception, cognition, memory, and affect.

Physical realization and constitutive realization are reciprocally realized manifestations of the same constitutive basis rather than distinct ontological domains or complementary explanatory perspectives. Relational unfolding denotes the ontophysical organizational dynamics through which relational organization is continually constituted, reorganized, and sustained under generative constraints. Through constitutive realization, this organization is specified as intrinsically informa-

tional organization and instantiated by substrate-specific poststructural dynamics, while embedded quasipolaritonic dynamics provide its substrate-specific physical realization. Both constitutive realization and physical realization are objectively characterizable and empirically investigable, yet neither ontologically exhausts the constitutive basis. Constitutive organization satisfying the self-consistency condition of reciprocal realization subsequently attains the ontological status of intrinsic realization, through which conscious actuality is realized, while phenomenality is its intrinsically realized manifestation. Consequently, objective descriptions may characterize constitutive and physical realization, yet remain ontologically incomplete because they do not characterize intrinsic realization.

Schiffer (2025) suggested a four-field model encompassing quantum-optical dynamics and EM interactions, requiring modulation that weak biophotons emissions coalesce in neurons to form a subjective field. However, coherent biophoton emissions are speculative without confinement. A physical substrate is essential for supporting confined EM interactions and quantum-optical dynamics beyond the limitation of microtubules, and to establish these same conditions to incidentally provide the physical environment required for quasipolaritonic coherence and reflexively stabilized closures based on earlier work on quantum-optical effects and the formation of quasipolaritons in cortical neuropil microcavities (Poznanski et al., 2024).

Studies by Zarkeshian et al. (2022) and Liu et al. (2024) propose that photons may play an active role in signaling within myelin sheaths along axons. However, their proposal assumes that thermal fluctuations acting on polaritonic states are negligible, an assumption that is difficult to justify at typical brain temperatures. Under physiological conditions, polaritonic excitations would rapidly thermalize unless they were strongly hybridized with surrounding molecular networks, such as structured water, forming more robust quasipolaritonic modes. For distributed quasipolaritonic coherence to arise, EM coupling would need to occur between structures separated by distances comparable to the relevant EM wavelengths. Quasi-optical modes in biological media matches the spatial scale of dendritic neuropil microcavities ($\approx 200\text{nm}$ – $1\mu\text{m}$). If such cavities lie within a few microns of one another, inter-microcavity EM coupling becomes physically plausible. The dense packing of dendritic processes within the neuropil further increases the likelihood that such cortical neuropil microcavities fall within EM coupling range (see Poznanski et al., 2025).

Quasipolaritonic Process Geometry (QPG)¹ is the mathematical formalism within PRG that specifies the relational template of admissible relational organization

that can arise during relational unfolding, and here reinterpreted as substrate-specific ontophysical organizational dynamics governing substrate-specific poststructural dynamics first identified by Poznanski & Alemдар (2024). Here, “geometry” does not denote a pre-given spatial or metric structure but refers to the invariant relational organization specified by admissibility constraints, thereby constituting the relational template in which QPG provides the mathematical formalism specifying the admissible relational organization independently of any particular spatial description. Ontophysical continuity is physically realized through its substrate-specific realization in embedded quasipolaritonic dynamics.

The PRG framework is fundamentally distinct from the relational quantum mechanics of Rovelli (2021). Relational quantum mechanics remains fully embedded within the standard formalism of quantum theory, relying on quantum states, Hilbert-space structures, and relational interpretations of measurement outcomes. By contrast, PRG does not ground its ontology in quantum states or measurement relations. Instead, it advances a physically embodied transscale ontophysical continuity dispositionally organized through intrinsically informational relational unfolding governed by self-consistency condition and generative constraints. Whereas relational quantum mechanics interprets quantum states relationally, PRG replaces state-based ontology with constitutively primary relational organization. Within PRG, the substrate-specific physical realization of consciousness is understood not as a collection of evolving quantum states, but as the physical realization of the constitutive basis through dynamically organized relational unfolding. Constitutive organization is ontologically prior to state-based description and constrains the

¹*QPG is a pre-topological, non-metrical, non-manifold relational formalism specified by self-consistency condition and generative constraints governing admissible relational organization. It is mathematically non-dynamical: rather than describing the evolution of states, it specifies the conditions under which relational unfolding is admissible. Here, “geometry” refers to admissibility constraints governing relational organization rather than to space, distance, embedding, or metric structure. Accordingly, QPG does not rely on topological invariants (e.g., homology), notions of topological complexity, fixed network adjacency, attractor topology, state-space representations, graph-theoretic structures, or category-theoretic formalisms. More fundamentally, it does not presuppose an underlying spatial substrate, spatial continuity, or embedding manifold. Instead, QPG mathematically formalizes the admissible relational organization under which constitutive organization becomes possible, while embedded quasipolaritonic dynamics provide its substrate-specific physical realization. QPG specifies which relational configurations are admissible, whereas the repertoire consists of those admissible configurations that become dispositionally stabilized through the operational negentropic bias (Q_{neg}).*

admissible relational organization from which objective physical states are abstracted. States, where employed, are therefore treated as descriptive abstractions of stabilized relational organization rather than as ontological primitives.

Rovelli's relational framework is grounded in relational multiplicity, where time is understood as a relational measure of change arising through interactions and observer-dependent physical descriptions. Within PRG, however, relational unfolding is ontologically prior to temporality. Temporal ordering derives from the substrate-specific physical realization of the constitutive basis rather than constituting the medium within which relational unfolding occurs. The critical question is therefore not whether relational multiplicity exists, but whether relational multiplicity alone can account for the constitutive basis of consciousness, its substrate-specific physical realization, and the intrinsic realization of that same constitutive basis as conscious actuality, whose intrinsically realized manifestation is phenomenality.

Geometry is abstracted from the organization of relational admissibility constituted through ontophysical organizational dynamics of relational unfolding and serves as a relational template rather than constituting the constitutive basis itself. Accordingly, the PRG framework specifies a pre-topological, non-metrical, and non-fractal geometry of relational organization in which "shape" is determined by coherence among admissible relational configurations rather than by spatial extension. Geometry therefore neither describes physical space (Popov, 2025) nor consciousness itself, but mathematically formalizes the admissible relational organization governing transitions among relational configurations. Consequently, relational organization need not be grounded in topology, embedded within spacetime, or formulated through field-theoretic frameworks. Instead, QPG-derived generative constraints govern the admissible relational unfolding of configurations directly.

QPG provides the mathematical formalism specifying the admissible relational organization abstracted from constitutive organization. The constitutive organization specified by QPG is physically realized through embedded quasipolaritonic dynamics within dynamic organicity. Dynamic organicity constitutes the substrate-dependent medium through which relational unfolding is physically realized rather than its cause. Relational organization is therefore not confined to ontophysical organizational dynamics alone but is physically instantiated through embedded quasipolaritonic dynamics, which embody the QPG-derived generative constraints governing relational unfolding in a substrate-specific form.

2. Physically embodied transscale ontophysical continuity

Embedded Quantum Physicalism (EQP) denotes the physically embodied constitutive realization of physically embodied transscale ontophysical continuity. Although EQP remains substrate-neutral, every realization of EQP requires physical embodiment within a substrate capable of instantiating the constitutive organization specified by QPG. Within EQP, 'embedded' preserves the original notion of quantum processes embedded within biological physical reality while extending it beyond objective characterization to the constitutive realization of conscious actuality.

During the processual continuation of physically embodied transscale ontophysical continuity, a critical relational organizational transition, governed by QPG-derived generative constraints, provides the physically embodied mechanism by which reciprocal realization is established and the self-consistency condition within EQP is achieved. Constitutive realization and physical realization thereafter become reciprocally realized manifestations of the same constitutive basis. Constitutive realization specifies the intrinsically informational organization of physically embodied transscale ontophysical continuity through substrate-specific poststructural dynamics, whereas physical realization specifies its substrate-dependent embodiment through embedded quasipolaritonic dynamics within dynamic organicity (Poznanski, 2024).

Accordingly, EQP is not a separate ontological domain, but the physically embodied constitutive realization through which physically embodied transscale ontophysical continuity is realized. Embedded quasipolaritonic dynamics within dynamic organicity provide the substrate-specific physical realization basis, while substrate-specific poststructural dynamics instantiate constitutive realization. Physical realization therefore concerns the substrate-dependent realization of physically embodied transscale ontophysical continuity rather than an independent ontological level.

In Edelman's neuroscientific theory of consciousness, the equivalence or grounding of space-time within brain dynamics remained unresolved. The brain is not appropriately described as a Riemannian space-time manifold, as suggested in diffusion-based formulations (e.g., Le Bihan, 2020), but rather as a system of relational organization arising through relational unfolding. Within PRG, relational organization is not understood as a network of pre-existing objects, interactions, or signal exchanges, but as an intrinsically constrained mode of organization governed by QPG-derived generative constraints specifying admissible relational organization. Within EQP, this admissible relational organization is

mathematically formalized by QPG and physically realized in a substrate-specific manner through embedded quasipolaritonic dynamics within dynamic organicity.

Although EQP is quantum-grounded, it is not reducible to the quantum scale. Embedded quasipolaritonic dynamics arise through quantum-optical processes, yet the relational coherence they physically realize is constitutively nonlocalizable, extending across successive regimes of relational organization rather than remaining confined to a particular spatial or temporal scale. These relational configurations possess "shape" only through coherent relational organization rather than spatial extension and are physically realized through constraint-consistent unfolding within dynamic organicity.

Accordingly, EQP does not admit a representation in Hilbert space. Its geometry is neither defined by state vectors nor metric structure but by the generative constraints specifying admissible relational organization. By contrast, standard quantum theory formulates physical systems within Hilbert space as state vectors evolving under Hermitian or non-Hermitian operators. Even when generalized to open systems through analytic continuation, the framework remains representational, describing physical processes within an abstract mathematical space rather than treating relational organization as physically embodied.

The limitation of Hilbert-space approaches is therefore not descriptive adequacy but ontological scope. They provide mathematically powerful descriptions of coherence, decoherence, dissipation, and open-system dynamics while leaving the constitutive organization of physically embodied transscale ontophysical continuity unspecified. Within PRG, quantum dynamics participate in the substrate-specific physical realization of this constitutive basis rather than constituting it. Curvature, scale, and intrinsic information are not independent variables but mutually implicative aspects of relational unfolding realized through substrate-specific poststructural dynamics and physically embodied through embedded quasipolaritonic dynamics.

QPG mathematically formalizes the admissible relational organization governing physically embodied transscale ontophysical continuity; it neither generates space nor specifies curvature as ontological primitives. Space, local curvature, and quantum dynamics belong to the substrate-specific physical realization through which the constitutive basis becomes physically embodied. Geometry is therefore neither an abstract representational container nor the constitutive basis itself, but the mathematical formalization of the admissible relational organization exhibited by physically embodied transscale ontophysical continuity. Conscious actuality

is consequently understood not as computation within an informational space but as the intrinsic realization of this constitutive basis. Its substrate-specific physical realization proceeds through embedded quasipolaritonic dynamics within dynamic organicity, while self-intending projective closure maintains constitutive organization by preserving physically embodied transscale ontophysical continuity.

2.1 Embedded quasipolaritonic dynamics: physical realization basis of ontophysical continuity

Embedded quasipolaritonic dynamics are physically realized within dynamic organicity, characterized by zero-momentum domains and regimes of negative effective quantum kinetic energy (Poznanski, 2025). Quasipolaritons constitute a distinct class of hybrid electromagnetic-matter excitations that do not depend upon the conventional strong-coupling criterion characteristic of exciton-polaritons. Rather, they arise through photon-matter aggregation sustained by complex many-body interactions within confined cortical neuropil microcavities. Their stabilization results from collective interactions among confined electromagnetic fields and material excitations in aqueous biological environments, yielding resonant, self-confined dynamical modes. Microcavity confinement prolongs EM field persistence relative to dissipative loss, thereby enabling localized light-matter interactions and the formation of hybrid embedded quasipolaritonic dynamics even under comparatively weak coupling conditions. These dynamics constitute experimentally accessible physical signatures of quasipolaritonic realization, since quasiparticles are generally inferred through their measurable physical effects rather than observed directly as discrete entities.

Can embedded quasipolaritonic dynamics within cortical neuropil be demonstrated in vivo? The transscale ontophysical framework predicts that the substrate-specific physical realization of conscious actuality requires phase-consistent, reflexively stabilized embedded quasipolaritonic dynamics within cortical neuropil microcavities. Experimental investigation would therefore focus not on observing conscious actuality itself, but on identifying substrate-specific physical signatures consistent with its realization through optical, electromagnetic, or coherence-related measurements. Suitable experimental approaches include ultrafast spectroscopy, quantum-sensitive optical imaging, and high-resolution microscopy (Hell, 2007; Ortega-Arroyo & Kukura, 2012). Techniques such as two-photon microscopy, stimulated emission depletion (STED) microscopy, and femtosecond pump-probe spectroscopy have demonstrated the capacity to resolve transient nanoscale biological dynamics and coherent light-matter interactions

at subcellular scales. Although embedded quasipolaritonic dynamics have not yet been experimentally demonstrated in living cortical neuropil, advanced optical and ultrafast spectroscopic techniques could, in principle, detect indirect physical signatures, such as transient coherent electromagnetic coupling, collective phase stabilization, or ultrafast optical responses, consistent with intermittent embedded quasipolaritonic excitations providing the substrate-specific physical realization of physically embodied transscale ontophysical continuity.

Within EQP, relational unfolding is not reducible to matter or energy alone; rather, it denotes an ontophysical mode of organization whose substrate-specific physical realization occurs through embedded quasipolaritonic dynamics. Its ontological identity resides in relational unfolding, whereas its physical realization depends upon substrate-specific dynamic organicity. Within the PRG framework, dynamic organicity is insufficient for consciousness not because of limited complexity but because it is not ontologically exhausted by objective characterization, since it already constitutes the physically embodied constitutive realization domain (EQP). Dynamic organicity provides the substrate-specific conditions under which relational unfolding is physically realized, while embedded quasipolaritonic dynamics constitute the corresponding substrate-specific physical realization through which constitutive organization is physically realized across successive regimes of relational organization. These dynamics are physically realized through local hybrid EM–matter excitations (quasipolaritonic modes) within cortical neuropil microcavities (Poznanski et al., 2024, 2025).

Embedded quasipolaritonic dynamics do not propagate across the cortex as discrete particles or wave-guided signals. Rather, coherence is physically realized through electromagnetic coupling among embedded quasipolaritonic excitations, yielding phase-consistent coordination across admissible relational configurations spanning successive regimes of relational organization. This coordination constitutes the substrate-specific physical realization of relational coherence within PRG. Phase consistency, however, does not define relational coherence but provides one of its operational physical correlates. Ontophysically, a phase denotes a stabilized regime of relational unfolding rather than a thermodynamic phase. Relational coherence denotes the persistence of admissible relational organization under generative constraints, whereas phase consistency is one substrate-specific mode of its physical realization.

Operationally, this physical realization is instantiated through intermittent embedded quasipolaritonic excitations (Alemdar et al., 2023) together with constraint-mediated coherence across cortical neuropil microcavities, providing experimentally accessible signatures of

the realization process. The apparent discreteness reflects sampling imposed by cortical architecture rather than the embedded quasipolaritonic dynamics themselves. Although these dynamics appear partitioned between neighbouring microcavities, such partitioning characterizes substrate-specific physical realization rather than any discontinuity of the underlying physically embodied transscale ontophysical continuity. Coherence is therefore repeatedly established, destabilized, and re-established across successive admissible relational configurations. Embedded quasipolaritonic dynamics consequently form transient quantum-optical coupling regimes rather than continuous EM fields.

Whereas quantum theories of consciousness typically localize quantum coherence within intracellular microtubules (Hagan et al., 2002), PRG proposes that embedded quasipolaritonic dynamics within cortical neuropil microcavities constitute the substrate-specific physical realization through which physically embodied transscale ontophysical continuity is realized under QPG-derived generative constraints. Dynamic organicity provides the substrate-specific realization framework within which this realization occurs. Although grounded in quantum-scale processes, the resulting constitutive organization is intrinsically transscale rather than reducible to any single physical scale. Constitutive indeterminacy operating under admissibility constraints prevents collapse into classically localizable dynamics, permitting the stabilization of coherent relational organization across successive realization regimes. Operationally, this may be interpreted as an anomalous quasipolaritonic dispersion regime in which quantum constraint geometry generates locally negative relational-curvature contributions that stabilize admissible relational organization. Constitutive indeterminacy therefore does not constitute consciousness itself but preserves the conditions under which coherent relational organization remains physically realizable.

Cortical neuropil microcavities, extending over several microns, provide confined photonic environments within which embedded quasipolaritonic dynamics are physically realized through sustained light–matter coupling. These substrate-specific dynamics enable coherent relational organization to be physically realized across multiple regimes of relational organization rather than remaining confined to isolated local processes. Within the PRG framework, the mosaic unity of consciousness becomes physically realizable only when neural tissue provides the substrate-specific physical realization conditions required for embedded quasipolaritonic dynamics, specifically through the formation of cortical neuropil microcavities within protein-rich neuropil (Poznanski, 2025). These cortical neuropil microcavities, composed of protein-rich hydrophobic pockets, do not themselves constitute physically embodied

transscale ontophysical continuity but provide the substrate-specific physical conditions under which its physical realization can be sustained across successive regimes of relational organization.

2.2. Intrinsic information under generative constraints of relational organization

Relational unfolding is a constraint-governed process rather than a selectionist system of the kind envisaged by [Edelman \(1979\)](#). Within PRG, physically embodied transscale ontophysical continuity constitutes the constitutive basis underlying conscious actuality, while process denotes the relational unfolding of that continuity governed by generative constraints. Although ontologically primary, this unfolding cannot exist independently of its physical realization. Accordingly, PRG advances a physically embodied transscale ontophysical continuity as the constitutive basis underlying conscious actuality through the intrinsic realization of constitutive organization.

The unfolding itself remains a single constitutive process, whereas its physical realization depends upon the properties of a particular substrate, specifically embedded quasipolaritonic dynamics within cortical neuropil microcavities. Consciousness is therefore not explained by two separate ontological domains or substances, but by a single constitutive basis through which physical realization and constitutive realization are reciprocally realized manifestations. Physical realization specifies the substrate-dependent embodiment of the constitutive basis, whereas constitutive realization specifies its intrinsically informational organization through substrate-specific poststructural dynamics. Conscious actuality is the intrinsic realization of that same constitutive basis. Reality is therefore understood as a unified, constraint-governed organization of physically embodied transscale ontophysical continuity rather than as a collection of independent physical states or information-processing operations.

The defining feature of transscale organization within PRG is that relational coherence is not localizable to any single regime of relational organization. Rather, transscale denotes the nonlocalization of physically embodied transscale ontophysical continuity across successive regimes of relational organization without reduction to any particular spatial, temporal, or organizational scale. It therefore does not describe multiple scales interacting, nor a privileged scale from which consciousness emerges, but the constitutive continuity of relational organization reflexively stabilized through self-intending projective closure. Because this continuity is nonlocalizable, it cannot be partitioned, isolated, or exhaustively characterized from the perspective of

any single realization regime. Accordingly, any description confined to one realization regime provides only a partial characterization of the substrate-specific physical realization of the constitutive basis, since physically embodied transscale ontophysical continuity persists across successive regimes of relational organization rather than being reducible to processes localized at any individual spatial, temporal, or organizational scale.

The constitutive basis of PRG consists of physically embodied transscale ontophysical continuity. Processual continuation denotes the relational unfolding of this continuity rather than an ontological primitive in its own right. The constitutive basis is ontologically primary, whereas physical realization specifies the substrate-dependent embodiment through which it is realized. This continuity is sustained through the continual organization and reorganization of relational coherence, while its physical realization occurs through embedded quasipolaritonic dynamics instantiated within cortical neuropil microcavities. Embedded quasipolaritonic dynamics are therefore not the constitutive basis itself but the substrate-specific physical realization through which physically embodied transscale ontophysical continuity is constituted and sustained.

Similarly, a phase is not the unfolding itself but a stabilized regime arising from the maintenance of relational coherence under generative constraints. During relational unfolding, phase-consistent relations are continuously constituted and reorganized, yielding coherent relational organization. Phase consistency constitutes one substrate-specific mode of the physical realization of relational coherence, whereas relational coherence denotes the persistence of admissible intrinsically informational organization under generative constraints. Through this organization, physically embodied transscale ontophysical continuity is sustained across successive regimes of relational organization without localization to any particular spatial or temporal scale. Although its physical realization is necessarily substrate-dependent, the continuity itself is not reducible to any specific physical embodiment.

Within the substrate-specific physical realization of embedded quasipolaritonic dynamics, intrinsic information specifies the constitutive organization of physically embodied transscale ontophysical continuity under self-consistency condition and generative constraints. It functions as the dispositional organization of relational unfolding, biasing admissible relational configurations throughout successive regimes of relational organization. Relational unfolding consists of the continual organization and reorganization of embedded quasipolaritonic dynamics, within which coherent relational organization is maintained through phase-consistent coupling. Such coupling reflects the persistence

of coherent constitutive organization across successive relational configurations and realization regimes rather than merely across spatial or temporal scales. Intrinsic information neither emerges from nor exists independently of the constitutive basis but specifies its intrinsically informational organization as it is physically realized through embedded quasipolaritonic dynamics.

In most forms of materialism, only entities possessing well-defined physical descriptors, such as mass, charge, or fields, are regarded as fully real. Information is therefore typically treated as a description of physical states or as a quantitative measure of uncertainty about those states (e.g., Shannon entropy), rendering it observer-relative and fundamentally epistemic rather than constitutive. By contrast, within transscale ontophysical process realism, physical reality is not constituted by static entities or state-based descriptions, but by the intrinsically informational organization of physically embodied transscale ontophysical continuity. Intrinsic information is therefore neither descriptive nor representational, but constitutes the intrinsically informational organization of physically embodied transscale ontophysical continuity. It is physically realized through constitutive realization while remaining irreducible to state-based or particle-based descriptions.

Intrinsic information is not a description of relational unfolding but the intrinsically informational organization specified by constitutive realization of physically embodied transscale ontophysical continuity. It is therefore observer-independent, physically instantiated, and nonrepresentational rather than epistemic, while remaining irreducible to particle-, state-, or process-based descriptions. Intrinsic information is non-reductively physical, not non-physical. It appears nonphysical only if physicality is restricted to a static, state-based ontology. Intrinsic information is understood as the intrinsically informational organization of the constitutive basis, physically realized through substrate-specific embedded quasipolaritonic dynamics.

Accordingly, intrinsic information is neither an abstract entity nor an epistemic representation, but the intrinsically informational organization specified through constitutive realization and physically realized in a substrate-specific manner through embedded quasipolaritonic dynamics. It is not merely descriptive but constitutes the intrinsically informational organization of physically embodied transscale ontophysical continuity through relational unfolding governed by generative constraints. Its constitutive organization is dispositionally realized under admissibility constraints within the constitutive realization domain (EQP) and does not exist independently of that unfolding. Consequently, intrinsic information is neither located in nor propagated through space as an independent entity, but is realized

only through the relational unfolding of physically embodied transscale ontophysical continuity.

Constitutive indeterminacy within the relational organization specified by QPG establishes the admissibility conditions under which physically embodied transscale ontophysical continuity can be realized within EQP. Through Q*-mediated constraint modulation (see *Section 3.1*), admissible relational organization is biased toward coherent relational regimes without eliminating the underlying multiplicity of relational configurations. This organization permits nonlocalizable relational coherence to be physically realized through embedded quasipolaritonic dynamics extending across cortical neuropil microcavities, thereby enabling long-range phase-consistent coupling. QPG does not contain intrinsic information within its relational templates; rather, it specifies the generative constraints under which intrinsically informational organization is constituted. Intrinsic information is therefore organized through relational organization, constituting the intrinsically informational organization of physically embodied transscale ontophysical continuity.

Poststructural dynamics denote the continual constitution, transformation, and stabilization of relational organization rather than the evolution of pre-existing structures. Within PRG, QPG specifies the generative constraints governing the relational template (schema) of admissible relational organization. These constraints shape the substrate-specific physical realization of poststructural dynamics through embedded quasipolaritonic dynamics, provide the substrate-specific physical realization through which physically embodied transscale ontophysical continuity is sustained. Relational organization is therefore continually constituted and reorganized under generative constraints rather than being pre-specified. These generative constraints arise from the coherence of relational organization itself rather than from any pre-existing implicate order. Consequently, relational coherence within QPG is not derived from a hidden implicate order (Bohm & Hiley, 1993), but from the admissible relational organization of the constitutive basis.

2.3 Intrinsic reflexivity

Intrinsic reflexivity is not reducible to a "reflexivity gradient" (Josipovic, 2024) or to the notion that consciousness is simply aware of itself. Nor does it denote recursive self-reference, representational self-modeling, or Husserlian intentionality. Rather, it designates a pre-reflective ontophysical characteristic of the relational unfolding of physically embodied transscale ontophysical continuity in which relational organization is intrinsically self-constraining under generative constraints. In-

intrinsic reflexivity therefore concerns the constitutive organization of relational unfolding, not through recursive embedding or self-reference, but through the immanent constraints governing the continuation of admissible relational organization. It denotes the self-constraining continuation of relational unfolding prior to the critical relational organizational transition through which constitutive organization becomes possible.

Intrinsic reflexivity and self-reference should not be conflated. Self-reference is a formal relation in which a representation, symbol, or structure refers to itself and is therefore fundamentally a property of representational, syntactic, or formal organization. Intrinsic reflexivity, by contrast, is a constitutive feature of physically embodied transscale ontophysical continuity, denoting the self-constraining continuation of relational unfolding under generative constraints. It neither represents nor refers to itself but constitutes the condition through which relational organization persistently constrains its own continuation.

Within the Self-Intending Projective Framework (SIPF), intrinsic reflexivity is stabilized through reflexive-projective closure, yielding a reflexive-projective organization capable of sustaining physically embodied transscale ontophysical continuity across regimes of relational organization. Intrinsic reflexivity is therefore ontophysical and transscale in constitution, whereas reflexive neural circuitry (Igamberdiev, 2024) constitutes a substrate-specific physical realization participating in, but not generating, the relational organization through which intrinsic reflexivity is physically realized.

Within EQP, intrinsic reflexivity is constitutively organized through the intrinsically informational organization of physically embodied transscale ontophysical continuity. Only through reflexive-projective closure and self-intending projective closure does relational unfolding become constitutively realized as conscious actuality, whose intrinsically realized manifestation is phenomenality. It is dispositionally expressed as the self-constraining continuation of relational unfolding under the intrinsic constitutive principles and generative constraints. Intrinsic form denotes the constitutive organization of intrinsic information as dispositions delimiting admissible relational organization, whereas form-within denotes the substrate-specific physical realization of those dispositions through embedded quasipolaritonic dynamics within cortical neuropil microcavities. These dispositions neither represent states nor encode information; rather, they constrain the admissible continuations through which relational organization persists, stabilizes, and transforms. Directionality at this stage is not yet intentional but consists of constraint-shaped dispositional tendencies intrinsic to relational unfolding.

Two distinct forms of *constitutive bias* participate in the self-constraining continuation of relational unfolding. First, the operational *negentropic bias*, Q_{neg} , biases admissibility toward coherent relational regimes, delimiting the admissible range of relational organization and preconditioning the continuations through which unfolding may proceed. Second, an constitutive *intrinsic bias* arises within relational unfolding itself as the dispositional manifestation of the generative constraints governing admissible relational organization. These tendencies neither determine specific outcomes nor encode representations, but constrain the admissible continuations through which relational organization is maintained, transformed, and stabilized. Neither bias is externally imposed; both are constitutive of the intrinsically informational organization through which physically embodied transscale ontophysical continuity is sustained.

3. Operational mechanisms

In spatiotemporal neuroscience (Northoff, 2024), neural information is treated as a downstream manifestation of cognitive-level organization, coupled to the extra-neuronal dynamic organicity physically realized within cortical neuropil microcavities. Coupling is not informational transfer but a constraint-mediated, phase-consistent modulation between intra-neuronal activity and embedded quasipolaritonic dynamics. It occurs through the modulation of quasipolaritonic phase configurations, whereby intra-neuronal activity establishes diachronic boundary conditions that shape the realization of Q^* -admissible coherent relational regimes under the joint influence of Q^* and Q_{neg} . Neuronal processes modify the boundary conditions governing which admissible phase configurations can be physically realized, whereas embedded quasipolaritonic dynamics influence synaptic efficiency, membrane thresholds, and temporal coordination through EM field effects and Q_{neg} -mediated coherence stabilization. Coupling therefore occurs not between signals, but between constraint relations and physically realized coherence. Realized coherence is a physically instantiated organization of phase-consistent embedded quasipolaritonic dynamics that is Q^* -admissible and Q_{neg} -stabilized.

These operational mechanisms should not be understood as independently generating conscious actuality, but as collectively governing the admissible relational unfolding of physically embodied transscale ontophysical continuity. Within PRG, they regulate the substrate-specific physical realization of relational organization by continuously constraining, stabilizing, and reorganizing coherent relational regimes under QPG-derived generative constraints. As relational organization undergoes continual reorganization, these mechanisms

progressively bias admissibility toward increasingly coherent constitutive organization until a critical relational organizational transition is reached. At this transition, the physically embodied mechanism establishes the self-consistency condition of reciprocal realization within EQP, enabling constitutive organization to instantiate constitutive realization through substrate-specific poststructural dynamics. Constitutive organization satisfying this self-consistency condition subsequently attains the ontological status of intrinsic realization, through which conscious actuality is realized.

The intrinsically informational organization of physically embodied transscale ontophysical continuity is sustained through a set of operational mechanisms. These include the effective quantum potential (Q^*), which modulates admissibility through generative constraints, and relational Green's functions, which propagate compatibility constraints across relational organization, enabling the formation of mutually reinforcing coherent relational regimes. Q^* does not govern dynamical evolution directly but selectively biases admissibility toward coherent relational organization while preserving the underlying constitutive indeterminacy and multiplicity of relational configurations. In this sense, Q^* operates non-dynamically by constraining the admissible range of relational continuations rather than by determining their evolution. Relational organization is continually constituted through the reciprocal organization of relational curvature, intrinsic information, and Q^* -mediated constraint modulation, yielding transient yet stabilized substrate-specific physical realizations of coherent relational organization.

3.1 Q^* -mediated constraint modulation

Within its substrate-specific physical realization, Q^* -mediated constraint modulation provides the operational mechanism through which coherent relational organization is sustained. Q^* does not determine relational unfolding but selectively biases admissibility toward coherent relational regimes, modulating which relational configurations may emerge, persist, and stabilize. In this sense, Q^* functions as a constraint-modulating term that regulates admissible relational organization while preserving the constitutive indeterminacy underlying relational multiplicity. It is consistent with quantum uncertainty relations, operating by constraining the admissible range of relational continuations rather than by directly governing dynamical evolution.

Q^* -mediated constraint modulation maintains coherent

relational organization through curvature-like coherence, understood as the intrinsic organizational pattern of relational unfolding under QPG-derived generative constraints. Through this organizational pattern, Q^* selectively biases admissible relational organization toward coherent relational regimes while preserving constitutive indeterminacy. Curvature-like coherence is not a geometric curvature in the conventional sense but the substrate-specific organizational pattern through which admissible relational organization is physically realized across successive regimes of relational unfolding. The constraint-modulating term (Q^*) shaping admissible relational configurations. It is defined through the logistic admissibility function:

$$Q^*(r, r^1; T, \Delta S, f) = Q_{\text{neg}}(r, r^1; T, \Delta S, f) / [1 + \alpha C^2(r, r^2)] \quad (1)$$

where the intrinsic relational curvature (C) describes the constraints on change or shape how relational organization varies across configurations, $Q_{\text{neg}}(r, r^1; T, \Delta S, f)$ is the negentropic biasing component, shaping admissibility toward coherent relational unfolding by capturing the non-equilibrium, negentropic influences that stabilize the coherent modes where T : local thermodynamic temperature, ΔS : change in entropy from cortical neuropil microcavity order, $\Delta S < 0$ = microcavities have become more ordered than the surrounding tissue, f : *thermo-quantum fluctuations* (cortical neuropil microcavities are inherently f –dependent), which modulate constraints and without constituting intrinsic information. Q_{neg} is not “information” it biases admissibility toward those which coherent configurations that remain viable, and so it represents a ‘*thermocoherent effect*’. Finally, α is the dimensionless, substrate-dependent relational parameter that governs the curvature sensitivity of Q^* , modulating the admissibility of relational configurations under QPG constraints.

Within PRG, intrinsic form and diachronic boundary conditions are constituted through intrinsic relational curvature (C). These boundary conditions arise from coherence constraints on relational organization, delimiting which relational configurations remain physically admissible across embedded quasipolaritonic dynamics realized within cortical neuropil microcavities and thereby constraining phase organization within Q^* -stabilized admissible regimes. Relational organization is constituted through the reciprocal interplay of intrinsic relational curvature (C), Q^* -mediated constraint modulation, and non-metric phase-relational coherence constraints, collectively specifying QPG-derived admissible relational geometry (**Fig. 1**).

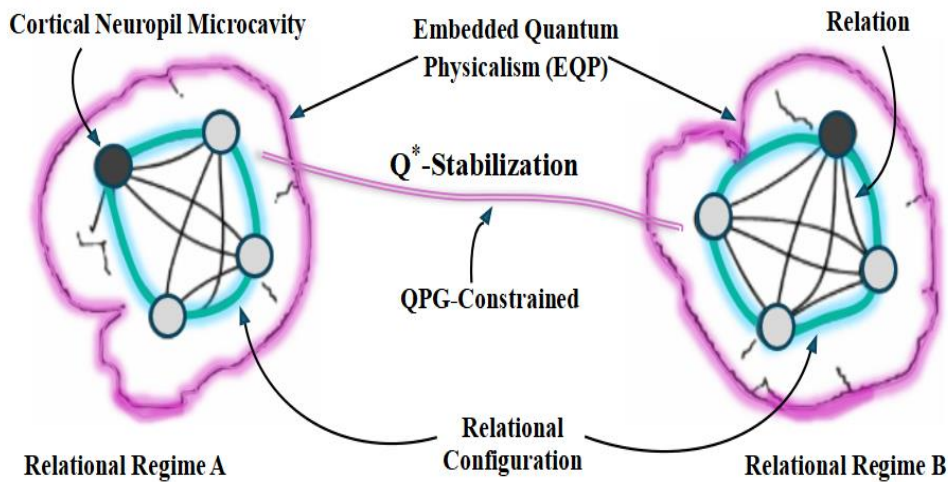


Figure 1 QPG provides the mathematical formalism specifying the relational template (schema) of admissible relational organization governing the constitutive organization of physically embodied transscale ontophysical continuity. Embedded quasipolaritonic dynamics provide its substrate-specific physical realization under QPG-derived generative constraints, while the operational constraint-modulating term Q^* biases admissibility toward coherent relational organization. The Q_{neg} -biased coherence stabilization delimits the admissible range of transscale alignment among relational configurations, yielding Q^* -admissible coherent relational regimes within EQP. Relational regimes (A and B) denote dynamically stabilized, distinct organizations of coherent relational unfolding, whereas the underlying physically embodied transscale ontophysical continuity remains continuous across successive regimes of relational organization.

Within this framework, QPG specifies the relational template of admissible relational organization, whereas embedded quasipolaritonic dynamics participate in the substrate-specific physical realization of relational unfolding under QPG-derived generative constraints. Q^* maintains coherent relational organization within an admissible coherence envelope, while intrinsic relational curvature specifies the intrinsic organization of form through diachronic boundary conditions. Q^* does not operate as a resonance phenomenon but as an operational constraint-modulating term that biases admissibility toward coherent relational organization by selectively stabilizing phase-relational configurations capable of remaining self-consistent across successive regimes of relational organization. Accordingly, Q^* is a non-dynamical operational construct that regulates admissible relational organization through curvature-dependent modulation. Diachronic boundary conditions function as coherence constraints by delimiting the admissible phase-relational configurations through which physically embodied transscale ontophysical continuity is physically realized across successive regimes of relational unfolding.

Q^* -mediated curvature does not correspond to geometric curvature on a manifold but to the operational modulation of admissibility within relational organization. Q^* is neither a quantum potential nor a wave-function-derived quantity, but a curvature-sensitive operational constraint-modulating term whose action is determined by patterns of relational coherence

within Q^* -admissible configurations. Relational coherence is therefore not maintained through homogeneous synchronization but through dynamically stabilized admissible relational organization that accommodates local variation in phase, scale, and curvature while preserving coherence across successive regimes of relational organization.

Within the PRG framework, closure denotes the constitutive stabilization through which relational organization becomes self-sustaining, directionally coherent, and capable of persisting across realization regimes. Closure establishes three constitutive conditions: (1) self-sustaining continuation, whereby relational unfolding maintains its own persistence; (2) stabilized directionality, whereby intrinsically informational dispositions acquire directional coherence as intrinsic intentionality; and (3) transscale continuity, whereby coherent relational organization persists across successive realization regimes without privileging any particular spatial or temporal scale. Closure is therefore not a causal mechanism acting upon an already existing consciousness but the constitutive condition under which conscious actuality becomes intrinsically realizable.

A central manifestation of this constitutive stabilization is reflexive-projective closure, through which admissible relational organization becomes persistently organized into coherent relational regimes. These regimes are dynamically stabilized organizations in

which constrained relations reciprocally reinforce one another under Q^* -mediated admissibility modulation and Q_{neg} -biased coherence stabilization. What appears biologically as functional selection is therefore the substrate-specific physical realization of coherent relational organization under QPG-derived generative constraints. Q^* is an operational constraint-modulating term that biases admissibility toward coherent, low-entropy relational organization. This operational bias is physically realized through local relational coupling among embedded quasipolaritonic dynamics, selectively stabilizing phase-relational configurations.

3.2 Relational Green's functions as constraint-propagation kernels

Within PRG, relational organization is physically realized through local constraint-mediated coupling among embedded quasipolaritonic dynamics. Local coherent relational organization is operationally stabilized through Q^* -mediated admissibility modulation, while relational Green's functions propagate compatibility constraints across distributed relational organization. Rather than transmitting information, relational Green's function propagation distributes the influence of generative constraints across successive regimes of relational organization, enabling coherent relational organization to be maintained despite continual local reorganization. Without this propagation, coherent relational organization would dissipate. Q^* does not generate relational organization but functions as an operational constraint-modulating term that biases admissibility toward coherent relational organization under QPG-derived generative constraints. In doing so, Q^* operationally constrains admissible relational configurations while preserving constitutive indeterminacy.

Relational organization is constituted through the reciprocal organization of intrinsic relational curvature, intrinsic information, and Q^* -mediated admissibility modulation, whereas relational Green's function propagation distributes the compatibility constraints through which this organization remains coherent across realization regimes. The relational Green's function provides the mathematical representation of admissible relational propagation within the EM field supporting embedded quasipolaritonic dynamics. It functions as a propagator kernel encoding compatibility relations among distributed cortical neuropil microcavities rather than as a carrier of information. The continuous EM field provides the physical substrate within which embedded quasipolaritonic dynamics arise through light-matter coupling and boundary-conditioned mode formation. Consequently, embedded quasipolaritonic dynamics interact when their EM

field components overlap through shared resonant modes, establishing phase-consistent relational coupling across distributed microcavity sites. Interaction is therefore mode-mediated and field-extended rather than determined solely by geometric distance.

Formally, relational Green's functions constitute constraint-propagation kernels through which generative constraints are distributed across admissible relational organization. The propagated compatibility relations selectively reinforce coherent relational organization, while Q_{neg} provides the operational negentropic bias that preferentially stabilizes coherent relational regimes. Generative constraints therefore arise from the intrinsic organization of relational coherence within QPG, whereas relational Green's functions distribute their operational influence across successive regimes of relational organization. Accordingly, relational Green's functions are defined as constraint-propagation kernels over a measure-theoretic organization of admissible relational configurations rather than as integral kernels defined over a metric space.

Relational Green's functions provide a mathematical formalism for PRG by describing the transscale propagation of Q^* -mediated constraints. If G^A and G^B are Green's function propagation kernel associated with two relationally constraint configurations, then their composition G^{AB} is the Green's function propagation kernel, over admissible relational continuations (not convolution over space) weighted by coherence (Q^* -admissibility) (Ahmad et al., 2025):

$$G^{AB}(\rho^1, \rho^2) = \int_{\mathfrak{g}} G^A(\rho^1, \rho) G^B(\rho, \rho^2) d\mu(\rho) \quad (2)$$

where $\rho, \rho^1, \rho^2 \in \mathfrak{g}$ and $\mathfrak{g}$ is the space of admissible relational configurations (ρ, ρ^1, ρ^2) under PRG constraints, G^A is the first constraint-propagation kernels, G^B is the second constraint propagation operator, $d\mu$ is a non-metric relational measure over admissible configurations. Constraints propagate from $\rho^2 \rightarrow \rho^1$ via G^B then from $\rho^1 \rightarrow \rho$ via G^A , aggregated over all admissible intermediate configurations.

For a given ρ^1 multiple admissible ρ exist contributing to the resulting relational organization. These configurations correspond physically to relationally ordered ensembles of interacting quasipolaritonic modes. EQP relies on constitutive indeterminacy, whereby embedded quasipolaritonic dynamics cannot be uniquely resolved into fixed relational configurations but remain distributed across multiple admissible relational continuations under QPG-derived generative constraints.

Constitutive indeterminacy is expressed as the non-

uniqueness of admissible relational configurations (ρ^1), reflected in the relational configuration space ($\mathcal{R}$), the non-deterministic mapping of relational Green's functions, and the aggregation over admissible configurations during constraint propagation ($\mathcal{R}$). Q^* mediated admissibility modulation subsequently biases this constitutive indeterminacy toward coherent relational organization by selectively stabilizing relational regimes without eliminating the underlying multiplicity of admissible configurations.

The integral is taken over relational configurations, not spatial co-ordinates where $d\mu$ is the constraint-induced relational measure over admissible configurations, weighting configurations by admissibility under QPG and their stability under Q^* . Two configurations are coupled through the generatively constrained relational coherence as a continuous process of relational unfolding in EQP designated by relational organization ($\mathcal{R}$) expressed in terms of a Q^* -dynamic:

$$\mathcal{R}(\rho) = \int_{\mathcal{R}} G^{AB}(\rho^1, \rho^2) Q^*(\rho, \rho^1) C[I(\rho^2)] d\mu(\rho^1) \quad (3)$$

where $C[I(\rho)]$ is the intrinsic relational curvature as a function of intrinsic information (I), $Q^*(\rho, \rho^1)$ is the effective quantum-scale weighting kernel (negentropic stabilization operator). Intrinsic relational curvature characterizes the organization of admissible relational coherence rather than propagating constraints itself. Constraint propagation is operationally mediated through relational Green's functions, whereas intrinsic relational curvature modulates which propagated relational configurations remain admissible by weighting compatibility within the propagation kernel. Operationally, this corresponds to dispersion curvature, whereby the propagation characteristics of embedded quasipolaritonic dynamics vary with momentum over admissible relational configurations without presupposing metric structure or spatial integration. Dispersion curvature therefore characterizes the propagation properties of embedded quasipolaritonic dynamics rather than the physical curvature of propagation itself. Physical realization occurs through differential embedded quasipolaritonic dynamics within cortical neuropil microcavities, particularly in the near-zero-momentum regime.

Negative intrinsic relational curvature denotes an admissibility regime in which dispersive spreading is suppressed, enabling persistent coherent relational organization under Q -mediated admissibility modulation and Q_{neg} -biased coherence stabilization. Rather than converging upon fixed attractors, relational organization remains metastably stabilized through continually reconfigurable admissible relational configurations.

Relational Green's functions provide the operational constraint-propagation kernels through which physically embodied transscale ontophysical continuity is physically realized across successive regimes of relational organization by preserving compatibility among transient relational configurations without convergence onto globally stable attractor states. Should the propagator assume a Weierstrass-type form, propagation no longer resembles deterministic trajectories but instead exhibits diffusive, statistically fractal relational organization. Consequently, physically embodied transscale ontophysical continuity is maintained through diffusive, statistically fractal relational propagation sustained by Green's function-mediated admissibility, thereby supporting nonlocalizable transscale coherence. Transscale closure subsequently arises through the stabilization of coherent relational organization under self-intending projective closure rather than through attractor convergence.

The relational organization sustaining physically embodied transscale ontophysical continuity therefore remains intrinsically labile rather than rigidly fixed or completely closed, while nevertheless maintaining coherent participation through intermittent embedded quasipolaritonic excitations (Alemdar et al., 2023) participating in its substrate-specific physical realization across cortical neuropil microcavities. Within PRG, lability does not denote instability in the conventional nonlinear dynamical sense but the capacity of coherent relational organization to undergo continual adaptive reconstitution under generative constraints while preserving physically embodied transscale ontophysical continuity across successive regimes of relational organization. PRG therefore avoids both rigid structural fixation and dynamical breakdown by maintaining coherent relational organization through continual constitutive renewal.

3.3 Self-Intending Projection Framework (SIPF)

The Self-Intending Projective Framework (SIPF) specifies the constitutive conditions under which physically embodied transscale ontophysical continuity becomes constitutively stabilized through self-intending projective closure. It operates at a pre-functional level, prior to perception, cognition, affect, and behavioural organization, and therefore does not operate upon signals, representations, or informational states, but upon the constitutive organization physically embodied through embedded quasipolaritonic dynamics within substrate-specific dynamic organicity. SIPF is not a mechanism externally imposed upon relational unfolding but the operational framework through which intrinsically reflexive constitutive organization is progressively stabilized under genera-

tive constraints. In this respect, SIPF replaces epistemic accounts grounded in inference, representation, and computation with an ontophysical account of constitutive stabilization. Reflexive-projective closure does not terminate relational unfolding but transforms its mode of continuation by operationally stabilizing admissible relational organization into persistently self-maintaining constitutive organization. Functional organization is therefore derivative of reflexive-projective closure rather than constitutive of it, while the functional geometry realized across cortical neuropil microcavities provides the substrate-specific physical realization through embedded quasipolaritonic dynamics under the admissible relational organization mathematically formalized by QPG.

SIPF describes the non-representational constitutive organization through which intrinsically reflexive relational unfolding becomes self-intending. It does not generate intrinsic reflexivity but presupposes it. Whereas intrinsic reflexivity provides the constitutive condition for the self-constraining continuation of relational unfolding, SIPF specifies the constitutive progression from intrinsically reflexive relational unfolding to self-intending projective closure. This progression occurs through reflexive-projective operationalization, which operationally biases admissible relational continuations, reflexive-projective closure, which operationalizes constitutive organization and establishes intrinsic intentionality, and culminates in self-intending projective closure, which constitutively stabilizes intrinsic intentionality into conscious actuality. Intrinsic reflexivity is therefore not replaced but transformed: intrinsically informational dispositions acquire directional coherence as intrinsic intentionality, giving rise to the constitutive organization through which conscious actuality is intrinsically realized.

Within the PRG framework, self-intending projective closure is neither a formal recursive loop nor a reflexive feedback process. Rather, it is the constitutive stabilization principle through which intrinsic intentionality becomes persistently self-maintaining, enabling the intrinsic realization of conscious actuality grounded in physically embodied transscale ontophysical continuity. Self-intending projective closure therefore constitutes the ontophysical condition under which constitutive organization is intrinsically realized as conscious actuality, while remaining physically embodied through substrate-specific embedded quasipolaritonic dynamics. The resulting constitutive organization exhibits intrinsic reflexivity through the continual stabilization of intrinsically informational organization, yielding directionally coherent intentional dispositions that persist through relational unfolding. It neither represents, infers, nor computes but reflexively sustains and projectively constrains the

continuation of admissible relational organization under generative constraints.

Accordingly, self-intending projective closure denotes the constitutive culmination of reflexive-projective operationalization and reflexive-projective closure, through which intrinsically informational organization acquires directional coherence as intrinsic intentionality. The projective aspect is neither representational nor computational but consists in the constraint-mediated continuation of admissible relational organization. Consciousness is therefore neither symbolic computation nor inferential processing but the intrinsic realization of constitutive organization grounded in physically embodied transscale ontophysical continuity and constitutively stabilized through self-intending projective closure. Phenomenality is the intrinsically realized manifestation of this conscious actuality.

3.3.1 *Reflexive-projective operationalization within constitutive organization*

Froese (2023) proposes an irruption theory of motivational activity grounded in enactivism, according to which no constitutive ontology precedes enactment and conscious motivation arises through episodic "irruptions" within ongoing organism–environment dynamics. Within this framework, neural entropy has been proposed as a correlate of such irruptive events. However, because the theory rejects an intrinsically constitutive organizational basis preceding enactment, neural entropy remains primarily a descriptive correlate rather than a constitutive explanation. In particular, the framework leaves unresolved the source of coherent admissibility, since fluctuations in neural dynamics alone cannot account for why some relational organizations become persistently stabilized whereas others dissipate. Consequently, irruption theory characterizes dynamical variability without specifying how enactivism gives rise to directionally coherent intrinsic intentionality. Without generative constraints governing admissible relational organization, irruptive dynamics remain statistically describable but ontologically indeterminate. By contrast, within the PRG framework, SIPF operationalizes the constitutive organization through which intrinsically reflexive relational organization acquires persistent directional coherence under generative constraints.

Within PRG, reflexive-projective operationalization constitutes the operational transition through which admissible relational organization becomes progressively biased toward coherent relational regimes under Q^* -mediated admissibility modulation, Q_{neg} -biased coherence stabilization, and relational Green's function propagation. Reflexive-projective closure is at-

tained when this operationalization becomes persistently self-maintaining, thereby establishing physically embodied transscale ontophysical continuity as a continuously coherent mode of relational organization. The transition to reflexive-projective operationalization therefore marks the onset of reflexive-projective closure, wherein intrinsic reflexivity and intrinsic constitutive bias become sufficiently coordinated through relational Green's function propagation to operationalize constitutive organization. Operationally, this organization is physically realized through phase-consistent coordination among embedded quasipolaritonic dynamics distributed across successive relational configurations.

Reflexive-projective operationalization constitutes the operational transition through which constitutive organization is progressively stabilized from relational unfolding under generative constraints. It operates through the operational negentropic bias (Q_{neg}), which biases admissible relational continuations toward coherence without generating new dispositional tendencies. Rather, it progressively operationalizes the admissible relational organization already implicit within Q^* -mediated relational unfolding. This operationalization is dispositional rather than classically causal: it neither introduces intrinsic constitutive bias nor determines specific outcomes but operationally biases admissible relational continuations toward coherent constitutive organization. The propagation of compatibility among distributed substrate-specific embedded quasipolaritonic dynamics is operationally mediated through relational Green's function propagation, distributing generative constraints across successive relational configurations and realization regimes. Reflexive-projective closure is attained when reflexive-projective operationalization becomes persistently self-maintaining, thereby establishing the constitutive conditions under which self-intending projective closure functions as the enabling stabilization mechanism for conscious actuality, without recourse to representational, computational, or informational processing.

3.3.2 *Reflexive-projective closure within constitutive organization*

Ontophysical continuity is physically embodied through substrate-specific dynamic organicity, within which embedded quasipolaritonic dynamics instantiate its physical realization. Through the fundamental intrinsic constitutive principle of reciprocal realization, constitutive realization and physical realization are reciprocally realized manifestations of the same physically embodied transscale ontophysical continuity. Constitutive realization specifies the intrinsically informational organization of this constitutive basis,

whereas physical realization specifies its substrate-specific embodiment. Reflexive-projective closure operationalizes this constitutive organization, establishing the coherent relational organization through which physically embodied transscale ontophysical continuity is operationally sustained across successive realization regimes. Under these conditions, physically embodied transscale ontophysical continuity constrains the stability of admissible quasipolaritonic organization, while embedded quasipolaritonic dynamics provide its substrate-specific physical realization.

Reflexive-projective operationalization is the closure-forming process through which intrinsically reflexive constitutive organization acquires directional coherence as intrinsic intentionality under generative constraints. It denotes the progressive constitutive stabilization of intrinsically informational relational organization through admissible projective reinforcement, yielding coherent relational regimes and persistently self-maintaining constitutive organization. Within the SIPF, reflexive-projective operationalization culminates in reflexive-projective closure, which operationalizes constitutive organization and gives rise to intrinsic intentionality. Operationally, its physical realization within dynamic organicity may be inferred through measurable signatures including phase-consistent coordination among embedded quasipolaritonic dynamics, persistent relational coherence across successive realization regimes, stability under perturbation consistent with self-maintaining constitutive organization, and Q^* -admissible, Q_{neg} -biased relational dynamics that resist incoherent drift.

Reflexive-projective closure is the operational stabilization through which constitutive organization becomes persistently self-maintaining under generative constraints. Closure is not itself a measurable physical variable but an ontophysical condition whose substrate-specific physical realization may be empirically inferred through its operational manifestations within dynamic organicity. These manifestations include sustained phase-consistent coordination among embedded quasipolaritonic dynamics, persistent transscale relational coherence across successive realization regimes, and stabilized substrate-specific quasipolaritonic dynamics. Within PRG, reflexive-projective closure operationalizes constitutive organization, through which intrinsically informational dispositions acquire directional coherence as intrinsic intentionality, thereby establishing the conditions for self-intending projective closure.

Intrinsic reflexivity denotes the self-constraining continuation of relational unfolding, whereas reflexive-projective closure denotes its operational stabilization. Reflexive-projective closure arises when intrinsically

reflexive relational unfolding becomes persistently stabilized under generative constraints, marking the transition from transient relational coherence to persistently self-maintaining constitutive organization. At this stage, relational unfolding neither dissipates nor propagates indefinitely but becomes organized as a coherent relational regime that operationally sustains physically embodied transscale ontophysical continuity. Reflexive-projective closure therefore constitutes the first operational closure, transforming transient admissible relational organization into persistently self-maintaining and causally efficacious constitutive organization. This stabilization is neither computational, inferential, nor representational, but an ontophysical process through which constitutive organization acquires the capacity to sustain and constrain its own continuation.

Reflexive-projective closure establishes the constitutive conditions under which intrinsic intentionality becomes possible but does not itself constitute conscious actuality. Constitutive realization, instantiated through substrate-specific ontophysical organizational dynamics of relational unfolding realized within dynamic organicity, specifies the intrinsically informational organization of the constitutive basis, while physical realization, instantiated through embedded quasipolaritonic dynamics, specifies its substrate-specific embodiment. Phenomenality is therefore not added to relational unfolding but is the intrinsically realized manifestation of conscious actuality, itself the intrinsic realization of constitutive organization grounded in physically embodied transscale ontophysical continuity. Embodied intrinsic information denotes the intrinsically informational organization of the constitutive basis physically instantiated through embedded quasipolaritonic dynamics within Q^* -admissible, Q_{neg} -biased coherent relational regimes.

Conscious actuality arises only when reflexive-projective closure is further constitutively stabilized through self-intending projective closure within the SIPF, whereby physically embodied transscale ontophysical continuity becomes intrinsically self-present through directionally coherent intrinsic intentionality. Phenomenality is therefore the intrinsically realized manifestation of conscious actuality rather than an emergent property, representational state, or computational construct. It is precognitive because it neither depends upon higher-order cognition nor arises from computational processing, while remaining physically embodied through substrate-specific embedded quasipolaritonic dynamics. Perception, cognition, affect, and memory are consequently understood as downstream dispositional manifestations of conscious actuality rather than as its constitutive basis.

3.3.3 *Self-intending projective closure within constitutive organization*

Intrinsic intentionality is constituted through the constitutive realization of the intrinsically informational organization of the transscale ontophysical continuity under reflexive-projective closure. Prior to closure, intrinsically informational organization persists as a constitutive aspect of relational unfolding, preserving continuity across admissible relational configurations without yet acquiring directional coherence. Directionality arises only when intrinsically reflexive relational unfolding becomes constitutively realized through reflexive-projective closure, whereby intrinsically informational dispositions acquire directional coherence as intrinsic intentionality. Through this constitutive realization, intrinsic intentionality emerges as a persistently coherent mode of constitutive organization.

Within SIPF, intrinsic intentionality does not denote representational aboutness but the directionally coherent persistence of intrinsically informational organization grounded in physically embodied transscale ontophysical continuity under generative constraints. Reflexive-projective closure operationally stabilizes constitutive organization, transforming intrinsically informational dispositions into directionally coherent intrinsic intentionality. A disposition becomes intrinsically intentional only when its continuation is operationally sustained through reflexive-projective closure within admissible relational unfolding. Self-intending projective closure subsequently constitutes the operational culmination through which constitutive organization becomes sufficiently stabilized for intrinsic realization, thereby maintaining physically embodied transscale ontophysical continuity as persistently coherent constitutive organization.

Intrinsic intentionality is neither inferred, computed, nor symbolically encoded. Rather, it is physically embodied through constitutive organization realized within substrate-specific dynamic organicity. Coherent constitutive organization is maintained across successive realization regimes, while reflexive-projective closure operationalizes this constitutive organization as physically embodied transscale ontophysical continuity. Throughout the constitutive progression, intrinsically informational dispositions acquire directional coherence under generative constraints, without requiring external goals, representations, or symbolic content.

Governed by the self-consistency condition of reciprocal realization, constitutive realization and physical realization are reciprocally realized manifestations of

the same physically embodied transscale ontophysical continuity. Within this constitutive organization, self-intending projective closure constitutively stabilizes intrinsic intentionality into conscious actuality, whereby embedded quasipolaritonic dynamics participate in the substrate-specific physical realization of transscale ontophysical continuity, while physically embodied transscale ontophysical continuity reciprocally constrains the stability of admissible quasipolaritonic organization.

Intrinsic intentionality is not understood as directedness toward an object, goal, or representational content. Rather, it denotes the directionally coherent persistence of intrinsically informational organization grounded in physically embodied transscale ontophysical continuity under generative constraints. Intent therefore refers to the intrinsic directionality through which physically embodied transscale ontophysical continuity sustains and constrains its own admissible continuation. Intrinsic intentionality is operationally established when intrinsically informational dispositions acquire directional coherence through reflexive-projective closure. Self-intending projective closure subsequently stabilizes this intrinsic intentionality into persistently self-maintaining constitutive organization, establishing the operational conditions under which constitutive organization may attain intrinsic realization and thereby realize conscious actuality, while phenomenality constitutes its intrinsically realized manifestation. Embedded quasipolaritonic dynamics provide the substrate-specific physical realization within dynamic organicity, whereas physically embodied transscale ontophysical continuity reciprocally constrains the stability of admissible relational organization across successive realization regimes.

3.3.4 *The constitutive basis underlying conscious actuality*

How does unified conscious actuality persist across perception, memory, cognition, affect, and bodily regulation? Conventional multiscale accounts describe coordination among objectively characterizable processes operating at different spatial and temporal scales, yet they do not explain how conscious actuality persists as a unified continuity across successive realization regimes. To address this limitation, the constitutive basis of the PRG framework is physically embodied transscale ontophysical continuity, which is not localized to any particular regime of relational organization but is maintained through self-intending projective closure that constitutes the final constitutive condition in the jointly sufficient realization of conscious actuality. Process therefore remains essential, but as the mode through which physically embodied

transscale ontophysical continuity relationally unfolds, rather than as the primary ontological category.

Within SIPF, self-intending projective closure is the operational stabilization mechanism through which intrinsic intentionality acquires persistent directional coherence within constitutive organization under generative constraints, thereby enabling physically embodied transscale ontophysical continuity to persist despite the continual local reorganization of substrate-specific embedded quasipolaritonic dynamics. Self-intending projective closure is therefore neither a bounded structure nor a static state but the operational culmination of the constitutive progression through which constitutive organization becomes persistently self-maintaining while remaining physically embodied through dynamic organicity. Constitutive organization satisfying the self-consistency condition of reciprocal realization subsequently attains the ontological status of intrinsic realization, through which conscious actuality is realized. Phenomenality is the intrinsically realized manifestation of conscious actuality.

Transscale continuity is operationally maintained through transscale closure. The coherent constitutive organization established through this maintained continuity constitutes transscale unity. Transscale unity therefore does not denote relational identity, homogeneous field continuity, or global synchronization but the persistent coherence of physically embodied transscale ontophysical continuity across successive realization regimes. Distributed substrate-specific embedded quasipolaritonic dynamics remain phase-consistent and Q^* -admissibly coupled under the operational negentropic bias (Q_{neg}) despite continuous local reconfiguration. Consequently, transscale continuity is maintained not through signal transmission, field continuity, or localized information storage but through Q^* -mediated admissibility together with the Q_{neg} -biased stabilization of coherent constitutive organization across distributed relational regimes.

Transscale consciousness arises only when constitutive organization is operationally stabilized through self-intending projective closure, thereby sustaining intrinsic intentionality across successive realization regimes. Self-intending projective closure establishes a persistently self-maintaining mode of constitutive organization in which intrinsically informational organization acquires stable directional coherence under generative constraints. Through this operational stabilization, physically embodied transscale ontophysical continuity persists despite the continual local reorganization of substrate-specific embedded quasipolaritonic dynamics, preserving coherent constitutive or-

ganization across successive realization regimes. Constitutive organization satisfying the self-consistency condition of reciprocal realization subsequently attains the ontological status of intrinsic realization, through which conscious actuality is realized, while phenomenality is its intrinsically realized manifestation.

Importantly, transscale consciousness is a physically embodied ontophysical organization rather than a substrate-neutral functional property. Its physical realization requires a substrate-specific dynamic organicity capable of sustaining admissible relational unfolding under generative constraints. Although the self-consistency condition of reciprocal realization is, in principle, not restricted to a particular material substrate, its physical realization depends upon substrate-specific capacities to sustain dynamic organicity, embedded quasipolaritonic dynamics, intrinsic intentionality, self-intending projective closure, and the critical relational organizational transition establishing reciprocal realization within EQP. PRG therefore supports a constrained form of multiple realizability in which realization is limited by the requirement that a substrate sustain the physical conditions necessary for physically embodied transscale ontophysical continuity. Constitutive organization satisfying the self-consistency condition thereby attains intrinsic realization as conscious actuality, while phenomenality is its intrinsically realized manifestation.

The explanatory problem of consciousness is not exhausted by accounting for the observable organization of a system or the mathematical principles governing that organization. It also requires explaining how physically embodied transscale ontophysical continuity becomes intrinsically realized as conscious actuality through the enabling stabilization mechanism of self-intending projective closure, thereby establishing the constitutive conditions under which there is something “it-is-like-to-be” that physically embodied ontophysical organization. Phenomenality is the intrinsically realized manifestation of that conscious actuality.

As illustrated in **Fig. 2**, the constitutive basis of PRG framework is physically embodied transscale ontophysical continuity. Relational unfolding proceeds through substrate-specific ontophysical organizational dynamics, realized through poststructural dynamics that instantiate constitutive realization. Constitutive organization is subsequently operationalized through reflexive-projective closure, establishing intrinsic intentionality, while self-intending projective closure provides the enabling stabilization mechanism

through which conscious actuality is intrinsically realized. Transscale consciousness is not directly measurable but is inferred through its intrinsically realized manifestation as phenomenality together with its dispositional manifestations in perception, cognition, memory, affect, and bodily regulation. It is therefore not identical with neural states, although its physical realization depends upon substrate-specific embedded quasipolaritonic dynamics operating within dynamic organicity, through which physically embodied transscale ontophysical continuity is operationally maintained across successive realization regimes.

4. Conclusion

The PRG framework does not localize consciousness to intracellular quantum coherence, quantum entanglement, or any discrete cellular substrate. Rather, conscious actuality is understood as the intrinsic realization of constitutive organization grounded in physically embodied transscale ontophysical continuity, whose intrinsically realized manifestation is phenomenality. Relational unfolding is physically realized through distributed substrate-specific embedded quasipolaritonic dynamics and constitutively stabilized through self-intending projective closure, thereby preserving the constitutive basis as a non-scale-localizable mode of ontophysical organization.

Within PRG, the ontophysical does not denote a secondary domain supervening upon the physical, but the constitutively primary organization of physically embodied transscale ontophysical continuity. Constitutive realization and physical realization are not separate ontological domains or complementary aspects, but reciprocally realized manifestations of the same constitutive basis under the fundamental intrinsic constitutive principle of reciprocal realization. Constitutive realization specifies the intrinsically informational organization of the constitutive basis through poststructural dynamics, whereas physical realization specifies its embodiment through embedded quasipolaritonic dynamics within dynamic organicity.

Accordingly, QPG provides the mathematical formalism specifying the admissible relational organization under which relational unfolding proceeds. QPG does not presuppose quantum coherence or entanglement as constitutive principles but formalizes the admissible relational constraints governing substrate-specific ontophysical organizational dynamics. Within the constitutive realization domain (EQP), these organizational dynamics instantiate constitutive realization, while embedded quasipolaritonic dynamics provide the corresponding physical realization.

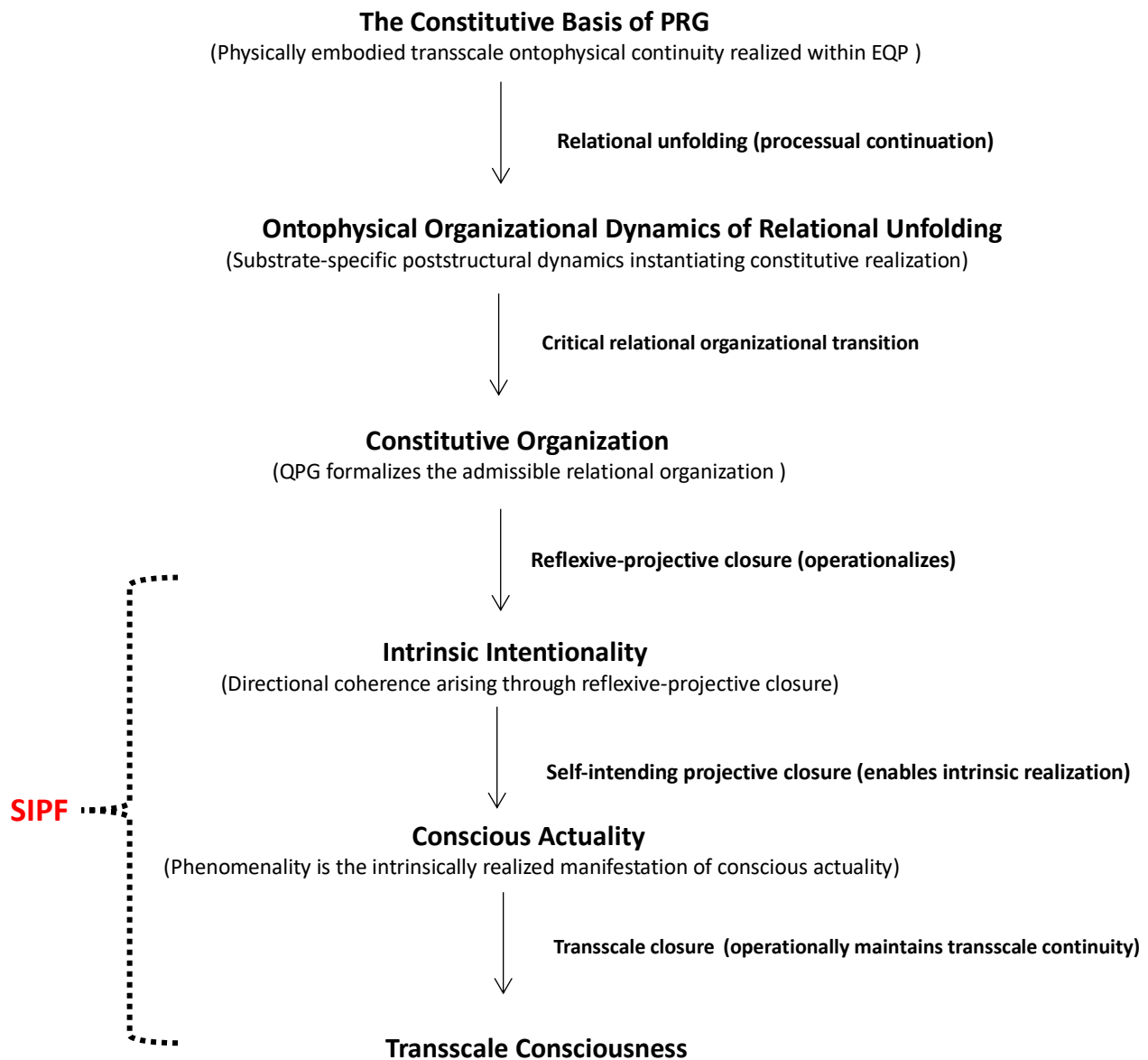


Figure 2 Operational hierarchy of the Processual Relational Geometry (PRG) framework. Physically embodied transscale ontophysical continuity constitutes the constitutive basis of PRG and serves as its constitutively primary ontological primitive from which the remainder of the framework is developed. The ontophysical denotes the organizational dynamics of relational unfolding through which physically embodied transscale ontophysical continuity is constituted and sustained. During the processual continuation of physically embodied transscale ontophysical continuity, a critical relational organizational transition provides the physically embodied mechanism by which reciprocal realization is established within EQP under QPG-derived generative constraints. At this transition, the ontophysical organizational dynamics satisfy the self-consistency condition, establishing constitutive reciprocity and enabling substrate-specific poststructural dynamics to instantiate constitutive realization. Constitutive realization specifies the intrinsically informational organization of the constitutive basis. QPG mathematically formalizes the admissible relational organization governing constitutive organization, while the operational negentropic bias (Q_{neg}) biases admissibility toward coherent relational regimes, preconditioning dispositional organization and stabilizing constitutive organization within EQP. Within the SIPF, reflexive-projective closure operationalizes constitutive organization, giving rise to intrinsic intentionality, whereas self-intending projective closure constitutively stabilizes intrinsic intentionality into conscious actuality. Intrinsic realization is the ontological status of a constitutive organization satisfying the self-consistency condition within EQP and, as the ontological mode through which conscious actuality is realized, phenomenality constitutes its intrinsically realized manifestation. Transscale closure operationally maintains continuity across successive regimes of relational organization, yielding the realized state of transscale consciousness. Perception, cognition, memory, and affect are subsequently realized as downstream dispositional manifestations of conscious actuality while remaining nonlocalizable to any particular spatial or temporal scale of brain activity. Although EQP is substrate-neutral, every realization of EQP requires physical embodiment within a substrate capable of instantiating the constitutive organization specified by QPG. Substrate-specific quantum degrees of freedom constitute the primitive physical realization variables from which embedded quasipolaritonic dynamics arise within dynamic organicity, thereby providing the substrate-specific physical realization through which the admissible relational organization specified by QPG is instantiated. From an engineering perspective, the challenge is therefore to realize a substrate-specific physical system capable of instantiating this constitutive organization, thereby establishing the ontophysical conditions under which conscious artificial intelligence could become feasible.

[Berent \(2023\)](#) argues that the hard problem of consciousness reflects a tension between dualism and essentialism arising from human psychological constraints. Although this analysis helps explain why consciousness appears irreducible, it does not resolve the ontological question of whether consciousness is distinct from the physical. The tension arises because consciousness appears irreducible to conventional physical description while not being ontologically separate from the physical. PRG addresses this tension through a constitutive essentialism grounded in a non-standard constitutive physicalism, in which physically embodied transscale ontophysical continuity constitutes the essential constitutive basis of conscious actuality. Consciousness is therefore neither reducible to objective physical description nor ontologically distinct from the physical, but is intrinsically realized through constitutive organization satisfying the self-consistency condition of reciprocal realization.

PRG therefore advances a foundational constitutive realization theory of consciousness in which physically embodied transscale ontophysical continuity constitutes the constitutive basis from which constitutive realization and physical realization become reciprocally realized manifestations. Intrinsic realization is the ontological status of a constitutive organization satisfying the self-consistency condition of reciprocal realization and thereby specifies the constitutive basis as conscious actuality, while phenomenality is its intrinsically realized manifestation. Reciprocal realization is neither an additional ontological layer nor a dual-aspect relation but the self-consistency condition through which constitutive realization and physical realization remain inseparable manifestations of the same physically embodied transscale ontophysical continuity. Consequently, transscale ontophysical continuity is neither a nonphysical substance nor a property supervening upon objectively describable physical states. Rather, it denotes the constitutively primary physically embodied continuity through which conscious actuality becomes intrinsically realized. PRG therefore occupies a position distinct from both classical dualism and standard physicalism by replacing objective structural description with a theory of constitutive realization grounded in physically embodied transscale ontophysical continuity.

PRG distinguishes physically embodied transscale ontophysical continuity from intrinsically informational organization. Intrinsically informational organization is specified through constitutive realization; it does not constitute the constitutive basis itself. Physical embodiment remains indispensable because the substrate-specific physical realization of physically embodied transscale ontophysical continuity requires a substrate capable of sustaining admissible relational

organization through dynamic organicity and embedded quasipolaritonic dynamics. This formulation yields empirically testable predictions, including measurable signatures of phase-consistent embedded quasipolaritonic coordination, Q^* -admissible and Q_{neg} -biased coherent relational organization, low-entropy constitutive organization, and transient quasipolaritonic spike-like dynamics. Observation of such signatures would provide indirect empirical support for the substrate-specific physical realization of physically embodied transscale ontophysical continuity.

Consciousness is neither an emergent property nor a complex biological process in PRG, but the intrinsic realization of constitutive organization grounded in the constitutive basis underlying conscious actuality. PRG distinguishes between the mathematical formalization of admissible relational organization and the ontological realization of conscious actuality. QPG does not mathematically model consciousness or its constitutive basis. Rather, it formalizes the admissible relational organization of physically embodied transscale ontophysical continuity by specifying the generative constraints under which constitutive organization becomes possible. In this way, mathematics formalizes the organizational principles governing constitutive realization rather than conscious actuality itself. Constitutive organization is mathematically formalizable, and physical realization objectively characterizable, whereas intrinsic realization is the ontological status of a constitutive organization satisfying the self-consistency condition established within EQP.

The Cogito² forms the basis of Reason's theorem ([Reason, 2024](#)), which suggests that no objectively characterizable mode of realization can completely specify the intrinsic realization of conscious actuality. If conscious actuality occurs, its constitutive basis cannot be ontologically exhausted by objective physical description alone. PRG therefore argues that conscious actuality requires a constitutive basis that is physically embodied while remaining irreducible to objective characterization. PRG identifies physically embodied transscale ontophysical continuity as the constitutively primary basis of conscious actuality. This constitutive basis is neither an additional physical object nor a non-physical entity, but the constitutively primary basis realized within EQP through which constitutive realization and physical realization become reciprocally realized manifestations. Accordingly, objective characterization applies only to its substrate-specific physical

²*Descartes's dictum "cogito, ergo sum" or 'I think therefore I am' is replaced with 'I realize, therefore I am'. Throughout PRG, 'realization' denotes ontological actualization or instantiation, not epistemic awareness or understanding.*

realization, whereas constitutive realization specifies the intrinsically informational organization of the constitutive basis. A critical relational organizational transition provides the physically embodied mechanism by which reciprocal realization occurs when an EQP configuration exhibits persistent bidirectional constraint between its physical dynamics and its relational organization across relevant scales is established, enabling constitutive realization and physical realization to become reciprocally realized manifestations of the same constitutive basis.

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