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Some necessary constructs of consciousness as defined in the dynamic organicity theory

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Abstract

The Dynamic Organicity Theory (DOT) explains consciousness as a process that cannot be reduced to a thing or a structure. This process, called the Polanyian process, involves the evolving diachronic boundary conditions of our experienceability. These boundary conditions are ontologically intertwined with higher-level boundary conditions, which lead to physiological nonlocal cause-and-effect relationships. Thus, adaptive changes occur when self-referential causal closure transforms syntactic structures into experienceable forms. Self-referential causal closure is a causal agent for diachronic boundary conditions that majorly structure intrinsic information in ways that experienceabilities are across time, suggesting that consciousness is not driven by an "internal clock" or regular biological rhythm but rather by intrinsic intentionality preceding path selection through a non-mechanical force of hidden thermodynamic energy that cascades to form a volitional agency of information-based action due to the gain of hidden intrinsic information. The process of transforming syntactical structures to experienceable forms in intrinsic informational pathways is conflated with nonlinear time, and its structuring defines the functionality of the brain. Consciousness-in-the-moment is an "averaging out" between different informational pathways involved across such nonlinear time. The transduction of quantum potential information as negentropic action is a *motif* for "potential complexity" to decrease the maximum complexity (derived from the brain structure, dynamics, and function) due to the reduction of uncertainty. Given that the functionality of maximum complexity lacks the self-referential causal closure to be a volitional agent needed for precognitive consciousness, it is proposed that negentropic entanglement unifies experienceabilities so that the functionality of multiscale complexity is greater than the functionality of maximum complexity. This may be enough to produce consciousness in organic systems.

Keywords: Dynamic organicity, self-referential causal closure, precognitive consciousness, functionality, multiscale complexity, experienceable forms, epistemic subjectivism, quantum potential information, diachronic boundary conditions, quantum entropy.

1. Introduction

The Dynamic Organicity Theory (DOT), proposed by Poznanski (2024), has been described in a comprehensive review of consciousness landscapes (Kuhn, 2024) as a quantum biological theory based on type-B materialism (Chalmers, 2003), where consciousness is a physical process, and epistemic objectivism alone does not define physicalism (Shand, 2021).

DOT (Poznanski, 2024) acknowledges the connection between life and consciousness through a negentropic state. The evolution of life, in terms of complexity, occurs through cooperative interactions that prevent entropic destruction. This mechanism is well-established (Cohen & Marron, 2020). However, according to DOT, the evolution of consciousness is driven by functional interactions. DOT uses a functional system approach to describe the nonmechanical guidance of the negentropic action that is physiologically nonlocal (from source to sink) due to diachronic boundary conditions and is nonsymmetric (from microscale to macroscale) in a multi-level environment, thus defining a functional interaction (Chauvet, 2004). It lays out the mechanisms required for empirical testing, making DOT a credible and robust theory in neuroscience and quantum biology.

In a cognitive or information-processing approach, the cognitive constituents of the neural syntax can be connected by changing constellations of synaptic

weights, which is achieved through the organization of cell assemblies and time-decoding neurons (Schonhaut et al., 2023). However, DOT describes consciousness as a Polanyian process where the contextual boundary or definition of the whole grants "meaning" to the parts contained within or composing the whole. Such partially structured information across time through selection by a continuous movement towards non-entropic structures is unlike information propagation across time (Revach & Salti, 2022). If time is objectively assessed, then it becomes the duration of entropy that is increasing in time-invariant space. The brain does not transfer or process information like a computer but transduces information and supports an epistemically subjective perspective of time. Therefore, the functions relay the well-grounded ontological characteristics of the functional systems in terms of functional interactions and are a means of etiological description of the massively parallel information pathways in brains.

The epistemic gap between information as subjective physicalism and energy/matter as objective physicalism rests on the concept of quantum entropy (Sbitnev, 2008) and is expressed in terms of quantum potential information by acting as an information channel. The quantum potential information has a separate degree of freedom, which cannot project "neural" manifestations of consciousness because evolving boundary conditions implicitly ground space. The geometric nature of space governs it in terms of information channels from which quantum potential information expresses the geometric properties of spatial information as a geometrodynamic entity (Friscaletti, 2012, 2018).

2. The first construct is the irreducibility of dynamic organicity

Consciousness comprises many levels of distributed process descriptions that contribute to its functionality. DOT (Poznanski, 2024) stipulates the necessary constructs leading to higher stages of consciousness to establish maximum complexity. DOT (Poznanski, 2024) describes the brain as a complex, diachronically interconnected dynamic system. Each part of the brain has a specific role and contributes to its overall functionality. Here, changeable boundary conditions in time-varying systems of non-inert material composition (due to a living negentropic state) provide energy capture and storage under energy flow, ensuring maximum complexity. The functionality of organic molecules, namely carbon with hydrogen, as they easily change their structure through interactions, adding functions to maximize complexity manifests the dynamic organicity theory. However, the functionality of maximum complexity lacks the self-referential causal closure[1] to be a volitional agent needed for free will and consciousness.

The evolving informational form is a manifestation of evolving diachronic (a relation between cause and effect that unfolds over time) boundary conditions. In this context, the control boundary conditions replace the required mental homunculus. Self-referential causal closure is not a homunculus because they are ontologically higher-level boundary conditions. Such functional interactions control boundary conditions, so information is causally effective. Functional interactions as a conduit for evolving boundary conditions. Paksi (2014) proposed that evolving boundary conditions, not natural evolution, are pivotal in how the brain evolves in the environment during its life span.

Polanyi relies on the assumption that boundary conditions supply degrees of freedom that, instead of being random, are determined by higher-level realities, whose properties are dependent on but distinct from the lower level from which they emerge. Evolving boundary conditions can sometimes be confused with holism. Holism is the process of combining individual parts under the influence of physical and chemical forces. Holism is not the same as the concept of irreducibility of dynamic organicity (Polanyi, 1968). Holism asserts that every component in a system is interdependent and should be valued accordingly, meaning that the overall function and significance of the system are not reducible to the function or importance of any individual component. In contrast, dynamic organicity acknowledges the interconnectedness of the system's components but recognizes that each element has its unique function and meaning arising from evolving boundary conditions. In dynamic organicity, the brain is a diachronically interconnected dynamic system, with each part of the brain having a specific role and contributing to its overall functionality.

In addition to a consciousness-producing mechanism, the physical properties of brain structure, dynamics, and function are known objectively, not subjectively. This presents an issue with epistemically subjective physicalism, which requires something beyond quantum physics and more than the Bayesian brain hypothesis[2] or quantum Bayesian (QBism) in quantum

[1] ***Self-referential causal closure*** *is where part of the system can refer to the whole system and vice versa entwined ontologically by higher-level boundary conditions.*

[2] ***Bayesian brain hypothesis*** *suggests that the brain may be approximating Bayesian inference; the variability of a neuron's activity describes an event's probability.*

biology because the subjective interpretation of information states excludes the subjective interpretation of quantum physics. It differs from quantum biology because its essence is not quantum effects in biological processes (quantum biology) but the causal relations and resultant functionality that stem from such causal relations.

The *modus operandi* of consciousness is a link between intrinsic information[3] as subjective physicalism and time, as time is not independent of experienceability. Therefore, time does not exist in the brain as some kind of "internal clock" or regular biological rhythm, but rather, time and consciousness are intertwined in "time consciousness" just like space and time in physics are intertwined in space-time. The brain is in macroscopically observable mean values, the negentropic action is the primary source of nonclassicality in fluctuations that acquire distributed processes to function globally (cf., Kershens & Perez, 2022).

The nonclassicality comes from the non-mechanical guidance of the negentropically derived quantum potential energy, where intrinsic information has an additional degree of freedom via the negentropically derived quantum potential energy (Poznanski et al., 2022). The dissipative quantum potential energy depends on the temperature, which takes place as negentropic action and is acted upon by molecular-embedded fluctuations in informational redundancy structures (Poznanski et al., 2022). The brain consists of a massive parallel informational redundancy structure from maximum complexity. If informational redundancy structures carry functional capabilities, then the postulation that the origin of syntax at the junction of the dorsal lateral cortex and fronto-limbic forebrain (Pribram, 1991) can be determined when the fluctuations are carried in noise.

Does consciousness come in through noise? DOT (Poznanski, 2024) proposes that the fundamental process of consciousness originates from raw fluctuations at the molecular level (~ 0.2 nm to 1nm), where thermal molecular agitation is a source of molecular-embedded raw fluctuations. Raw fluctuations are informational because thermo-qubits are supposed to be the noncontextual raw syntax at the source of syntactical structures. However, at the microscopic scale, the thermo-qubit fluctuates. So, the thermo-qubit is smeared into a fluctuation where a "qubit" or quantum bit is the basic unit of quantum information that is unlikely to be present in brains.

Instead, the most apparent characteristic of "bio-quantumness" is the concept of information quantization as "quantum of information"[4]. In this way, consciousness can be seen as a macroscopic quantum effect in structuring the quantum of information under the auspices of irreversible time made possible through resonance. The notion of resonance (also known as synchrony, coherence, or shared vibrations) has a long history in neuroscience, but a general resonance theory of consciousness is not supported because quantum coherence is insufficient, while the DOT of consciousness invokes resonance states, i.e., quasi-bound states embedded in the continuum of open quantum systems where resonance energy is attributed to temperature effects (Brändas, 2021). One example is the electromagnetic (EM) resonance of EM waves due to electrons accelerating in benzene rings within aromatic residues of amino acids due to the nonlinear pathways of electron delocalization.

3. The second construct is the transduction of quantum potential information

The "functionality space" in DOT is epistemic subjective physicalism. The "functionality of space" being temporal (with space implicitly as boundary conditions) is in line with the notion that space emerges in entropic Bohmian mechanics from the notion of quantum entropy (Sbitnev,2008; Faiscaletti, 2012, 2018). In traditional quantum mechanics, a Hilbert space describes the angular momentum or "spin" of a particle (electron, proton, neutron), which then provides a physical representation of a "qubit." In open quantum systems, a thermo-qubit is represented in Liouville space. However, the problem is that using Hilbert or Liouville space conjures an epistemically objective physicalism.

In quantum potential chemistry, temperature affects "average out" wave functions as quantum-thermal fluctuations. The origin of quantum-thermal fluctuations is an additional source of negentropic action that is not mechanical action but that guides quantum-thermal fluctuations beyond nonpolar molecular agitation. A nonmechanical action derived from hidden thermodynamic energy. The hidden thermodynamic energy is transduced across informational pathways to form a volitional agency. The transduction of quantum potential information as

[3] ***Intrinsic information*** *is subjective physicalism It is not just information disclosed by introspection but implicit or "hidden", i.e. "unconscious subcortical information" (Hurley, 1994), which is neither pragmatic information that is objective (Roderer, 2016) nor 'physics information' that is processed (Meijer et al., 2021).*

[4] ***Quantum of information*** *was proposed by Pribram (1991) as an impulse delta function in time crisscrossing a sinusoidal, this means it is nonlinear in time.*

negentropic action is a modification of space that is ascribed as an information channel for the temporal distribution of intermittency spikes (Almendar et al., 2023). Quantum entropy designates a degree of freedom for informational pathways to cascade in which information-based action acts as the volitional agent in path selection. It is postulated that the second necessary construct of consciousness is the transduction[5] of quantum potential information as negentropic action. A dissipative Schrödinger-like equation (Mollai & Fathi,2021) facilitates the transduction of quantum potential information to temperature-dependent quantum-thermal fluctuations.

The information-based action is due to the "gain" of hidden intrinsic information. Here, the hidden intrinsic information results from negentropic gain to minimize uncertainty, suggesting that the mechanism of understanding can be thermodynamic but is not a cognitive conscious experience (Beshkar, 2018; Poznanski et al., 2023). This information is transduced through Brillouin's negentropy principle of information (Brillouin, 1953,1962), essentially equivalent to Boltzmann-Gibbs thermal entropy as negentropic action. This negentropic action is acted upon to restructure intrinsic information. Therefore, the activity of information in terms of information-based action carries the potential for understanding "meaning", so the experienceability of "meaning" must be equivalent to the experience of acting. Understanding "meaning" is through changes to functionality to better understand uncertainty. Consciousness is the act of understanding uncertainty (Poznanski et al., 2023). Understanding "meaning" by reducing uncertainty is through the experienceability of acting. Experienceability is the capacity for experience.

The evanescent "meanings" are labile, spontaneous, and actualized when the resultant information-based action selects functional systems patterns (i.e., functional fluctuations) from the interference patterns by re-organizing informational redundancy structures. The selected functional systems patterns give experienceable extrapolation of the potential to understand "meaning" by reducing uncertainty in structuring intrinsic information. It is a basic mechanism leading to experienceable forms with the potential to understand "meaning." It manifests as a temporal structure through the temporal re-organization of informational redundancy structures, which entails transforming syntactic structures into experienceable forms. In other words, volitional agency is a physical mechanism acting upon experienceability through negentropic action.

Searching for the mechanism of consciousness requires looking at the fundamental level where the hidden thermodynamic energy is transduced across informational pathways to form a volitional agency. The cascading effect is causative, but that effect unfolds over time. Therefore, it is not just a negentropic force (cf., Heifetz et al., 2016) but a negentropic action. We call it information-based action being a volitional agency that informs/guides in the structuring intrinsic information (as both hidden thermodynamic energy and hidden thermodynamic information) as a cascading effect in which the negentropically-derived quantum potential representing the macroscopic aggregated effect of the microscopic random quantum-thermal fluctuations (Heifetz & Cowan, 2015). The negentropically-derived quantum potential energy (containing temperature as a term) is non-Bohmian in the sense that it is not limited to the atomic scale's hidden thermodynamic energy but depends on the direct transfer to nonpolar molecular pockets associated with protein dynamics and enzymatic activity in neuronal membranes and protein-protein interactions. Hence, information-based action is diachronically causal and acts as a cascading effect.

Transforming syntactic structures to experienceable forms *prior to* path selection requires quantum-like[6] nature of intrinsic intentionality[7] involving a transduction of quantum potential information. Intrinsic intentionality is based on structuring redundancies, consisting of intrinsic information, in terms of informational redundancy structures, and their interference patterns result from information-based action through diachronically asymmetric boundary conditions. This means that quantum holism does not interpret quantum physics beyond the microphysical realm (Esfeld, 1999) but results in an ability to act *a priori* to path selection. This is intrinsic intentionality, as there are no precognitive feelings. We have a precognitive affect that triggers intrinsic intentionality. The source of consciousness we focus on is the exper-

[5] ***Transduction*** *is the transformation of information from one energy carrier to another.*

[6] ***Quantum-like*** means outside the *quantum mechanical domain, where quantum entropy is replaced with negentropic action via Brillouin's negentropy principle of information (Brillouin, 1953, 1962).*

[7] ***Intrinsic intentionality*** *is the ability to act a priori on path selection. It is based on structuring redundancies, which consist of intrinsic information. Informational redundancy structures and their interference patterns result through diachronically asymmetric boundary conditions stemming from dynamic organicity.*

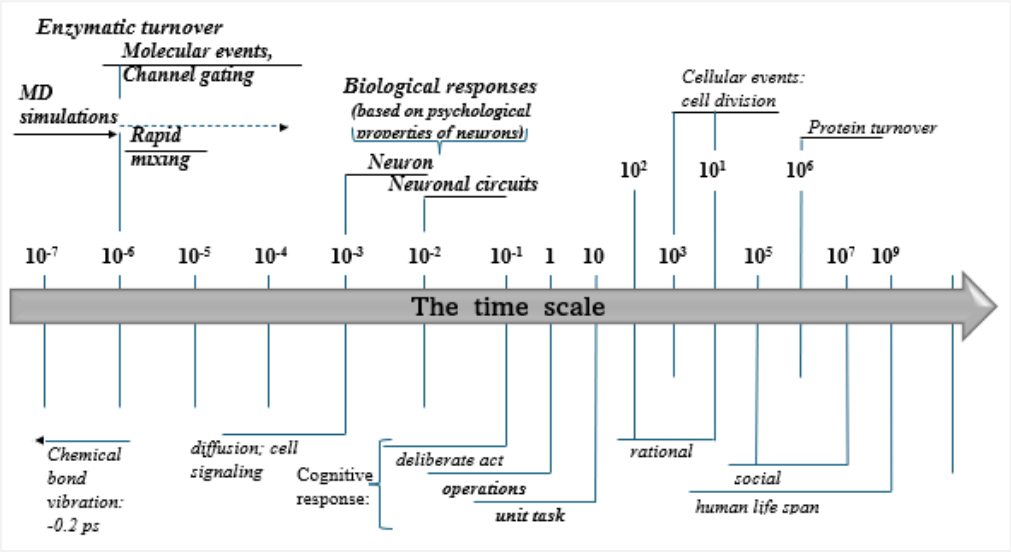

Figure 1. *A linear sequence where time is measured through a single timeline of events. It is postulated that time consciousness cannot arise on such a temporal scale because it does not allow for the" averaging out" of time consciousness. Blakemore (2002) states that the linear stream of time consciousness disappears. Understanding time consciousness primarily becomes understanding how consciousness arises as a macroscopic phenomenon with time orientation. Adapted from Cocchi et al. (2021).*

ience of acting on a thought, for example. The continuity of intentions-in-action carries pre-contextual "meaning", leading to volitional discrete intentions sensed as feelings (Bohm, 1989). Intrinsic intentionality is also referred to as "aboutness" where 'aboutness' can be the potential understanding "meaning" in transforming syntactic structures into experienceable forms. The potential to understand "meaning" that arises from the causal attribution of negentropic action.

The experienceable forms can act before the path selection of function through volitional agency, and experienceable forms express "meaning" directed at something from a primitive form of awareness. Experienceable forms are realized when a functional organization's informational redundancy structures are reorganized through realization relations. Experienceable forms entail a temporal process with space defined implicitly through the decomposition of time and space. Space and time in neuroscience remain different coordinates to which experimental observations are inferred (Buzsáki & Llinás, 2017). Thus, while temporal and spatial coordinates are jointly represented in the brain, they are dissociable or separable at the neuron level (Schonhaut et al., 2023). But can this dissociation be possible across time? If time is a linear sequence of temporal events (see **Fig. 1**), then there is no temporal structure of experienceability.

After intrinsic intentionality acts upon experienceability, the next step is the instruction to act in path selection, which is influenced by the rate of change in entropy. It is an instruction to act in path selection due to fluxes occurring at different rates, causing spontaneous ordering. The outcome is that entropy production matches the negentropic gain in achieving the minimum possible entropies, defined as an ensemble of minima of the least entropy or a minimum uncertainty. Spontaneous ordering reduces uncertainty, leading to an instruction to act in path selection in forming a functional organization in which a negentropic state makes it possible for quantum amplification. Shannon information or Boltzmann-Gibbs entropy drives thermodynamics. Fisher information generates quantum mechanics and operates simultaneously because Shannon information tends to grow, but Fisher information seeks a minimum. We find negentropic gain at this minimum, reflecting the negentropic state required for quantum amplification (R. Tsekov, *personal communication*).

4. The third construct is the conflation of nonlinear time with intrinsic information pathways

The multiscale nature of information quanta changes meaning according to the scale of analysis or observation. Tao et al. (2018) claim that experience is encoded in time sequences and integrated into the form of dynamic "clocks". The findings suggest that populations of lateral entorhinal cortex neurons repre-

sent time inherently through the encoding of experience. However, the more difficult problem is decoding experiences from the structure of time in the brain. In other words, what is the structure of time in the brain that makes experiences possible? In the past, psychologists have posited that time and consciousness are somehow linked, with consciousness being viewed as a sequence of temporal experiences (see, e.g., Block 1979). However, recent studies suggest that time and consciousness are not a continuum referred to as "time consciousness" (e.g., Kent & Wittman, 2021). We extend this concept of time consciousness from experiential time to, more fundamentally, how time is conflated with structured intrinsic information in the brain. This perspective of time in the brain is what we mean by time consciousness. It is distinct from our subjective perception of time and the objective time of the universe.

The structure of time in the brain as a nested clock where "clock" means a temporal "biological rhythm" has been explored by Bandyopadhyay (2020). The problem is that multi-fractality does not exist across the full brain scale, from subatomic particles to large neuronal systems. Self-similarity along a few scales differs from the brain's complete fractal geometry (Bandyopadhyay, *personal communication*).

The brain is a system of epistemic relations between intrinsic information harnessing a multiscale complexity reflecting a grossly nonmetrical and nonfractal geometry that is a dynamic holarchy, like holons, holarchies and non-hierarchical modularities. The difference between a brain state and an information state is that the latter is epistemically subjective. The self-referential dynamic structures grow in complexity through the spontaneous production of constraints of realization relations (not causations) under self-referential causal closure in abstractions (under epistemically objective physicalism, and in reality (under epistemically subjective physicalism). Functional-structural realism is subjectively epistemic, and one should avoid making the mistake of interpretation through epistemically objective reality. It is dynamic organicity, in which epistemic subjectivism dictates functionality and creates an integrated whole, and each part is diachronically interconnected and influences the others.

The epistemically subjective physicalism of information caters to novel aggregativity stemming from irreducibility through negentropic entanglement brought on by massive parallel information pathways. The self-referential causal closure establishes a temporal scale of dynamics in which information pathways from the microscale to the macroscale (this includes nonlocal pathways) bring about diachronic causation and how the disunity of causal order in the redundancy creates a weak unity (irreducibility through negentropic entanglement) of the experienceable forms, that convey the potential for understanding "meaning." Each moment of consciousness actualizes into conscious experience certain selections of the unconscious "quantum of information" that, resting in potentiality for long periods, constitute the precognitive experienceability, i.e., experienceable form. This is because the overall aggregate is like a time-based series of experienceabilities, thus supporting an epistemically subjective perspective of time consciousness.

Given that experienceable forms constitute an experience in higher cognitive pathways, the Polanyian process must be on a nonlinear temporal scale, beginning when all the experienceable forms become unified through realization relations (epistemic relations, not causative). The irreducibility of experienceable forms through negentropic entanglement becomes a weak unity of consciousness as a subjective temporal experience. Therefore, the third necessary construct is the epistemically subjective meaning of time conflated with how intrinsic information is structured. It is a concept that suggests that time consciousness is not just a linear sequence of events but rather a complex web of interconnected informational pathways with experienceabilities interconnected or happening simultaneously to some extent in various brain processes.

The nature of time consciousness stems from how nonlinear time[8] flows in the brain through the informational pathways, and it has an irreversible arrow of time. Time flows in different information channels from perception and cognition, as explored in studies on blindsight. The rate at which time flows can vary depending on how intrinsic information is structured. Consciousness-in-the-moment results from the "averaging-out" across all the informational pathways involved per unit of time (see **Fig.2**). Nonlinear time reduces causality to the self-referential causal closure of the omnipresent negentropic state in the dynamic organicity theory (DOT) of consciousness. This means

[8] ***Nonlinear time*** *is a postulate with no referential points as if everything in time is connected through diachronic boundary conditions. No referential points mean that time is not just an infinite line but a web of crisscrossing infinite timelines running into and out of each other. In such a case, time does not move with a clock's tick but depends on the information pathways.*

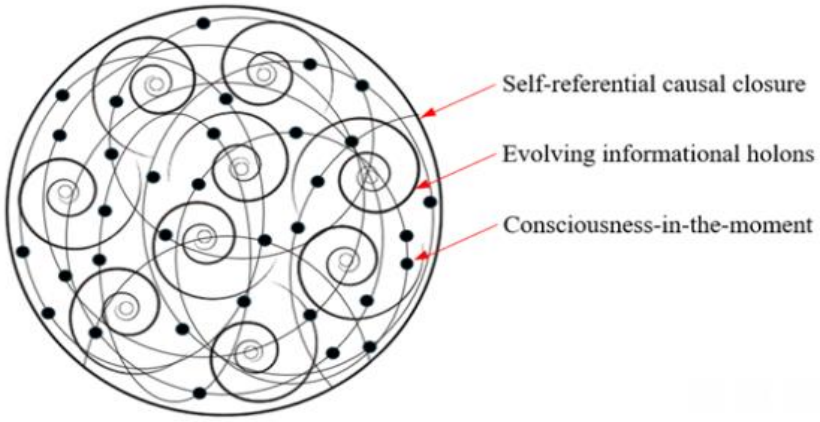

Figure 2. *In experienceable forms, evolution is not teleological but nonlinear, occurring through nonperpetual time consciousness. This means that cause-and-effect relationships become physiologically nonlocal and are in a state of immediacy, existing within a certain multiscale interval in dynamic evolution. Experienceabilities impose thermodynamic constraints that shape the structure of information pathways, and the state of experienceability is precognitive, where time is not a strict progression of cause to effect but rather subjugated to a self-referential causal closure represented by consciousness-in-the-moment where each point on the experienceable form is "averaged-out" across all the informational pathways. Time can flow at different rates relative to the unit of time since the quantum of information is nonlinear.*

that cause-and-effect relationships become physiologically nonlocal and are in a state of immediacy, existing within a certain multiscale interval in dynamic evolution. This state of experienceability is precognitive, where time is not a strict progression of cause to effect but through diachronically manifested boundary conditions.

Time flowing on a nonlinear timeline depends on how intrinsic information is structured through intrinsic information pathways, and space is implicitly grounded in the contingency of changing boundary conditions by the geometric interpretation of quantum potential (Fiscaletti, 2018). In **Figure 2,** each point on the experienceable form is all that is actualized in evanescently evolving informational holons, transforming syntax into experienceable forms leading to a reduction of uncertainties and potential understanding of "meaning," which upon ending of the structuring of intrinsic information becomes consciousness-in-the moment. This view of time is the epistemically subjective meaning of time consciousness. So, time flowing in informational pathways is the temporal structure of experienceability with a nonlinear timeline.

Self-referential causal closure refers to a "pocket" of experience that can only be experienced by the individual having that experience. Experienceability is the capacity to have an experience that must be causally closed from other "pockets". If there were no such closure, there would be no unique such experiences or "pockets". By "averaging out," these pockets are negentropically entangled, and the extended temporal unity occurs as consciousness-in-the-moment. The concept of "averaging out" is often looked at on a larger scale and must be looked at through multiscale neuroscience. There is no evidence of a few selected molecules causing the amplification of quantum-level phenomena into macroscopic-level biology. However, like in inanimate material, the "averaging out" does bring about a causal effect in the animate matter differently because of the negentropic state. This means that self-referential causal closure allows consciousness-in-the-moment to have functional capability across time. This allows for a weak unity of consciousness to arise by negentropic entanglement.

5. The fourth construct is the functionality of multiscale complexity

Life exists with and without consciousness, but consciousness arises by a process whereupon experienceable forms depend on a living negentropic state (life). In addition to the evolution of complexity via dynamic organicity – as changeable boundary conditions – there is a functionality of (multiscale) complexity. The approach is based on the dynamics of functional relations (epistemic relations). It is associated with the temporal aspect of the functionality. Here, functionality refers to the biological realization of

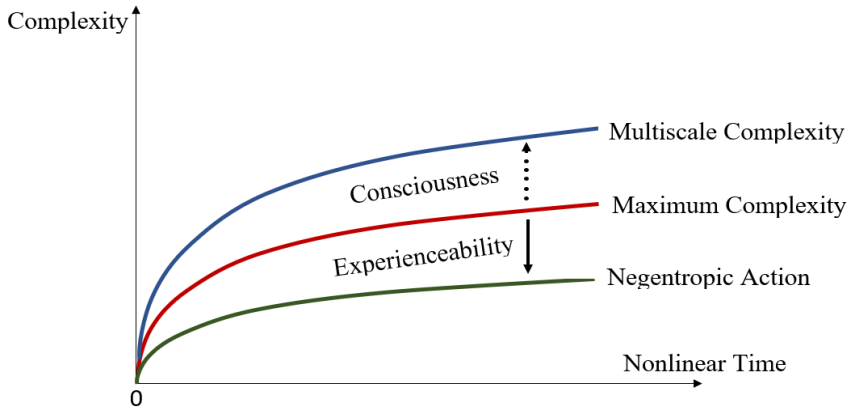

Figure 3. *Functionality can be decoded from the structure of intrinsic information It arises from the complexity versus nonlinear time because nonlinear time dampens the increasing entropy production and increases multiscale complexity. The addition to the maximum complexity (red) of "potential complexity" due to systems patterns of experienceable forms by the process of negentropic action (Green) reduces the maximum complexity in systems with internal constrictions (heterogenous dissipative systems) to produce qualitatively novel aggregativity, leading to new systemic qualities expressed as functionality. Functionality underlying intrinsic intentionality can reduce functionality below maximum complexity (Green). Moreover, negentropic entanglement increases the functionality of maximum complexity, referred to as "multiscale complexity" (blue), but in return, also instantiates consciousness. This suggests that through negentropic entanglement, a weak unity of consciousness is made possible by the contiguity of "potential complexity". There appears to be a gradual increase in the functionality of multiscale complexity.*

the physical as those features of usefulness that exist subjectively. Therefore, it rules out functionalism and focuses on subjective physicalism.

Any characteristic of a living negentropic state has greater functionality beyond structure, dynamics, and function. Brain activity with "potential complexity" encompasses the subjective experience of the self through its functional capability. A self-referential dynamic structure creates "potential complexity" in structuring intrinsic information, rendering consciousness part of the self-referent structure. Therefore, the functional capability of the negentropic state changing over time has evolved to become more complex than life, and this increased complexity has resulted in greater functionality that has given rise to higher levels of self-awareness, collectively referred to as consciousness. The highest level, for consciousness to arise, becomes a functional capability rather than a process, and it underlies the fourth construct of consciousness, which is the functionality of multiscale complexity exceeding the functionality of maximum complexity (Kuhn, 2024):

$$F_{MultiCompexity} > F_{MaxComplexity} \quad (1)$$

where $F_{MultiCompexity}$ is not a step function but a gradual ascendance to the plateau accounting for different degrees of consciousness. Consciousness arises when "potential complexity" due to negentropic entanglement increases functionality above the maximum complexity, referred to as functionality of maximum complexity (derived from the brain structure, dynamics, and function) (See **Fig. 3**) and reaches the functionality of multiscale complexity (derived from an additional degree of freedom made possible by quantum information biology[9]).

Brains have a sufficient consciousness-producing mechanism when all the necessary conditions are satisfied. Equation (1) can be tested in artificial systems, such as a multiscale hierarchical network, which does not satisfy self-referential causal closure causality and may not satisfy equation (1). In other words, self-reference at one layer only does not satisfy the self-referential causal closure for consciousness. Furthermore, given that functionality is defined as epistemically subjective, it becomes obvious that intrinsic intentionality as the source of consciousness cannot be a functionally emergent property of dynamic effects but is a physical property of the irreducibility of dynamic organicity.

Brain structure, function, and dynamics, such as novel aggegrativity (or systems patterns), depend on the

[9] ***Quantum information biology*** *is not defined through information theory in the sense of Shannon (1948) or in a subjective probabilistic way through quantum formalism (Asano et al., 2015) but through subjective physicalism. Therefore, it is important to emphasize that quantum information biology is related to epistemic subjectivism rather than epistemic objectivism.*

various cortical connections (e.g., associative, commissural, and projection fibers), including the striatum, thalamus, and hippocampus, associated with higher cognitive functions. These connections are all influenced by well-integrated transcription factors for gene expression of protein-protein interactions (Suzuki, 2006). Yet, functionality requires more explanation of the principles underlying the weak unity of consciousness. Consciousness arises from the intentional selection of pathways in building the structure of time in the brain and the organization of information, leading to a weak unity of consciousness. The weak unity of consciousness is not a field like the EM field but a locally generated contagion of structured intrinsic information where every source of raw syntax transforms syntactical structures into patterns of evolving experienceable forms, becoming consciousness-in-the-moment at the end of structuring intrinsic information.

Subjective experiences are experienceable forms as part of the system's functional organization. They are only functional activities that add to the functionality of the system. Functional connectivity is metacognitive and is often carried out through brain neuroimaging (see, e.g., Popp et al., 2024). It cannot prove the functionality of multiscale complexity, which requires the self-referential causal closure in the topological sense. The functional organization describes the multiscale complexity through self-referential dynamic structures (of evolving informational holons) that transform syntactic structures into experienceable forms. Therefore, the functionality of multiscale complexity is that the patterns of the functional system convey the potential for understanding "meaning", and here, it is characterized as "potential complexity." Through the accretion of "potential complexity" from functional systems interference patterns of experienceable forms across time and various nonlocal pathways, it is how negentropic entanglement through intrinsic relational realizations between evolving informational holons increases multiscale complexity, resulting in qualitatively novel aggregativity.

The functionality of multiscale complexity is the system patterns of experienceable forms that go beyond the functionality of maximum complexity. They carry an inferred purpose, an indicator of consciousness from the potential complexity where experienceable forms convey the potential for understanding "meaning" of novel aggregativity, leading to the new systemic qualities expressed through the functionality of multiscale complexity. Complexity increases functionality from which consciousness arises as a self-referent structure of multiscale complexity. In a self-referential structure, all parts must be constrained, including those that are not self-referential. A holon is a self-referential structure, but many holons, such as holarchical modularity, require constraining parts for the whole to be a self-referential dynamic structure. There needs to be a holarchical modularity for self-referent structures to constrain parts that are not self-referential for the experienceability to arise from self-referential structures that carry the potential for understanding "meaning". Therefore, if a holon is self-referential, then a holarchical modularity, a composite of many holons, must constrain non-self-referential parts to become self-referential. The notion of "constraining" is through partial information states supplemented by different temporal time scales under self-referential causal closure. This reduces uncertainty by time-dependent "meaning" and increases understanding (Poznanski et al., 2023).

6. Conclusion

Exploring how quantum potential information leads to understanding consciousness is a new epoch in quantum information biology. It concerns non-random partially structured information states of massively parallel information pathways of experienceabilities. Intrinsic intentionality relies on the transduction of quantum potential information as negentropic action. The volitional agency is a physical mechanism that utilizes negentropic action to structure intrinsic information. It is important to note that intrinsic information is not itself processed but is intrinsically embedded in the substrate of the system, from macromolecules to neural networks. For instance, intra-neuronal (changes in protein conformation, concentration, and synthesis) and extra-neuronal factors (EM resonance when a biophoton is exchanged in benzene rings of lipids and proteins) can have a profound effect on energy transduction mechanisms that create new information at each scale. Consciousness-in-the-moment is the end process of structuring intrinsic information that occurs through self-referential causal closure. Intentionality, not brain structure, is the source of consciousness through the structuring of intrinsic information that defines the brain's functionality.

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