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‘Quantum of information’ functionality as a measure of subjectivity beyond the capabilities of deep learning

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Abstract

The potential of conscious artificial intelligence (AI), with its functional systems that surpass automation and rely on elements of understanding, is a beacon of hope in the AI revolution. The shift from automation to conscious AI, once replaced with machine understanding, offers a future where AI can comprehend without needing to experience, thereby revolutionizing the field of AI. In this context, the proposed Dynamic Organicity Theory of consciousness (DOT) stands out as a promising and novel approach for building artificial consciousness that is more like the brain with physiological nonlocality and diachronicity of self-referential causal closure. However, deep learning algorithms utilize "black box" techniques such as “dirty hooks” to make the algorithms operational by discovering arbitrary functions from a trained set of dirty data rather than prioritizing models of consciousness that accurately represent intentionality as intentions-in-action. The limitations of the “black box” approach in deep learning algorithms present a significant challenge as quantum information biology, or intrinsic information, is associated with subjective physicalism and cannot be predicted with Turing computation. This paper suggests that deep learning algorithms effectively decode labeled datasets but not dirty data due to unlearnable noise, and encoding intrinsic information is beyond the capabilities of deep learning. New models based on DOT are necessary to decode intrinsic information by understanding meaning and reducing uncertainty. The process of “encoding” entails functional interactions as evolving informational holons, forming informational channels in functionality space of time consciousness. The “quantum of information” functionality is the motivity of (negentropic) action as change in functionality through thermodynamic constraints that reduce informational redundancy (also referred to as intentionality) in informational pathways. It denotes a measure of epistemic subjectivity towards machine understanding beyond the capabilities of deep learning.

Keywords: Deep learning, dynamic organicity theory, quantum information biology, motivity of action, epistemic subjectivity

1. Introduction

In recent years, our understanding of the brain's complexity has significantly transformed with the advent of multiscale neuroscience (Bassett & Gazzaniga, 2011). This emerging field challenges the traditional belief that the mind-body problem is part of neuroscience. Instead, it proposes that a multiscalar brain is key to new computing paradigms. These paradigms are based on nonTuring computation, not brain-like computing (Aimone & Parekh, 2023). In contrast, Turing computation necessitates information processing presupposes representational theory in computation. Therefore, the theory of mental representation is a special case of information processing (Ramos, 2014), which misconstrues how the brain works. Syntactical and semantic information are computational representations not inherent in brains unless one considers the brain a computer.

According to Dennett (1991), the multiple drafts model of consciousness consists of multiple informational channels that occur in parallel, leading to the perception of a unified conscious experience. The model suggests that no central "self" experiences consciousness but rather a dynamic and distributed process within the brain. The mistake is to consider that consciousness *is* the experience (Koch, 2019). The primary function of consciousness is conscious recall (Solms, 2014, 2017), which is experienced in time consciousness so that conscious reality is not self-awareness of the conscious experience nor the feeling that ascribes such a phenomenological motif such as smelling a rose, but how precognitive experienceabilities attain "meanings" from raw syntax evolving in self-referential information channels from micro- to macroscale.

The "Hard Problem of Consciousness" (Chalmers, 1995) describes phenomenological existentialism of experience as a philosophical purview. Explaining function is the easy problem of consciousness. Consciousness is hard because it is not clear why the performance of these functions accompanies experience (Chalmers,1995). Explaining functions is insufficient, but a change in functionality explains dynamic organicity rather than just complexity. Redefining complexity as a measure of change in functionality and giving function not only quantity but quality; therefore, moving beyond the dictum that function is static requires functional interactions. Using a novel functional-structural realism framework, by re-examining the concept of function from a static concept to a dynamic concept, the introduction of functional interactions where there is now structure associated with functionality in the brain brings out the properties of the dynamic organicity of (DOT) consciousness (Poznanski, 2024a,b).

The Dynamic Organicity Theory (DOT) (Poznanski 2024a,b) can be viewed as a quantum biological interpretation of quantum Bayesian (QBism), where conscious agents are given due consideration. Here, consciousness is temporally experienced in time consciousness, and its action relies on matching informational patterns due to thermodynamic constraints in which convoluted information pathways dictate the temporal actions. It is a signature of negentropic action that arises in informational channels convoluted by the diachronicity of self-referential causal closure. The scale problem of consciousness in which conscious experience does not reflect information from every scale (Chang et al., 2020) ignores that the brain is unique in that its functionality is across scales, each scale with a function that is part of a self-referential causal closure.

In DOT (Poznanski 2024a,b), one has self-referential causal closure, which means random physical effects cannot be a sign of a conscious act as a whole must be involved for the conscious act to occur. Action effects do not occur randomly; this is the crux of "intentionality" as the source of consciousness (Searle, 1983; Poznanski et al., 2023a).

Consciousness-in-action is concerned with the processes causing movements in the conscious brain. Its primary focus (Hurley, 1998) is to understand uncertainty by restructuring information redundancy and subsequently broadcasting this understanding to the cognitive processes. Bayesian statistics and reinforcement learning agree with selection dynamics (Fernando et al., 2012) as a model of how information is handled in the brain through redundancy structures Pribram (1991). This information does not consist of 1s and 0s like digital computers process information, but rather in terms of information-based action.

In DOT (Poznanski, 2024a,b), the functional interactions are not physical interactions. No physical forces are at play, only negentropic action, which is not force-based action but information-based action, i.e., quantum potential energy as an action where the quantum potential is informational. The concept of information is linked to this epistemic subjectivism as subjective physicalism when information is defined intrinsically or internally. Therefore, negentropic action is epistemically subjective and physical but not physical through the lens of epistemic objectivism (cf., Manzotti & Owcarz, 2020). It is intrinsic in Nature through the living negentropic state, i.e., life is an essential prerequisite for consciousness only because it fosters a living negentropic state through the irreducibility of dynamic organicity.

Quantum biological information plays a significant role in creating an epistemically subjective functional-structural realism instead of an epistemically objective reality that exists independently of the conscious agent. However, consciousness has several constructs that depend on the irreducibility of dynamic organicity, which goes well beyond creating a neural network (NN) or manipulating weights and biases inside a network. This differs from the metacognitive approach used in earlier theories of consciousness (Storm et al., 2024). Moreover, the "quantum mind" cannot bridge the epistemic "gap" between subjective and objective. The laws of quantum physics cannot aid in solving the mystery of consciousness because time is irreversible, and quantum systems are extended in Hilbert space. While quantum systems operate deterministically in the Schrodinger equation governing the wavefunction of the system, the brain has no wavefunctions, only fluctuations.

Consciousness depends on the energy fluctuations manifested by the thermodynamics of a dissipative structure. This means that consciousness is temperature dependent. As the thermal fluctuations, e.g., those at the hot and wet conditions in a living brain, threaten to wash out precise quantum effects, the latter necessary for maintaining an indispensable long-range organization, it is adamant about finding a strategy that frustrates the interferences, i.e., forbids the abstruse decoherence problem and supports the boundary conditions for negentropic action. Unfortunately, the free energy principle in theories of consciousness (Solms, 2019) relies on variational free energy, optimizing both the thermodynamic free energy and the entropy, so they cannot address this problem. Free energy based on a higher-order probabilistic representation (Friston, 2010; Solms, 2019) is variational free energy, an information-theoretic functional of higher-order probabilities borrowing its terminology from thermodynamics. Using predictive coding (Hassabis et al., 2017) to build conscious AI depends on the "free energy" principle in subcellular networks and adjustments in metabolic pathways.

Any realistic approach to understanding consciousness as a biological phenomenon depends on the temperature at the sub-molecular or molecular level, and it is not "free energy" but thermodynamic energy. To understand how consciousness operates, it is necessary to understand its relationship with temperature through matter. Protein-protein interactions involving complex protein interactions are essential to enable the consciousness process to penetrate brain regions due to different regulated gene sets as opposed to single region-specific genes (Poznanski et al., 2022). Protein pathways in the cerebral cortices are connected in a single network of thousands of proteins. Proteins are composed of aromatic amino acids. We start from quasiparticles (energy excitations) and move up the scale to perception and cognition, including memory, which often designates the end of the consciousness process. Water can then be a key element for amplifying local events for "qubits" to macroscopic phenomena covering the whole brain, which is unlikely when the functionality of water is known for protein turnover and not communication. Water is helpful for protein turnover, but it is not needed in AI applications. Protein-protein interactions in water surely must be replaced in any artificial system. At the microscale, the "wetware" captures the quasiparticles that are the basis of the material composition of consciousness in any future conscious AI based on polaritons (cf., Poznanski et al., 2023b). Therefore, protons are convenient quantum objects for transferring bit units in minimally conscious artifact designs (Poznanski et al., 2023b). The phonon-polariton interaction in such a medium adds informational complexity.

2. Emphasizing the significance of the challenges and limitations of deep learning

Deep learning, a subset of machine learning, operates through intricate multi-layered NNs known as deep NNs (Goodfellow et al., 2016; Bishop, 2023). This technology empowers computer systems to learn from data and make predictions or decisions without explicit programming. It's like showing the system many examples and letting it learn independently. However, these deep learning models, often called "black boxes" (Rudin, 2019), can be quite challenging to comprehend. This lack of interpretability can make it difficult for users to trust and explain the decisions made by the model. Moreover, deep learning, a process of training computer systems to learn from data and make predictions or decisions without explicit programming, often relies on a concept known as "dirty hooks" in PyTorch to debug backpropagation, visualize activations and modify gradients (see e.g., Stevens & Antiga, 2019). These "dirty hooks" operationalize the algorithms, but their use can introduce certain challenges and limitations. For instance, the availability of large datasets is perceived to be a key requirement for training deep learning models. Large amounts of quality data achieve high accuracy and generalizability.

However, obtaining such data can be challenging, especially in areas with limited access to information, so dirty data relies on dirty hooks for dirty data processing in deep learning. Dirty data refers to incomplete, inaccurate, noisy, or unlearnable data. It arises when automation via "dirty hooks" embedded in deep learning algorithms is left to computation. This is one reason conscious AI cannot use deep learning since consciousness is not data-driven, which means it cannot be mapped. This represents the biggest hurdle to conscious AI based on Turing computation and information processing, where many blindly follow the deep learning, AI revolution, claiming that the popular Generative AI models (e.g., GPT4) only learn but do not understand and rely on unpredictable "black box" models with emergent capabilities are consciousness (He et al., 2023). Consciousness is not a learnable problem. In hindsight, deep learning algorithms generate unpredictability via their "black boxes" because they lack consciousness. Consciousness is understanding uncertainty and limiting unpredictability (Poznanski et al., 2023a).

In deep learning, “black box” refers to the complex NN models used for various machine learning tasks. These NN models are often called black boxes as their internal workings are often opaque or difficult to interpret, especially in deep NNs with many layers. Although these NN models (also called models) can make accurate predictions or generate outputs, it can be challenging to understand how they arrive at those conclusions. The predictions of these “black box” models can influence users' and developers' trust in the model and, consequently, their confidence in deploying it (Rai, 2020). Further, the black box poses an obstacle to validating the developed AI algorithms and poses “strong limitations” for AI applications in many domains (Yang et al., 2022). Though the prediction of these models and explanations of their internal workings are independent, explanation is an important aspect of trusting their prediction (Buhrmester et al., 2021).

Despite the challenges posed by “black box” approaches, researchers have made significant strides in developing techniques to understand the interpretability of these models for clean data (see, e.g., Chen et al., 2024). Methods such as feature visualization, attention mechanisms, and model-agnostic interpretability techniques offer insights into the inner workings of these models. The “black box” challenge of the NN models becomes evident in interpreting dirty data and that achieving conscious AI will depend on consciousness being a non-data-driven phenomenon mimicked through dirty data using dirty hooks. This remains a pivotal turning point in the success of deep learning algorithms.

3. Machine understanding inspired by irreducible organicity

Searle (1992) argues against functionalism (and, a fortiori, behaviorism). A set of formal rules for manipulating symbols is not consciousness. There needs to be understanding, free will and, therefore, intentionality. According to Searle, “*looking in the algorithm is looking in the wrong place*”. The algorithm is purely formal, and the formal properties are insufficient for the causal properties. Mental states and events are literally a product of the operation of the brain, but the algorithm is not in that way a product of the computer. Searle (1992) will argue that no matter how complex the software, no matter what inputs and outputs it negotiates, it cannot be ascribed mental states in any literal sense, and neither can the hardware that runs the program since it lacks the causal powers of human (and other) brains that produce intentional states. We need to understand feelings. The gist is to understand that intention we "sense" as feeling (Bohm, 1989). These are two different points of view. We have said that intention is sensed as feeling. Therefore, it would be redundant for AI to feel if they can express intentions in action, i.e., the experience of having a thought or, in a nutshell, "understanding". How does AI understand? The reason is not through adjustment of synaptic weights but a degree of freedom through quantum potential information. The quantum degrees of freedom would represent a nonlocal pathway adding to the classical physiological mechanism for the remaining degrees of freedom of brain dynamics.

A new generation of deep learning algorithms utilizes machine learning by adjusting link weights using gradient descent (an optimization technique) via backpropagation on one layer. Still, the problem is that a hierarchical network is not conducive to self-referential causal closure across all the layers of the deep learning networks. This is why DeepMind cannot take that additional step towards machine understanding. The failure to develop self-referentiality in AI agents is a major stumbling block for machine understanding (Pepperell, 2022). A major problem with existing AI is that it can be autonomous without understanding. Learning in automation is not intelligence. The problem with learning is that it is "thinking" without any understanding. It is the “act of understanding,” which is the process of understanding and not understanding *per se*.

DeepMind® is self-recurrent, but it is not self-referential. A self-recurrent NN is a type of NN that can refer to its own internal states or parameters during its operation. Self-referential NNs can improve the network’s ability to model sequential or time-varying data (see **Figure 1**). A network cannot have a self-referential recurrent structure since self-reference at one layer is insufficient. In a self-referential structure, all parts/comments must be simultaneously acted upon from the bottom to the top. In other words, 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. Can the artificial NNs be changed to incorporate this requirement? When informational levels are multi-level redundancy structures, unique holarchical modularity can form (Poznanski, 2024a). From the perspective of multiscale neuroscience, dynamic brain organization is holarchical in that each scale is inter-

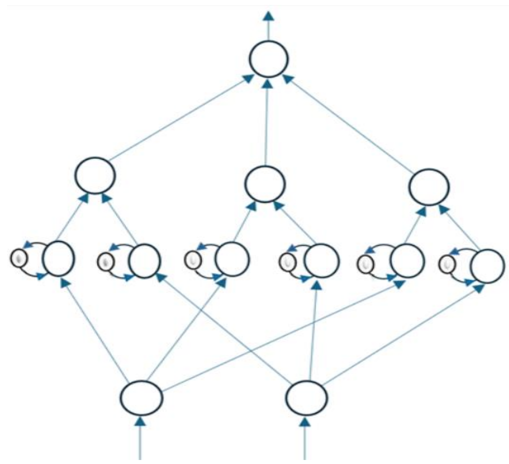

Figure 1 A hierarchical self-recurrent NN cannot satisfy a self-referential causal closure for identifying psychological causations in machine understanding because real-time classification ignores the conflation of nonlinear time with intrinsic information pathways. What matters about the brain, namely its causal properties and ability to produce intentional states, mandates self-referential causal closure, which means each network layer is self-referential in time. This means that nonlinear time is irreversible and non-flowing (i.e., non-perceptual). It is not absolute time because no reference frame or spacetime metric projection exists. There can only be an experiential flow of time, i.e., perceptual, but perception only considers linear time, so there cannot be a flow of time.

connected, not necessarily integrated, but massively modular, resulting in a modular holarchy.

Can consciousness emerge in machine learning systems? In a recent review by Krauss & Maier (2020), this question was asked with the proverbial answer of "*merely mimicking conscious behavior without being conscious at all.*" Clearly, deep learning algorithms have limits. Deep learning algorithms use "black box" techniques to simulate intentionality by finding arbitrary functions from a trained set. This leads to integrated information through observer-relative computation based on the paradigm that the brain or machine processes information. Machine learning in artificial NNs is trained by information inputted into the system. Then, the outputs are learned through what you could call machine learning. The NN receives feedback, usually from some testing data. While Strong AI is often associated with artificial agency intelligence (Cheng, 2022), and deep learning algorithms are suitable for decoding labeled datasets, deep learning cannot encode intrinsic information.

Table 1 *Shows the main differences between Agential AI and conscious AI*

Agent-based Strong AI	**DOT-based conscious AI**
- Complex information processing - fast/algorithmic/Turing computation - Learning predictive correction of error to reduce surprise - Predictive coding leads to cognitive processing - Semantic functions are teleofunctionalist look-up tables - Decision-making without intentionality - Adaptability through rules and algorithms of chance - No feelings - Syntactical computer programs - Formal language - Pseudo-agency - Representations as states of the real world - Integrated information -Temperature independent -Time effect on information processing - *deux ex machina* functionalism -Embedded in physical system	- Complex information structuring ("structuralism") - Slow/nonalgorithmic/nonTuring computation - Consciousness as the act of understanding uncertainty - Syntactical structures evolving into experienceable forms. - The function of consciousness is to endow conscious recall to memory - Decision-making through intentionality - Experienceabilities lead to cognitive experientiality - Feelings are sensed intentions - Freely evolving agency - Temperature-dependent fluctuations as raw syntax - Non-integrability of information - Space is implicitly defined through boundary conditions - Functional activities as experience in time - Free of constraints of the embedded physical system - Self-referential causal closure

Strong AI, the appropriately programmed computer, is a mind. This is a fallacy, according to Searle (1980). It presumes. Deep learning algorithms may simulate human psychology and psychological causation, as they may simulate weather or model economic systems. Still, they do not themselves have conscious states because they process information. Their outcome is integrated information (See **Table 1** for a summary of differences between functionalism/Strong AI and structuralism/conscious AI).

In Strong AI (and functionalism), algorithms matter, independent of their realization in machines. This form of functionalism insists that what is specifically causal has no intrinsic connection with the actual properties of the brain. According to Jonas (2001), the organic functions of life are not characterized by biological processes but by subjectivity related to the phenomenon of life. This is not the same as functionalism but supports self-referential causal closure. Jonas summarizes this nicely: *"the organic even in its lowest forms prefigures mind, and ... mind even on its highest reaches remains part of the organic."* Here, the "mind" is replaced with the evolving self-referential information channels containing raw syntax across the scale from micro- to macroscale in a multiscalar brain, which is attributed to functional activity that causes causation (Poznanski et al., 2024).

Cave *et al.* (2023) point to the exponential growth of computational machines, reaching 10^{16} operations per second as equivalent to intelligence. De Quincy (2023) claims the idea of intelligence without consciousness is meaningless. The development of artificial intelligence has gained significant momentum in recent years due to the increasing computing capacity of computers. However, it is important to question whether increasing computational power is enough for artificial intelligence to be truly "conscious". Discussions about what artificial intelligence needs to gain consciousness often focus on the importance of computing power. Automated intelligence is made possible due to the large number of operations per second available on digital computers (Wei et al., 2022). In other words, computational power has increased to such an extent that information contains a huge amount of labeled data, yet it seems it is all a mirage (see Schaeffer et al., 2023).

4. Quantum information biology in relation to the brain's epistemic subjectivism

In its basic formulation, quantum biology concerns efforts to explain biological processes that cannot be understood classically. However, such a minimal definition excludes the essence of brain science, which has been called the 'mind' for centuries. It requires an epistemic subjective perspective (Shand, 2021). In recent years, our understanding of the brain's complexity has significantly transformed with the advent of multiscale neuroscience. It proposes that quantum information biology is key in describing the multiscalar brain. It is not defined in a subjective probabilistic way through quantum formalism (Asano et al., 2015) but through subjective physicalism. Therefore, it is important to emphasize that the "quantum of information" functionality in biology is epistemic subjectivism rather than epistemic objectivism.

The argument is how to define quantum biology so that information is not defined through information theory as qubits in the sense of Shannon (1948) but through subjective physicalism. This requires more than just quantum information; it requires "quantum of information" (Pribram, 1991) functionality. Quantum information biology differs from quantum physics because information must be selected from a redundancy of information to be meaningful (McDowell,2010) and, therefore, has functionality. Quantum biology, unlike quantum physics, is "quantum-like." With "quantum-like," one can move toward QBism (classical analog) or away from QBism (quantum analog), excluding QBism from quantum information biology because the subjective interpretation of informational states gives the agent a central role. Yet, in quantum information biology, there is no agency, but only consciousness is encoded at multiple scales and depends fundamentally on cross-scale functional interactions (self-referential causal closure), which is a guidepost for the rationale of consciousness-in-action (Hurley, 1998).

Quantum biology has two important roles: (1) to explore quantum dynamics in biological systems and (2) to explore how the intrinsic quantum processes play a role in our understanding of information as subjective physicalism. In the first case, quantum computation is a way of processing information (different from digital computers) that can solve protein-protein interactions of various functional interactions between many molecules changing shape and rendering functional motifs. However, this can only reach the functionality of maximum complexity and, therefore, not consciousness, which requires that the functionality of multiscale complexity be greater than that of maximum complexity (Kuhn, 2024; Poznanski 2024a,b). To reach consciousness, negentropic entanglement increases the functionality of maximum complexity. This suggests that through negentropic entanglement, a weak unity of consciousness is made possible by the contiguity of "potential complexity" (Poznanski, 2024a,b).

Quantum dynamics involving intrinsic quantum processes are causal but diffused, occurring not as quantum superpositions but as noisy fluctuations. Resonance energy occurs when temperature affects the quantum state, which becomes resonant in open quantum systems. Resonance states are subjected to irreversible time evolution, represented by information that comes from communication (syntax), leading to negentropic gain. Quantum entanglement could also cause the irreversibility of time, but this is based on the premise that the brain is a quantum computer. Quantum brain dynamics assumes the idea of an isolated quantum brain against the construct of consciousness. Therefore, by avoiding reference to "quantum brain" or "quantum consciousness," a "quantum-like" road is chosen.

Quantum information biology is what we classify as a "quantum-like" phenomenon. It is outside the quantum mechanical domain, where quantum entropy is replaced with negentropic action via Brillouin's negentropy principle of information (Brillouin, 1953, 1962). It does not use the quantum effects of electron tunneling but thermo-quantum effects. In quantum potential chemistry, we have delocalized dipoles, not electron tunneling, as in chemical reactions and mitochondria chains. Therefore, it is important to emphasize that quantum potential information provides an additional degree of freedom for information pathways linked to subjective physicalism.

Quantum information biology is not quantum information in biology. What is information in the context of quantum information biology? Simply put, the information allows you (who has that information) to make predictions with accuracy better than chance (Adami, 2016). However, in a system with intentionality, the definition of information is not "*to make predictions which accuracy better than chance*" but the motivity of action as change in functionality present in a dissipative system with intentionality that is a precursor of quantum potential energy that leads to the functionality of multiscale complexity through self-referential pathways in informational holons. Intentionality is affected by quantum potential energy producing quantum potential information. We suggest intentionality leads to a change in functionality through self-referential information pathways in highly nonmetric functionality space. Accordingly, the informational holons in the functionality space are redundancy structures that contain raw syntax (in terms of thermo-qubits) being the source from where experienceability forms and becomes substrates of "meaning". However, information is not what is interpreted as "meaning". There is no information processing, information transfer or information propagation in functionality space.

Natural language processing in deep learning is syntactical information with no intrinsic meaning. The evolution of syntactical structures conveys "meaning." First, "meaning? is not found in language but in intrinsic information, which carries noncontextual information in syntactical structures described in DOT as informational holons. The meanings have intentionality reflecting an action that constitutes the experienceable forms of experienceabilities. Second, the understanding meaning of "precognitive affect" is attributed to functional activity that brings causation via selecting organic function without symbolic information processing (Poznanski et al., 2023a).

An informational holon is an informational redundancy structure (noise or fluctuations) that evolves in functionality space or functional domain, and this has important implications that go beyond the capabilities of deep learning. Consciousness is not an instrument of the brain for understanding in the traditional sense. Instead, it changes its functionality to gain a better understanding of uncertainty. Functionality is subjective because it is intrinsic to the observer and is where consciousness resides in functionality space, which is temporospatial; we represent space implicitly by the effect it has on evolving boundary conditions and not as an additional dimension of spacetime, and, therefore, time can be nonlinear and its flow designation of information pathways. This is the opposite in deep learning algorithms, which represent time implicitly rather than explicitly as an additional dimension of the input but rather as a time effect it has on information processing (Elman, 1990).

The conscious AI has the potential to effectively decode hidden data that existing AI cannot train. Unlearnable noise hinders deep learning and makes it unlearnable noise (Fajardo-Fontiveros et al., 2023). This is based on the premise that noise sustains information. The Landauer principle suggests that the recording and erasure one bit of information require minimum energy kBT ln 2 with the Boltzmann constant kB and temperature T. Physiological temperature T = 310K indicates kBT ln 2 = 20meV. If we adopt super-radiant waves with wavelength λ = 500nm, the energy of the photon used to record holographic images is 2.4 eV. This energy scale is much larger than kBT ln 2 = 20meV with h ･ $2\pi/\lambda$ kBT ln 2 $\gg$ 1, so that information at physiological temperatures has no risk of thermal degradation (when above 20meV). Therefore, intentionality can be incorporated within functional aspects of brain dynamics. Quantum-thermal fluctuations or "thermo-qubits" as raw syntax carried by fluctuations must evolve into experienceable forms before the information encodes the functionality of subjective physicalism.

The subjective experience of consciousness is epistemically subjective and a realm of potentiality and information. Of course, the potentiality of whatever kind implies no motivity of action as change in functionality in the physical domain, but it can imply a change in the functionality space. Psychological causations are not physical forces but functional activities. Hence, the DOT theory of consciousness does not have an 'explanatory gap" because the mind does not exist; it is part of a multiscalar brain. The final metaphysical leap from brain to mind is non-existent in a multiscalar brain. What is suggested is that information is non-integrated, so channels in the brain must satisfy the self-referential casual closure. By "channels," we mean a passage, not a specific structural pathway but an informational pathway. Quantum potential information is through such pathways, which are considered quantum effects. Based on recent studies in physics (Fong et al., 2019), we postulate that the raw syntax of quantum fluctuations in brains can induce phonon coupling as a quantum mechanical effect, suggesting that phonon transport through quantum fluctuations represents a novel mechanism for passing quantum potential information, fundamentally different from conventional electromagnetic radiation theories.

Restoring redundancies to select a function is an ability to act before selection or intentionality. Intentionality is 'aboutness' or expressing 'meaning' directed at something. Aboutness of a semantic representation of semantics in terms of reducing uncertainty. The experience of acting is intentionality. Experienceability is the capacity for experience. Therefore, the activity of information carries the potential for "meaning", so the experienceability of 'meaning' must be equivalent to the experience of acting, suggesting that intentionality is the implicit goal-directedness of intrinsic information. The idea is that conscious reality is not just conscious experiences or experientiality but preconscious experienceabilities, i.e., the intrinsic information capable of being experienced by the act of understanding uncertainty (Poznanski et al., 2023a). Here, "uncertainty" refers to a lack of information from the environment, and to "understand" meaning is through experienceability of meaning. The "act" comes down to a change in functionality, whereupon an experienceable form is altered or created.

5. Passage along information pathways of negentropic action

Consciousness in our brains depends on the brain's internal free energy (Solms & Friston, 2018). It is a labile structure that is not permanently affixed and influences our existence upon interaction with the environment. Conscious experience is phenomenology and arises in cognition/perception through different channels of consciousness. Consciousness does not require an associate or perceptual memory. It works via different informational channels (Alemdar et al., 2023). Consciousness runs in different information channels from perception and cognition, as explored in empirical findings on blindsight. Work on blindsight informs us that perception without consciousness does exist (Humphry, 2006). Conscious perception is a way of forming conscious experience, but this is not the mechanism of consciousness, and Weiskrantz (1977) does not understand how quantum biology could play a role.

Consciousness remains outside the limits of AI engineers, not because of an ontological jump from physical to physical + nonphysical (de Quincey, 2023) but epistemic subjectivism in terms of intrinsic information as quantum potential information. By process of elimination, we can at least narrow down the causes of anesthesia, which causes displacement of

London forces. This suggests that consciousness has a quantum component because London forces are quantum in nature.

Hameroff (2023) recently elevated the Husserlian perspective on time consciousness as a phenomenological motif, suggesting that consciousness and the "flow of time" are identical concepts. However, this implies that time perception is intrinsically embedded in precognition or that precognition does not exist. We take an alternative view that time consciousness is unrelated to perceptual time, but instead, it is the **passage of negentropic action in informational pathways.** Negentropic action may give functionality to something but not itself. Negentropic action is a "force-free" information-based action that may not exist in the physical domain as motion because methods based on symmetry used in physics are closely linked to the brain's structural organization. In contrast, biology has the important property of nonsymmetry and nonlocality (Chauvet, 1996). Therefore, an important property of functional interactions associated with self-referential diachrony gives credence to functional dynamics as a biological action in functionality space.

Conscious AI does not need to feel; it must understand based on encoding intrinsic information through functional interactions (observer-independent computation). Conscious AI is possible only when "understanding" can be harnessed, the current AGI or AI DeepMind enterprises are sidestepped to neural decoding, and DOT encodes information. However, the computation cannot be self-automated based on formal rules; rather, a nonTuring style computation could be any computation without symbolic encoding that reduces uncertainty in the act of understanding (Poznanski et al., 2023a). In other words, information channels prefer to reduce informational redundancy through negentropic action. The "quantum of information" functionality is the motivity of (negentropic) action as change in functionality in functionality space of time consciousness. The concept of "quantum of information" was proposed by Pribram (1991) as an impulse delta function in time crisscrossing a sinusoidal; this implies that time consciousness is nonlinear as time consciousness is the passage of negentropic action in these informational pathways.

Information is not flowing or processed (Leisman, 2024). We need multiscale information pathways that structure information for "meaning" and understanding to arise. One must conflate information pathways as remnants of functional interactions in functionality space of time consciousness by designating the "quantum of information" functionality expressed in terms of the motivity of (negentropic) action as change in functionality. It is important to note that intrinsic information is subjective and intrinsic to the observer. Therefore, any contemplation of information or its derivatives, like integrated information, being equal to consciousness is problematic (e.g., Fleming et al., 2023).

In a living negentropic state, the difference in time consciousness is by "averaging out" from the Brownian motion. Since time consciousness does not flow but evolves from raw syntax to experienceabilities, what matters is that the informational pathways are nonlinear, which makes an "averaged-out" time consciousness possible. Assuming the passage of negentropic action would be sufficiently "spread out" in the informational pathways for consciousness-in-the-moment to happen. In the brain, time is measured through consciousness as time consciousness. This is not a linear progression of time but nonlinear time, meaning that the time consciousness is conflated with the informational pathways forged by thermodynamic constraints (Poznanski 2024b). Consciousness-in-the-moment are different temporalities where temporal cohesion results from agential mediators such as negentropic action via quantum potential information connecting the adjacent temporalities in a manner different from spatial cohesion observing only the single temporality restricted to the consciousness-in-the-moment.

Consciousness is not a categorical but a functional property within functionality since the subtle unity of consciousness depends on functional relations within the functional domain or functionality space that can describe the qualitative nature of time consciousness (Poznanski, 2024a). For a discrete flood of random moments of consciousness-in-the-moment to have any impact, the process must be negentropically entangled so that a weakly unified consciousness arises from intentionality or conscious choices. The biological interpretation of consciousness-in-the-moment underscores the contrast between physical and functional interactions. From this perspective, time consciousness is seen as distinct from immediate sensory responses processed by the brain, and functionality is across scale through the "averaged-out" time consciousness.

It is suggested that the "quantum of information" (Pribram, 1991) in the brain cannot be carried by just one structure but a whole contingency of structures in various fluctuations. With its huge number of operations in parallel, a computer will significantly undermine its power compared to what a conscious AI could be capable of achieving. Current computers perform operations in a largely linear and sequential manner. This suggests that computers may be inadequate at accommodating time consciousness. Therefore, the way to create a conscious AI is to develop computational techniques that can better mimic the intertwined pathways in the functionality space of time consciousness.

6. The "encoding" process in terms of functional interactions

Physical interactions exhibit the property of information exchange, information transfer and, subsequently, information propagation and, ultimately, information processing. Information processing and information transfer rely on formal rules for manipulating symbols (Searle,1980). Symbolic AI is a set of formal rules for manipulating symbols, which is a learnable problem. A Turing machine executes computation that manipulates symbols and is observer relative. Here, symbolic information is based on symbols created by humans. Syntactical information is symbolic information. All symbolic processing is mathematical. It is observer-relative, and there is no epistemic subjectivity.

Symbolic information processing is a higher action to deep machine learning. Even the idea of quantum computing is to use quantum superpositions for massively parallel information processing. Similarly, quantum machine learning uses photonics for the noiseless transfer and processing of quantum information, a Turing machine. NonTuring models emphasize encoding intrinsic information. Therefore, there is a possibility that advances will be made through observer-independent computations, but this will require replacing machine learning with machine understanding (Sanz & Aguuado,2020).

NonTuring computation could be any computation without symbolic encoding that calculates and describes the relations between algorithmic steps. As Turing computation is driven solely by syntactical rules and requires integrated information, we must agree that computation in the brain is not Turing-computable. However, this represents the computational fallacy of AI, which evolves to form contextual information referred to as semantic information and is used in data labeling. The evolution process, we claim, is the structuring of intrinsic information (Poznanski, 2024a). This procedure of encoding intrinsic information is bypassed in deep learning algorithms.

A Turing machine executes computations that manipulate symbols. Symbolic information is based on symbols created by humans. This information is observe-relative meaning bias in AI system in the data it was trained on is biased and has come into existence from training data by the artificial NN learning how to extract the "meaning" of the sentence and use this "meaning" to predict the next word then the AI model picks up skewed patterns and produces biased output. This limitation in the deep learning process of training data in mitigating bias is to approximate intentionality. The weakness of such an approach is interchanging the concept of consciousness-in-action (Hurley, 1998) with information so that actions being part of our perceptions are a language revolving around a series of information-bearing symbols or symbols.

Norbert Weiner, the founder of cybernetics – control and communication in the animal and machine-believed that information was not energy in the context of cybernetics. This makes sense if biological information occurs only when control and storage of information are possible; otherwise, energy transfer is just the same as information transfer in machines. Asby (1957) made the claim that biological systems are "*open to energy but closed to information and control*" (Chang et al., 2020). This fits well with the notion that storing constrained energy under energy flow defines information in a biological system.

The importance of energy capture and storage under energy flow (Ho, 1997) works well for metabolic energy. This is a practical solution to the intrinsicality problem (i.e., knowing how syntax becomes semantics) and provides a way to address the binding problem. Often, it is misleading to assume psychological causation is yet unknown (Cheng, 2022). To quote Henry Stapp: "*To have free will, you need psychological processes that have a causal impact on the physical world*". However, the mechanisms of such psychological processes have yet to be determined with precision. We show that top-down contextual influences are not fundamental bottom-up influences. For instance, sentience, as the capacity for feelings or intentions sensed as feelings (Bohm, 1989), is not foundational to consciousness; intentionality is intentions-in-action, i.e., the experienceability to act precedes.

We suggest an alternative way. Here, we add that the energy involved in consciousness is quantum potential energy that acts as motivity of action as change in functionality for the passage of negentropic action in the presence of temperature effects. Self-referential causal closure in coupled informational holons maximizes local autonomy and temporal cohesion by negentropic entanglement. Temporal cohesion is the agency of concatenating the preceding present (what has been produced) to the succeeding present (what is going to be produced) (Matsuno,2023).

The origin of consciousness lies in intentionality, leading to functionality through intrinsic information encoding in the brain rather than the environment, as it requires encoding before it describes functionality. There is no need for information processing when intentionality gives rise to functionality of multiscale complexity. Poznanski et al. (2023a) claim that intentionality occurs within the brain as an information-based action. Here, the action is negentropic, but it distinguishes itself from neural activity (as a selected function to act) in the inclusion of intentionality in terms of aboutness, namely being for something or serving a purpose, expressed through functional interactions describing evolving boundary conditions (ability to act before selection) that naturally lead through the analysis of functional interactions.

The role of consciousness in memory formation is that information must be understood through consciousness, as memory is unavailable without conscious recall (Solms, 2014, 2017). The notion of understanding is not in the traditional context of meaning but in changing its functionality to gain a better understanding of uncertainty. The act of understanding uncertainty where "uncertainty" refers to lack of information from the environment and "understand" meaning is through experienceability. The "act" is a change in functionality whereupon an experienceable form is altered or created. Functionality in functional systems theory does not refer to the "efficiency of the function" but the selection of a function from various functional interactions due to changing boundary conditions. Functional interactions are not physical interactions, but they are the window to consciousness via subjective physicalism. The end product has functional properties that build upon the functionality of the multiscale complexity. In general, information is subjective physicalism, but intrinsic information is the outcome of quantum potential information that, through its encoding, leads to functionality. Subjectivity lies in intentionality, leading to functionality through intrinsic information encoding in the brain. The process of "encoding" entails functional interactions in evolving informational holons. Functionality is specific to functional interactions that do not occur outside of the brain. It selects a function from myriad functional interactions in biological systems because of changing boundary conditions that do not occur in inorganic matter.

The psychological causation depends on functional interactions, in which the temporal structure of time consciousness is nonlinear (Poznanski 2024). It has an ideal-like character since space is implicit, while in physically described terms, the brain assigns functional properties to space and time points. We can describe the world in terms of functions and functionals. Still, we cannot describe psychological causation using functions or functionals. It is not brain function or functional connectivity as they do not delineate the "quantum of information" functionality.

The psychological explanation requires a quantum effect, which raises the question of how intentionality for selecting function as intention without symbolic information processing comes about. In this way, we eliminate the need for the question to be answered by "psychological processes" (mind), which, according to Stapp (2017), describes the "mind" as being fundamental. Hence, it is a form of dual-aspect idealism.

In idealism, the consciousness (mind) is the fundamental entity that causes the *appearance* of the matter-in-itself since the matter-in-itself is unknown. For instance. microtubules oscillate at 10^{43}, while EEG waves oscillate at 10^{2}, making it hard to assume a connection. Thus, the spectral domain is not a way to measure "affect", which is precognitive. So, Stapp's view is irrelevant here. The "perceptible" amount of content is through different channels. Therefore, we replace the dual-aspect idealism of Stapp (2017).

7. Information redundancy across scale due to diachronic boundary conditions

Penrose (1989) argues that the consciousness process cannot be computed due to Gödel's theorem. This assumes quantum consciousness; otherwise, trying to impose noncomputatability in the classical realm, e.g., in the rapid onset and highly variable thresholds of action potentials, is unconceivable since they are noise-related epiphenomena (cf., McCormick et al., 2007). More recently, anesthesiologist Stuart Hameroff asked: "*How can consciousness come in through noise?*" Information-based action arises from the negentropic-derived quantum potential energy as an intentional agency with a time structure in transforming syntactic structures into experienceable forms by restructuring informational redundancy structures (noise or fluctuations).

Neuroscience has no place for noncomputability unless exotic physics is assumed in the quantum realm. On the other hand, Poznanski (2024a,b) argues that information cannot be integrated into the consciousness process. Information is not fixed in a conscious state but is ever-changing, constantly restructuring and evolving. This evolution of information is what drives functionality and suggests a functional plurality of functional contributions of consciousness (Ludwig, 2022). Both approaches contradict the integrated information theory, signifying integrated information theory as a pseudoscience (Fleming et al., 2023). In short, we can compute consciousness without being able to picture it. A good image of consciousness must be mathematical. This is because consciousness is not a property of matter but an event that occurs in matter influenced by diachronic boundary conditions and negentropic action.

Conscious properties are properties of a brain process, but mapping is not one-to-one, i.e., there is no identity theory if one considers epistemology. Epistemic objectivism and epistemic subjectivism are physical forces (standard physicalism) and intrinsic information-based action (subjective physicalism). The latter is dependent on temperature and quantum potential information. However, it is not the cause of epistemic subjectivism. What matters is the negentropic action that arises in spontaneous ordering in large biomolecules. DOT posits that consciousness arises at the molecular level, not the atomic level, falling short of "microfeels" in the psychonic theory of consciousness. There is no evidence of a few selected molecules causing the amplification of quantum-level phenomena into macroscopic-level biology. However, a "weak" or subtle unity of consciousness can arise from negentropic entanglement because of the irreducibility of experienceable forms becoming unified through realization relations in functionality space. Negentropic entanglement (negentropic = relating to information gain; entanglement = binding or spread) is a contagion for spontaneous ordering (anti-entropic process) that eliminates redundancies through nonlocal pathways. Through negentropic entanglement, multiscale complexity increases beyond maximum complexity, allowing functionality to increase and representing the functionality of multiscale complexity (see Poznanski, 2024a,b).

Consciousness-in-the-moment episodes could be an intrinsic feature of fundamental spacetime geometry, in which quantum entanglement for an orchestrated proto-consciousness occurs supposedly in microtubules, as suggested in the *Orch OR* theory of consciousness (Hameroff & Penrose, 2017). The problem is conceptually rooted in orthodox quantum mechanics for isolated systems, i.e., the quantum connection between the particles. It may not be true in microtubules unless the brain is a quantum computer (Hameroff, 2007). Furthermore, Bohm's quantum potential has been combined with the Orch OR theory (Gallego, 2011), which states that the quantum potential makes the brain behave as a collection of macro-neurons, as suggested in the DOT theory of consciousness. Dynamic organicity is a concept in neurobiology that describes the brain as a complex and diachronically interconnected dynamic system (Poznanski et al., 2024 a,b). Each part of the brain has a specific role and contributes to its overall functionality.

A simultaneous existence in different brain locations is possible through diachronicity. The separation of structures via diachronic boundary conditions enables functionality to be expressed in terms of evolving syntactical structures (Chomsky, 1957) via the irreducibility of dynamic organicity, which relies on self-referentiality across many layers, not just one referred to as self-referential causal closure. So, what is the chain link in the self-referential causal closure? It comes from a system of epistemic functional relations. It is important to note that the brain is not a spacetime projection. It simply means computation in the material brain is moot on the idea of spacetime being fundamental for the motivity of action as change in functionality can occur without motion (e.g., the conscious act is a planned action, not necessarily an action in motion).

When space and time are intrinsic, they can also be self-referential. With relationalism, self-referential amplification can exist and function only as relational entities. Therefore, space and time in the brain is a system of epistemic functional relations reflecting a grossly nonmetric manifold (i.e., locally Euclidean topological spaces that do not carry a metric structure). Nonmetric space refers to those concepts of space where distance is irrelevant, like in the brain. Here, computation in a self-referential system because it carries evanescent 'meaning' due to changeable diachronic boundary conditions the decoupling of space from time arises from the constraints imposed by the boundary conditions. Examples of diachronic boundary conditions are physiological/ biophysical/atomic structures that affect the dynamic state of brains across scales. It is too difficult to visualize, so it is best to keep structural complexity implicit through changeable boundary conditions and focus on the functional structure embedded in the "functionality space" of time consciousness (Poznanski, 2024a).

8. Conclusion

The AI revolution presents a unique opportunity for neuroscience. Current deep learning algorithms on artificial NNs must be replaced. This paper gives the main reason why deep learning cannot be conscious. The most important aspect of achieving consciousness for an AI is machine understanding. Syntactical algorithms cannot achieve true understanding, as Searle argued in his Chinese Room thought experiment. Deep learning uses semantically based algorithms and labeled data to decode information. It does not satisfy self-referential causal closure at each layer of a hierarchical network for understanding to be made possible. Since raw syntax could evolve into noncontextual meanings, new forms of nonTuring computation will need to be developed to become fully self-referential. Conscious AI will not be self-aware, but machine understanding through functionality to better understand "uncertainty" will be the true hallmark of machine consciousness. Machines do not require feelings and conscious experiences since they are life traits, not traits of intelligence. Moreover, machine understanding would surely surpass human-level intelligence, not leading to a singularity but leapfrogging singularity. In conclusion, according to the principles of quantum information biology, the brain cannot be viewed as a perfect example of computation, whether classical or quantum. Regardless of the AI revolution in classical and quantum machine learning, consciousness is not a learnable problem and, therefore, cannot be replicated under any computational paradigm if information is processed.

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