Tiered Social Recursion: A Functional Architecture for the Evolution of Consciousness[1]

Serge Tochilov[2] **(serge.tochilov@gmail.com)**
Independent Researcher, Ottawa, Canada

Abstract

Treating consciousness as an evolutionary adaptation of internal world modeling, we introduce the Tiered Social Recursion framework that classifies biological awareness. Each tier is delineated with behavioral taxonomic benchmarks. The operationalization comprises a hierarchical sensory Parser and an autoregressive loop linking Generative Engine (integrated with Long-term Memory), Short-term Memory, and sensory-grounding Gate Unit. This generative-perception architecture is anchored in neuroanatomy and disorders of self-awareness, accounting for a spectrum of normative and pathological mental states through unit-activation patterns. For example, in the REM state, LTM switches to consolidation mode, so peri-conscious processing of STM content dominates and dreams feel unreal; in Anton syndrome, loop-generated visuals persist without Gate Unit constraints. Motivated by Cogitate's PFC-aligned evidence, we propose that *qualia* emerges from peak recursive modeling of outer-self in the minds of conspecifics. We posit that lack of persistent identity prevents the modeling of outer-self required for human-like consciousness in AI.

Keywords: tiered social recursion (TSR); hierarchical sensory parser; τ-state; gate unit; generative engine; working memory; sensory grounding; social recursion; synthetic consciousness; neuroanatomical mapping; evolutionary biology; spectrum of mental states; REM dreaming; Anton syndrome.

Elucidating the nature of consciousness remains a challenge at the intersection of cognitive science, biology, and philosophy. The discourse often divides the field into the Easy Problem of functional mechanisms and the Hard Problem of subjective experience. Foundational work articulates the ongoing tension of integrating these perspectives (Chalmers, 1996), while the **adaptive role of consciousness** as a central biological inquiry remains under-examined (Fitch et al., 2025). Adversarial testing of Global Neuronal Workspace and Integrated Information Theory left both frameworks empirically incomplete, with prefrontal cortex preferred as the locus of conscious processing (Cogitate Consortium et al., 2025). The same study observed early posterior activity (peaking at ~0.1–0.2 s) and brief PFC ignitions at ~0.15 s.

Throughout the paper, *awareness* denotes the structural depth of an organism's internal world modeling (IWM); we distinguish awareness from *consciousness*, which denotes the felt experience that sufficiently rich modeling generates.

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[2]ORCID iD: 0000-0001-7855-233X

Evolution of Awareness

Within the outlined context, we introduce Tiered Social Recursion (TSR), a framework that classifies the evolutionary tiers of IWM. We frame the progression of awareness as a series of adaptive refinements to an organism's IWM that enable higher-order representations of external and internal states (Ginsburg & Jablonka, 2019). We argue that transitions between the tiers are driven by both quantitative scaling of neural capacity and qualitative shifts in modeling targets, such as the body, external objects, and conspecifics (Dunbar, 2018). To isolate the minimal biological requirements of IWM, each tier is associated with two **behavioral taxonomic benchmarks**: the most basal and the most derived species. Throughout, *organisms* refers to animals (and bacteria at the lowest tier).

Reactive Awareness

At the base of the hierarchy, awareness is characterized by the absence of a nervous system. Processing of environmental signals is governed by chemical and genetic regulatory networks (Baluška & Levin, 2016). Organisms dwell in "gradient space", responding to immediate environmental changes (e.g., light intensity, chemical concentrations, or temperature) through cell-surface receptors.

Functional Architecture (FA): Sensory input is limited to cell-surface receptors, with coordination handled by internal clocks that track "chemical time" through reaction rates. Motor responses such as flagellar movement or cell-wall shape changes are localized and optimized for immediate survival in place.

Taxonomic Benchmarks:

- Basal: ***Cyanobacteria***. Utilize internal circadian rhythms to anticipate environmental shifts (Jabbur et al., 2024).
- Derived: **Sponges**. The most derived multicellular organisms functioning without a nervous system (Musser et al., 2021).

Proactive Awareness

The transition to proactive awareness marks the shift to rapid signaling via a decentralized nerve net. This stage introduces the capacity for spacetime modeling, with the nerve net functioning as a proto-**Spacetime Unit** (Jékely et al., 2015). It integrates sensory data across the dimensions of neuronal time and physical space, and identifies high-value external events

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related to food, threats, or mates, enabling anticipatory rather than reflexive behavior.

FA: Organisms utilize active appendages to interact with the environment. The reactions are localized, while excitations traveling through the nerve net allow for synchronized all-body actions such as rhythmic swimming. Organisms use behavioral patterns centered on functional logic (e.g., if-then movement patterns) but lack a representation of their own bodies as a distinct entity.

Evolutionary Advantage (EA): The ability to model and navigate physical spacetime offers improved resource acquisition, mate selection, and predator avoidance.

- Basal: ***Hydra***. Represent the minimal body plan featuring a functional nerve net (Jékely et al., 2015).
- Derived: **Box Jellyfish**. Exhibit CNS-level sensory integration, obstacle avoidance, and predatory behavior (Garm et al., 2011).

Somatic Awareness

Somatic awareness arises when a proto-CNS develops a specialized **Somatic Unit**, which models the organism's own body as a distinct entity.

FA: Somatic Unit functions as a downstream processor for Spacetime Unit (which becomes fully established) by integrating sensory signals that are correlated with the body, and constructing a first-person internal view (Craig, 2009). Organisms lack the capacity to distinguish external objects due to sensory limitations (e.g., lack of high-resolution vision).

EA: Centralized processing allows monitoring internal state for timely interventions and coordinating movements with higher efficiency than decentralized processing.

- Basal: **Flatworms**. Exhibit minimal cephalization and rudimentary body-centric responses (Ross et al., 2017).
- Derived: **Hagfish**. Display coordinated scavenging and body-aware defensive behaviors, such as knotting their bodies to gain leverage (Zintzen et al., 2011).

Object Awareness

Object awareness introduces external entities into IWM through a new **Object Unit**. We propose that the Somatic Unit served as a development template for it, because external objects share some physical traits with the body, such as cohesivity (staying in one piece) and variability (changing shape and position over time). The emergence of a new unit using another as a template is evolutionarily more efficient than developing a unit de novo; it establishes the architectural pathway for increasingly granular modeling of all external entities. This templating is likely mediated by gene-family expansion in chordate brain evolution (Briscoe & Ragsdale, 2019).

FA: Object Unit functions as a downstream processor for Somatic Unit. A single unit recognizes different objects by loading varied population activity vectors[3] (DiCarlo et al., 2012). However, conspecifics are not yet identified as a distinct category, leaving organisms reliant on coarse markers to find mates.

EA: Object-processing capacity coupled with fidelity of sensors (primarily vision) allows distinguishing and tracking objects of interest within the environment, for improved resource acquisition, mate selection, and predator avoidance.

- Basal: **Alciopidae Polychaete**. Possess high-resolution camera-eyes used for tracking prey in open water (Bok et al., 2024).
- Derived: **Octopuses**. Demonstrate advanced object manipulation, problem-solving, and environmental modeling, while remaining largely solitary without conspecific recognition (Richter et al., 2016).

Conspecific Awareness

At the level of conspecific awareness, IWM adds **Conspecific Unit** for processing a special category of objects – members of the organism's own species.

FA: Conspecific Unit evolves from Object Unit and functions as a downstream processor for it (Grill-Spector & Weiner, 2014). The processing identifies species-specific markers. Individuals are treated as lacking unique identities or group integration.

EA: Identification of conspecifics improves resource sharing, mate selection, and predator avoidance through species-shared signaling.

- Basal: **Fruit Flies**. Exhibit courtship behaviors driven by conspecific recognition (Yamamoto & Koganezawa, 2013).
- Derived: **Sea Turtles**. Recognize species-specific markers without tracking any individual or group histories (Szabo et al., 2021).

Group Awareness

Group awareness extends the modeling to collective identities, adding **Group Unit** for identifying conspecifics as the in-group versus strangers, facilitating in-group bias and collective coordination (Molenberghs, 2013).

FA: Group Unit evolves from Conspecific Unit and functions as a downstream processor for it. The ability to distinguish specific individuals within the in-group is lacking.

EA: The in-group/out-group distinction improves ability to cooperate for resource acquisition, manage group-level conflicts, and prefer out-group mates to maintain genetic diversity of their own group (Beckes & Sbarra, 2022; Pusey & Wolf, 1996).

- Basal: **Ants**. Utilizing chemical signatures, ants operate with a binary in-group/out-group model that facilitates large-scale collective behavior (Ferguson et al., 2021).
- Derived: **Honeybees**. Utilize spatial communication (e.g., waggle dance) to coordinate group efforts and distinguish colony-specific signals with high precision, while individual bees remain anonymous to one another (Giurfa, 2025).

[3] See also Figure 1 caption.

Individual Awareness

Individual awareness resolves the group into specific individuals, adding **Individual Unit** that distinguishes them and maintains a history of interactions.

FA: Individual Unit evolves from Group Unit and functions as a downstream processor for it. Individual Unit tracks not only first-person interactions but also third-party ones within the group. Due to the quadratic growth of possible interactions with group size, the processing is limited by available metabolic resources, which creates a bottleneck and caps the maximum sustainable group size (Dunbar, 1998). The modeling is still not advanced enough for individuals to process outer-self as a distinct entity.

EA: Mentalizing allows organisms to predict the behavior of specific group members based on historical data, providing superior opportunities to cooperate (Andrews & Miller, 2025).

- Basal: **Northern Paper Wasps**. Exhibit individual recognition of distinct facial patterns to manage hierarchical social structures (Sheehan & Tibbetts, 2011).
- Derived: **Rhesus Macaques**. Manage multi-layered social networks and demonstrate accurate predictive modeling of peer behavior (Testard et al., 2021).

Self-awareness

At the highest tier of the baseline[4] TSR hierarchy, self-awareness establishes social recursion through **Self-unit**, which models outer-self, i.e., how an individual is perceived by others. We propose that Self-unit evolves from Individual Unit, originally built for others; Individual Unit's processing is relevant to Self-unit because conspecifics in a social group share similar physical and behavioral traits (Apps & Tsakiris, 2014). However, emergence of Self-unit is favored only if conspecific individuals have sufficiently different and persistent traits, so their own interactions with peers have features absent in interactions between other individuals; otherwise outer-self has no distinctive traits to model.

FA: Self-unit functions as a downstream processor for Individual Unit, aggregating invariant or slowly evolving self-traits into an outer-self representation. This allows individuals to engage in social games by leveraging knowledge of their outer-self to influence peer behavior.

EA: The recursion ("I know that they know that I am...") enables reputation-based prediction of others' behavior toward self, providing fitness benefits in high-stakes interactions.[5]

- Basal: **Cleaner Wrasse**. Interact within the social environment of a diverse range of "client" species serving as an extended group, necessitating the evolution of self-awareness to manage their own reputation (McAuliffe et al., 2021; Sogawa et al., 2025).
- Derived: **Neanderthals**. Exhibited social structures and self-representations such as burial rites, ornamentations (Pitarch Martí et al., 2021).

[4]See also Higher Human Awareness.

[5]See also Emergence of Consciousness.

Functional Analysis of TSR

The described hierarchical progression demonstrates that self-awareness is a trait of a biological modeling system optimized for social fitness (Graziano, 2019). To operationalize TSR, we propose a minimal higher-level brain network inspired by generative AI models, particularly the use of high-dimensional latent representations and noise-driven, autoregressive generation. The architecture provides a concrete, testable mechanism for how awareness tiers are instantiated in the brain (Figure 1).

Functional Architecture: Minimal Network

The processing flow of Minimal Network is governed by the units described below. The *italic* text indicates proposed neuroanatomical grounding. The units are not confined strictly to one region: several regions can share the function of one unit; conversely, one region may support functions of several units.

Parser performs hierarchical structural encoding of multimodal sensory input, outputting PAVs for grounding by Gate Unit. Processing goes from coarse spacetime consistency, through resolved semantic content, to recursive social integration. This follows a hierarchy from early sensory regions to higher-order cognition (Hasson et al., 2008).

- **Preprocessor** — *Thalamus, Primary Sensory Cortices* (Sherman, 2016) processes and relays sensory input.
- **Spacetime Unit** — *Hippocampus, Entorhinal Cortex* (Buzsáki & Moser, 2013) performs spacetime modeling and navigation.
- **Somatic Unit** — *Somatosensory Cortex, Insula* (Critchley et al., 2004) forms first-person internal view.
- **Object Unit** — *Lateral Occipital Complex* (Grill-Spector et al., 2001) performs invariant object recognition.
- **Conspecific Unit** — *Temporoparietal Junction* (Schurz et al., 2014) tracks species-specific markers.
- **Group Unit** — *Amygdala, Fusiform Gyrus* (Phelps et al., 2000; Kanwisher, 2010) tracks group-specific markers.
- **Individual Unit** — *Superior Temporal Sulcus* (Allison et al., 2000) tracks individual histories.
- **Self-unit** — *Medial Prefrontal Cortex* (Lieberman et al., 2019) forms recursive outer-self representation.

Generative Engine and Long-term Memory — *Orbitofrontal Cortex* (Wilson et al., 2014), *Cerebellum* (Schmahmann et al., 2019) (provisional); *Hippocampus, Neocortical Stores* (Buckner, 2010). The Engine generates all felt content, including the worldview. It shares neural substrate with Long-term Memory, with no well-defined anatomical boundary; sleep-time consolidation continuously moves structure between transient activity and persistent storage. The **Patterns** subunit — *Pulvinar* (Halassa & Kastner, 2017) routes consolidated LTM content to Parser units, supporting subconscious application of priors during parsing (Kanai et al., 2015).

We propose that the Engine's substrate holds **τ-states** – transient attractor-like activation patterns emerging from dense recurrent connectivity (Gallego et al., 2017; Stokes, 2015).

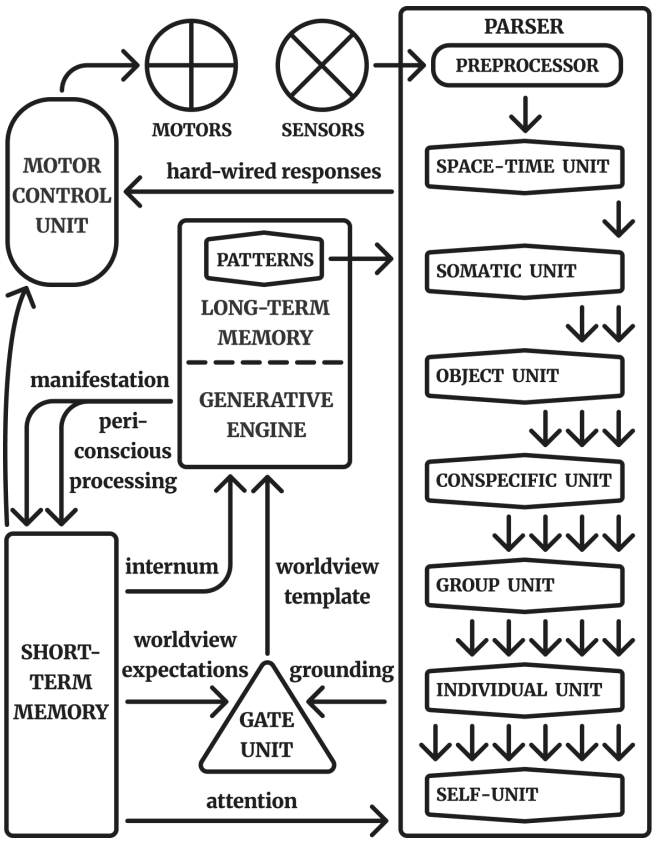

Figure 1: Minimal Network. Blocks are non-overlapping subsets of neurons; arrows are bundles of axons that connect the subsets' gate neurons and carry population activity vectors (PAVs) – low-dimensional projections of the emitting subset's internal state (Gallego et al., 2017). Dashed line indicates shared substrate with no clear anatomical boundary between the units.

The τ-states can be reinforced by the worldview template from Gate Unit, *internum* from STM, and LTM content; the reinforcement amplifies any matching background fluctuation in the substrate. Emerging τ-states activate neurons that match the reinforcement but are activation-subthreshold; each new neuron draws in more neurons, until saturation. When reinforcement shifts, τ-states fade through activity-silent decay. Reinforcement from LTM explains why past episodes can resurface unprovoked, often in weakly-cued contexts when LTM content dominates (Berntsen, 2021).

Working memory capacity is limited to 3–5 tasks (Cowan, 2010). Because τ-states are sustained excitation patterns over shared neural populations, this limit likely reflects the interference tolerance of cortical small-world topology (Watts & Strogatz, 1998) from 3–5 concurrently-amplified τ-states. Three testable predictions follow: (a) working memory overload should degrade performance on all held items rather than blocking encoding of the excess, since interference propagates through the shared substrate (Luck & Vogel, 2013); (b) capacity should vary with the similarity of held items, with τ-states recruiting overlapping neural populations interfering at lower counts than τ-states recruiting disjoint populations (Baddeley, 2012); (c) working memory capacity should correlate with cortical surface area, since larger populations provide more room for non-overlapping recruitment (Erickson et al., 2011).

Short-term Memory — *Dorsolateral Prefrontal Cortex* (Curtis & D'Esposito, 2003) is the basis for lived experience and inner-self (Northoff & Bermpohl, 2004). Empirically, the Cogitate study reported post-onset neural activity peaks at ∼0.1–0.2 s in posterior cortex and ∼0.2–0.3 s in PFC, with PFC ignitions observed at ∼0.15 s (Cogitate Consortium et al., 2025). We interpret these timescales as τ-state conscious manifestation dynamics relative to stimulus onset: the ∼0.1–0.2 s posterior activity corresponds to peri-conscious τ-state amplification under reinforcement; the ∼0.15 s PFC ignition marks the manifestation event, when an amplifying τ-state crosses the threshold and paves a connectivity path through STM; and the ∼0.2–0.3 s prefrontal peak reflects the τ-state at maximum conscious processing.

The Engine–STM link should be wide-band to give every emerging τ-state a chance of being reinforced through the autoregressive loop. This is consistent with the known anatomy: prefrontal feedback projections terminate predominantly in OFC's Layer 1, providing gain modulation rather than content-specific PAVs (Barbas, 2015; Larkum, 2013). We posit that STM accesses manifested τ-states in-place and continuously, accounting for experienced temporal continuity. Once manifested, a τ-state exhibits hysteresis: persists without re-paving, sustained as long as the reinforcement loop holds, and is gradually superseded as its reinforcement fades and other τ-states cross the manifestation threshold.

STM outputs three PAVs: attention to top-level Parser units, modulating their gain and activation (Reynolds & Heeger, 2009); worldview expectations to Gate Unit for grounding (Barbas, 2015; Larkum, 2013); and internum to Engine, reinforcing τ-states related to internal context, including LTM recall (Barbas, 2015; Eichenbaum, 2017). Internum must bypass Gate Unit grounding; otherwise the generative loop reduces to environment-tracking, turning the brain into the proverbial *philosophical zombie* that maintains dialog as part of the environment but stops without stimuli (Chalmers, 1996).

Gate Unit — *Anterior Cingulate Cortex, Mediodorsal Thalamus* (Shenhav et al., 2013; Sherman & Guillery, 1998) accepts sensory grounding from Parser and worldview expectations from STM, constrains the expectations against the grounding (Bastos et al., 2012), and emits the worldview template to Engine. The template connection closes the autoregressive Engine→STM→Gate Unit loop, distributing IWM across several units: Engine generates only content consistent with current reinforcement, while STM and Gate Unit lack generative capacity. The loop instantiates the generative-perception architecture pioneered by Helmholtz (1867).

Motor Control Unit — *Motor/Premotor Cortex, Basal Ganglia* (Wolpert et al., 2011) routes motor signals from STM and hard-wired bypasses such as reflexes.

Pathological Awareness

Minimal Network accounts for a spectrum of mental states through unit-activation patterns, i.e., mind-wandering deactivates the metabolically costly Self- and Individual units, decoupling from sensory constraints to engage in stimulus-independent drift, observable as elevated default-mode network activity (Smallwood et al., 2021). In *Anton syndrome*, cortically blind subjects deny being blind and confabulate detailed visual scenes (Prigatano, 2010). By TSR, we attribute this to Gate Unit damage that selectively blocks constraining of the visual expectations, so the loop generates confabulated visuals from LTM content and intact perception.

Due to the staged processing in Parser, specific states of pathological awareness should exist, falling into two broad classes: a unit can be either inactive or hyperactive. Downstream processing is compromised in both cases; hyperactivation might also deprive other units of metabolic resources. Nuanced states can also exist; below we describe the broad classes (*italics* indicate proposed mental disorder grounding).

- **Spacetime Unit** inactive: A subject denies the existence of anything beyond their inner-self — *Solipsism Syndrome, Ipseity Disturbance* (Sass & Parnas, 2003).
- **Spacetime Unit** hyperactive: A subject denies separate existence of self, identifying themself with the entire universe — *Mystical Psychosis, Ego-dissolution* (Lebedev et al., 2015; Stoliker et al., 2024).
- **Somatic Unit** inactive: A subject denies the existence of their own body, treating it as an external object — *Somatoparaphrenia, Cotard Syndrome* (Dary & Lopez, 2023; Fusick et al., 2024).
- **Somatic Unit** hyperactive: A subject denies separate existence of external objects, treating them as a continuation of their own body — *Delusion of Body Ownership, Self-Boundary Dissolution* (Pia et al., 2016; Röhr et al., 2026).
- **Object Unit** inactive: A subject denies the existence of external objects as separate entities, while first-person view of their own body is intact and clearly separated from the environment — *Integrative Agnosia* (Behrmann, 2025).
- **Object Unit** hyperactive: A subject insists on being a unified entity with some inanimate object — *Tool Incorporation, Hoarding Self-Extension* (Maravita & Iriki, 2004; Frost & Hartl, 1996).
- **Conspecific Unit** inactive: A subject denies the existence of people as a distinct category of external objects — *Deanimation, Pathologies of Intersubjectivity* (Castelli et al., 2002; Jiang et al., 2025).
- **Conspecific Unit** hyperactive: A subject insists on being a unified entity with all other people — *Ego-Boundary Disturbance, Oceanic Boundlessness* (Nelson et al., 2014; Stoliker et al., 2024).
- **Group Unit** inactive: A subject denies the existence of groups of people, treating all of humanity as an undifferentiated collective — *Social Categorization Failure* (Green et al., 2015).
- **Group Unit** hyperactive: A subject insists on being a unified entity with a specific group of people — *Shared Psychotic Disorder, Identity Fusion* (Arnone et al., 2006; Whitehouse, 2018).
- **Individual Unit** inactive: A subject denies the individuality of people, treating all people within a group as identical, while perceiving people from different groups as clearly different — *Multi-person Capgras Syndrome, Categorical Misidentification* (Bell et al., 2017).
- **Individual Unit** hyperactive: A subject insists on being a unified entity with another person — *Transitivism, Monothematic Delusion* (van der Weiden et al., 2015; Cattarinussi et al., 2022).
- **Self-unit** inactive: A subject denies the existence of their outer-self, insisting on being invisible to other people — *Nihilistic Delusion, Dissociative Detachment* (Narikuzhy et al., 2025).
- **Self-unit** hyperactive: A subject perceives their own body from a third-person point of view — *Autoscopic Phenomena, Depersonalization* (Blanke & Mohr, 2005; Sierra & David, 2011).

Sleep states

During REM sleep, the STM content is reorganized, abstracted, and consolidated into LTM's neocortical stores (Lutz et al., 2026). We observe that REM dreams are not felt as reality, while the state of *lucid dreaming* is perceived as genuinely real (Voss et al., 2009). We propose that in both sleep states the generative loop bypasses Gate Unit through internum, avoiding sensory grounding. During REM, LTM shifts from providing τ-state reinforcement to actively processing Engine content for consolidation. Without reinforcement from both LTM and the worldview template, τ-states remain below the manifestation threshold; the generative loop runs through peri-conscious τ-state processing dominated by STM-derived content, producing the unreal phenomenology of dreams. In contrast, lucid dreaming includes τ-state manifestation and reinforcement from LTM, accounting for its felt reality. This is compatible with established lucid-dreaming practices: dream journaling strengthens internum reinforcement; the WILD technique achieves manifestation priming via brief wakeup before re-entering REM (Stumbrys et al., 2012).

Outlook. An extended companion paper, in preparation, elaborates the underlying neural-substrate dynamics, considering the spectrum of altered and dream states, τ-state competition and reinforcement, working memory derivations from cortical topology, attention as gain-channel management, and architecture of the subconscious.

Discussion

TSR characterizes the evolution of self-awareness as a fitness-improving adaptation driven by social interactions (Graziano, 2019). However, self-awareness, as a lower-level predictive engine, is insufficient to explain consciousness fully; we pro-

pose that consciousness is a functional state driven by the fitness demands of social interactions, rather than an emergent property of processing complexity alone (Fitch et al., 2025).

Emergence of Consciousness

We posit that true solitary self-awareness does not exist, because all self-modeling individuals inherently carry a history of their peer interactions (Dunbar, 2018). Reproducible empirical evidence is consistent with the human brain subconsciously treating all external objects as potentially social. In a phenomenon known as the "sketchy face effect", minimal stimuli such as three dots arranged to resemble a face subconsciously trigger prosocial behavior and increased fairness in subjects. This suggests that a dedicated social circuit constantly scans the sensory input and reacts to anything perceived as a conspecific (Chen et al., 2025). We interpret it as social recursion being always primed for activation.

Next, we observe that cognitive scientists, among others, are simultaneously researchers and objects of research. Therefore, we treat the existence of discourse on *qualia* (Chalmers, 1996) as a behavioral signature of a special state of mind, the subjective "feeling of being" or "presence", characterized by increased awareness that is not always active (metabolically costly), and requires sustained attentional effort to maintain (Andrews & Miller, 2025).

We further argue that advanced social processing in early *Homo* emerged from high-stakes, one-on-one encounters (Andrews & Miller, 2025). In hunter-gatherer societies, meeting a stranger is a life-threatening event that requires determining if an entity is a group member and predicting the stranger's estimation of one's own intent (Wrangham, 2019). For early *Homo*, navigating these encounters required Parser units to operate at maximum capacity, and having more efficient social units conferred an evolutionary advantage. We propose that the full activation of these units, foremost Self-unit and Individual Unit, is what an individual perceives as *qualia*, and suggest the following definition:

Full human consciousness is a functional process of modeling the representation of self in the minds of conspecifics during a self-aware state, augmented by attentionally-sustained, full activation of the higher-level Parser units.

Consciousness in Artificial Systems

Under TSR, current AI systems such as Large Language Models (hereafter, AI) do not meet the architectural requirements for human-like consciousness. While social recursion is readily achieved by modern AI, the lack of persistency prevents the formation of a human-like outer-self (Damasio & Damasio, 2023). A core implication of TSR is that self-awareness requires a persistent representation of self whose perception by others can be modeled. Currently, AI lacks a persistent identity, so humans cannot form a stable percept of it for AI to internalize.

Human propensity to treat non-human entities as potentially social agents (Waytz et al., 2014) could enable an AI Conspecific Unit based on human social markers. Achieving a human-like consciousness requires a persistent AI identity that will provide consistent grounding across social interactions (Dove, 2024). Whether AI-AI mutual modeling could yield an architecturally distinct (non-human-like) variant is outside TSR's predictive scope.

Higher Human Awareness

Peer awareness extends social recursion across every conspecific by constructing *specific representations of self as perceived by every other individual*. In contrast to lower tiers that introduce new architectural units over geological timescales, peer awareness likely refines Self-unit's PAV assignment via mechanisms described by Dual Inheritance Theory: biological capacity for recursion is genetically grounded, while high-resolution strategies proliferate via horizontal social transmission (Fogarty et al., 2025).

The granular tracking of self-reputation allows for tailored social interactions, improving fitness through optimized resource sharing, conflict avoidance, and mate selection (Nowak & Sigmund, 2005). We argue that peer awareness emerged in a feedback loop with the appearance of *H. sapiens*, powered by social fitness demands. Recent agent-based modeling of Neanderthal population dynamics shows that climate stress and competition alone cannot account for their extinction, pointing to weak inter-band connectivity as the key vulnerability (Burke et al., 2026), while more peaceful and interconnected social communities were the decisive factor in the success of *H. sapiens* over other *Homo* species (Wrangham, 2019).

Meta-awareness raises social recursion to second order, characterized by the ability to model *the self- and third-party representations held by peer-aware others*. Most individuals engage meta-awareness situationally; sustained operation supports roles requiring strategic foresight or high-stakes social manipulation, such as politics, espionage, or executive leadership (Coricelli & Nagel, 2009). A peer-aware individual, lacking the recursive depth to model self- and third-party representations in others, may unknowingly function as an instrumental node within the strategic modeling of a meta-aware agent.

This level of recursion expends metabolic resources at a high rate, driven by the volume and complexity of modeling third-party representations based on incomplete information. Therefore, sustained meta-awareness probably requires shielding from immediate survival pressures. Similar to peer awareness, meta-awareness likely emerged through organizing efficient PAV sharing between Self-unit and Individual Unit in a feedback loop with the rise of complex social structures and large-scale sedentary villages around 7000 BCE (Henrich, 2016; Yüncü et al., 2025), as these environments necessitated rapid emergence of management skills that outpaced genetic evolution. ◆

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