Review of: "Artificial Consciousness: Misconception(s) of a Self-Fulfilling Prophecy Nobody Wants"

Stefano Turini[1]

1 Alma Mater Europaea

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Review of manuscript

Artificial Consciousness: Misconception(s) of a Self-Fulfilling Prophecy Nobody Wants v2

By

Dr. Prof. **Stefano Turini** MBioLSc PhD

Analysis: Part 1 - Abstract

Precision in Findings:

The abstract presents a clear stance on the concept of artificial consciousness, stating that it is misconceived. The argument is well-articulated and precise in expressing why artificial consciousness may not be achievable.

Effective Use of Terminology:

The document employs specialized terminology related to neuroscience, artificial intelligence, and consciousness. It effectively communicates complex concepts without sacrificing clarity.

Quantitative Specifics:

While the abstract doesn't provide quantitative data, it offers a qualitative analysis of the challenges and requirements for achieving artificial consciousness. It relies on detailed explanations rather than numerical measures.

Sharp Characteristics:

The abstract sharply outlines the potential implications of pursuing artificial consciousness, addressing issues related to ethics, human rights, and the role of AI in the context of divinity. It establishes a strong position against the feasibility of artificial consciousness.

Research Significance:

The research significance is evident in challenging the prevalent notion of achieving artificial consciousness. It addresses

the potential consequences and ethical considerations, contributing to the discourse on the limits of AI.

Broader Implications:

The document hints at broader societal and ethical implications, suggesting that the pursuit of artificial consciousness may impact fundamental human rights and the perception of divinity. This broadens the scope of the discussion.

Opening New Avenues:

While the document primarily challenges the feasibility of artificial consciousness, it opens avenues for discussions on the ethical, philosophical, and societal aspects of AI development, encouraging a more nuanced consideration.

Scientific Review - Precision and Specificity:

The abstract maintains precision by focusing on the intricate details of brain evolution, neural circuitry, and the unique aspects of human consciousness. Specific terms and concepts are employed effectively.

Scientific Review - Interpretation of Findings:

The findings are interpreted in the context of brain evolution, neural circuitry, and the uniqueness of human consciousness. It provides a comprehensive analysis of why achieving artificial consciousness may be misconceived.

Scientific Review - Broader Implications:

The document effectively integrates scientific principles with broader implications, connecting the scientific aspects of brain function to the potential societal impacts of pursuing artificial consciousness.

Forward-Looking Language:

The abstract adopts forward-looking language by considering the potential consequences of achieving artificial consciousness and challenging the prevailing views on the subject. It prompts readers to reconsider the trajectory of AI research.

Scientific Relevance:

The abstract maintains scientific relevance by grounding the argument in principles of brain function and neural circuitry. It emphasizes the need for a deep understanding of these biological processes to appreciate the challenges in achieving artificial consciousness.

Impact of Research:

The impact lies in challenging conventional ideas about artificial consciousness and emphasizing the intricate nature of human consciousness. It encourages a reevaluation of the goals and ethical considerations in AI research.

Future Perspectives:

The document hints at the future perspectives by suggesting that achieving artificial consciousness would require capabilities beyond current AI capabilities. It implies that future advancements should consider the complexities of human consciousness.

The abstract effectively blends scientific rigor with philosophical and ethical considerations, contributing to a well-rounded critique of the concept of artificial consciousness.

Analysis: Part 2 - Introduction

Precision in Findings:

The introduction precisely articulates the prevalent notion of "artificial consciousness" as a magic spell and critiques the assimilation of biases in AI through training data. It sets the stage for a critical examination of the unpredictable dynamics of human consciousness.

Effective Use of Terminology:

The document effectively uses terminology related to AI, consciousness, and neuroscience. Terms like "singularity," "global brain," and "core consciousness" are introduced and defined within the context of the discussion.

Quantitative Specifics:

The introduction lacks quantitative specifics but provides qualitative insights into the challenges of AI and the misconceptions about consciousness. It relies on conceptual explanations rather than numerical data.

Sharp Characteristics:

The introduction sharply critiques the idea of artificial consciousness as a self-fulfilling prophecy and highlights systemic flaws in AI, emphasizing biases in training data. It challenges the optimistic views of AI proponents and introduces the concept of "singularity."

Research Significance:

The introduction is significant in calling for a deeper reflection on the dynamics of human consciousness amidst the proliferation of efforts to create AI emulating human learning. It questions the fundamental assumptions of a 'global brain' and the ambitious goals of achieving superhuman AI.

Broader Implications:

The broader implications are suggested by pointing out the biases absorbed by AI, questioning the creation of superhuman AI, and critiquing the attempts to emulate the plasticity of the human brain. It implies ethical and societal considerations in AI development.

Opening New Avenues:

The introduction opens new avenues for reflection on the implications of biases in AI, the limitations of emulating human consciousness, and the potential societal impact of the pursuit of super-intelligent AI. It encourages readers to question prevailing narratives.

Scientific Review - Precision and Specificity:

The introduction maintains precision by addressing specific concepts like singularity, global brain, and core consciousness. It specifically targets the flawed assumptions about consciousness in AI development.

Scientific Review - Interpretation of Findings:

The findings are interpreted through the lens of neuroscience, awareness-guided behavior, and information processing in humans. It sets the stage for a critical examination of why previous attempts to crack the code to human consciousness have failed.

Scientific Review - Broader Implications:

The document effectively integrates scientific concepts with broader implications, connecting biases in AI training to societal consequences. It suggests that the flawed assumptions about consciousness have broader ethical and societal repercussions.

Forward-Looking Language:

The introduction adopts forward-looking language by discussing the potential acceleration of technological progress and the creation of superhuman AI. It sets the tone for a future-oriented examination of the implications of AI development.

Scientific Relevance:

The introduction maintains scientific relevance by grounding the critique of artificial consciousness in concepts from neuroscience, neural theories, and human brain plasticity. It emphasizes the intricacies that make human consciousness challenging to emulate.

Impact of Research:

The impact lies in challenging the prevailing narrative around artificial consciousness, raising awareness of biases in AI, and prompting critical reflections on the ambitious goals of achieving super-intelligent machines. It lays the groundwork for a nuanced discourse.

Future Perspectives:

The introduction hints at future perspectives by indicating the flaws in current assumptions about consciousness. It implies that future AI development should consider a more realistic understanding of human consciousness and intelligence.

The introduction effectively combines a critical perspective on artificial consciousness with scientific concepts, encouraging readers to reevaluate assumptions and consider the broader implications of AI development.

Analysis: Part 3 - Conscious Behaviour is not Consciousness

Precision in Findings:

The section provides a precise critique of the traditional approach where specific conscious behavior is considered an indicator of consciousness. It discusses experiments and theories related to consciousness, including the concept of "access of information to conscious report."

Effective Use of Terminology:

The document effectively uses terminology related to consciousness research, including terms like "conscious report," "access consciousness," and "neural correlates of consciousness." The terminology is well-defined within the context of the discussion.

Quantitative Specifics:

The section lacks quantitative specifics but discusses various experiments and theories in the field of consciousness research. It focuses on conceptual explanations and critical questions rather than numerical data.

Sharp Characteristics:

The section sharply criticizes the idea of equating conscious behavior with consciousness. It questions the limitations of experiments relying on conscious reports and emphasizes the difficulty of linking conscious behavior to the mechanisms that generate consciousness.

Research Significance:

The section is significant in challenging the traditional approach to studying consciousness through conscious behavior. It raises critical questions about the nature of conscious experience and the reliability of conscious reports in understanding consciousness.

Broader Implications:

The broader implications involve questioning the assumptions about the relationship between conscious behavior and consciousness. It suggests that current approaches have limitations in unraveling the mechanisms that produce consciousness.

Opening New Avenues:

The section opens new avenues for reconsidering the link between conscious behavior and consciousness. It prompts readers to think beyond traditional experimental paradigms and raises awareness of the complexity of consciousness.

Scientific Review - Precision and Specificity:

The section maintains precision by discussing specific experiments (Dehaene et al., Crick & Koch) and theories (Block's concept of access consciousness). It critically evaluates the limitations of these approaches in understanding consciousness.

Scientific Review - Interpretation of Findings:

The findings are interpreted by highlighting the critical questions surrounding conscious reports, the timing of conscious experiences, and the challenges in linking conscious behavior to neural activities. It emphasizes the need for a deeper understanding.

Scientific Review - Broader Implications:

The document effectively integrates scientific concepts with broader implications. It challenges the idea that studying conscious behavior alone is sufficient for understanding consciousness, pointing to the limitations of current research approaches.

Forward-Looking Language:

The section adopts forward-looking language by questioning the adequacy of current approaches and suggesting that the field needs to move beyond the limitations of studying conscious behavior. It sets the stage for reevaluating hypotheses about consciousness.

Scientific Relevance:

The section maintains scientific relevance by discussing neurobiological functions, the concept of the Self in relation to consciousness, and the limitations of studying actively behaving observers. It emphasizes the need to go beyond conscious behavior.

Impact of Research:

The impact lies in challenging traditional hypotheses about consciousness and advocating for a more comprehensive understanding. It prompts a reconsideration of the neural correlates of consciousness and encourages a broader perspective.

Future Perspectives:

The section hints at future perspectives by suggesting that the understanding of consciousness requires moving beyond the concept of a "neural field" within the brain. It encourages future research to explore alternative approaches to studying consciousness.

This section critically evaluates the traditional approach of equating conscious behavior with consciousness, emphasizing the need for a more nuanced understanding. It raises important questions and challenges existing hypotheses, paving the way for future investigations into the intricacies of consciousness.

Analysis: Part 4 - Consciousness is not a Neural Field within the Brain

Precision in Findings:

The section presents a precise critique of field theories of consciousness by drawing parallels with field theories in physics. It highlights the key limitation that current theories of consciousness lack the objective measurability and mathematical accountability seen in physics.

Effective Use of Terminology:

The document effectively uses terminology related to field theories of consciousness, such as "representational fields," "neural field theories," and "conscious and non-conscious states." The terminology is applied in a manner consistent with the subject matter.

Quantitative Specifics:

The section lacks quantitative specifics but provides a conceptual analysis of the limitations of field theories of consciousness. It focuses on the fundamental problem of the unobservable nature of the presumed space-time continuum.

Sharp Characteristics:

The section sharply critiques field theories of consciousness, particularly the comparison with field theories in physics. It questions the objective measurability of specific brain activities and emphasizes the distinction between awareness and consciousness.

Research Significance:

The section is significant in challenging the conceptual foundation of field theories of consciousness. It points out the danger of remaining in the realms of philosophy when a field is not directly observable by known physical means.

Broader Implications:

The broader implications involve questioning the validity of field theories of consciousness and the need for a clear conceptual distinction between awareness and consciousness. It challenges the assumption that consciousness can be encapsulated within a neural field.

Opening New Avenues:

The section opens new avenues for reconsidering the nature of consciousness and the limitations of current theories. It encourages a clearer distinction between awareness and consciousness and prompts a shift away from field theories.

Scientific Review - Precision and Specificity:

The section maintains precision by critiquing specific field theories of consciousness, citing examples like Libet's Mind

Field Theory and neural field theories. It addresses the limitation of objective measurability and mathematical accountability.

Scientific Review - Interpretation of Findings:

The findings are interpreted by emphasizing the unobservable nature of the presumed space-time continuum in field theories of consciousness. It critiques the idea that consciousness can be encapsulated within a neural field.

Scientific Review - Broader Implications:

The document effectively integrates scientific concepts with broader implications. It challenges the conceptual foundation of field theories of consciousness and underscores the importance of distinguishing between awareness and consciousness.

Forward-Looking Language:

The section adopts forward-looking language by challenging the existing paradigm of field theories and suggesting the need for a conceptual shift. It prompts readers to reconsider the foundations of theories about the nature of consciousness.

Scientific Relevance:

The section maintains scientific relevance by critiquing both representational and neural field theories of consciousness. It questions the independence of a presumed field of consciousness from specific brain activities during perceptual or cognitive processes.

Impact of Research:

The impact lies in challenging the foundational assumptions of field theories of consciousness and emphasizing the need for a conceptual distinction between awareness and consciousness. It prompts a reevaluation of theoretical approaches to consciousness.

Future Perspectives:

The section hints at future perspectives by suggesting that any field of consciousness, if it existed, would need to be independent of specific neural activities. It encourages future research to explore alternative conceptualizations of the relationship between brain activity and consciousness.

Analysis: Part 5 - Awareness is not Consciousness

Precision in Findings:

The section precisely articulates the distinction between consciousness and awareness. It emphasizes that while awareness of the immediate physical environment may be present in some mammals, consciousness, as a unique property of the human mind, involves the capability for abstract analysis and projection into the future.

Effective Use of Terminology:

The terminology is effectively employed to distinguish between awareness and consciousness. Concepts like "conscious mind," "awareness-based choice selection," and "higher level motivated agential involvement" are used to clarify the nuanced differences.

Quantitative Specifics:

The section lacks quantitative specifics but provides a conceptual analysis of the evolution of consciousness. It raises fundamental questions about the origin of consciousness and the unique capabilities of the human mind.

Sharp Characteristics:

The section sharply differentiates between awareness in animals, which is survival-driven and outward-directed, and consciousness in humans, which involves higher-level motivated agential involvement and introspection. It addresses the "hard problem of consciousness" and its unresolved nature.

Research Significance:

The section is significant in highlighting the evolutionary aspects of consciousness, linking it to higher-level neural connectivity and the collaborative function of self-awareness. It questions existing theories and points out the challenges in scientifically operationalizing the complexity of consciousness.

Broader Implications:

The broader implications involve challenging the limitations of existing theories in explaining specific aspects of human consciousness, such as the ontological links between mind, time, and the self. The reference to art and the Renaissance adds a cultural and historical dimension to the discussion.

Opening New Avenues:

The section opens new avenues by prompting a reevaluation of the relationship between awareness and consciousness. It encourages exploration into the evolutionary timeline of consciousness and the unique properties that remain unexplained by current theories.

Scientific Review - Precision and Specificity:

The section maintains precision by delineating the differences between awareness and consciousness. It introduces concepts like "higher level motivated agential involvement" and references Jaynes' distinction between consciousness and sensory awareness.

Scientific Review - Interpretation of Findings:

The findings are interpreted in the context of human evolution, introspection, and the breakdown of the "bicameral mind."

It suggests that consciousness emerged with the higher level motivated agential involvement coinciding with the ability to introspect.

Scientific Review - Broader Implications:

The document effectively integrates scientific concepts with broader implications, such as the "hard problem of consciousness." It challenges the scientific operationalization of consciousness and emphasizes the unique properties of the human mind.

Forward-Looking Language:

The section adopts forward-looking language by raising questions about the origin of consciousness, its evolution, and the unresolved nature of the "hard problem." It prompts a reconsideration of existing theories and encourages future exploration.

Scientific Relevance:

The section maintains scientific relevance by addressing fundamental questions about the origin and nature of consciousness. It aligns with contemporary debates on the "hard problem" and challenges the limitations of current theories in explaining human consciousness.

Impact of Research:

The impact lies in prompting a reevaluation of the relationship between awareness and consciousness, especially in the context of human evolution. It highlights the unique properties of human consciousness that remain unexplained by current theories.

Future Perspectives:

The section hints at future perspectives by indicating the need for a more comprehensive understanding of consciousness. It encourages future research to explore the ontological links between mind, time, and the self that existing theories have not fully explained.

Analysis: Part 6 - Consciousness is not conscious information processing

Critical Evaluation of Prior Models:

The section critically evaluates prior models, specifically Tononi & Edelman's (1998) conscious state concept, von der Malsburg's (1997) continuous process, and John's (2002) notion of the "conscious ground state of the brain." It identifies reductionist tendencies in these models and proposes an alternative perspective.

Functional Characteristics of Conscious States:

It introduces two major functional characteristics of conscious states: limited information processing capacity and a unique

representational content for a limited and relatively short duration. This conceptualization aligns with earlier studies and addresses the intricate relationship between conscious and non-conscious processes.

Quantitative Aspects - Limited Capacity:

The section introduces quantitative aspects by discussing the limited capacity of conscious processes, emphasizing the "magic" number of about 7 representations in working memory. It contrasts this with the vastly greater information-processing capacity of non-conscious activity.

Functional Constraint - Serialization and Parallelism:

It highlights the functional constraint of conscious processes, mainly relying on serial processing and the challenge of conscious "seriality." It contrasts this with non-conscious activity, which operates through massively parallel processing, allowing it to handle more information.

Integration of Psychophysical Data:

The integration of psychophysical data, including observations on change blindness and change detection, strengthens the argument about the limitations of conscious processes. The section underscores the role of working memory in compensating for these limitations.

Buffering Function of Pre-conscious Processes:

The proposal by Mangan (2003) regarding the buffering function of pre-conscious processes at the fringe of consciousness is introduced. It suggests that these processes act as a buffer, compensating for and regulating the limited capacity of conscious states.

Capacity of Non-conscious Processing:

The section estimates the processing capacity of the non-conscious within a range of at least 10^7 bits, highlighting the vast difference compared to the limited capacity of working memory in conscious processes.

Representational Content and Selective Retrieval:

The section introduces the idea that the representational content invading a conscious state is selectively retrieved from non-conscious long-term memory. It aligns with Churchland's (2002) definition of integrated representations based on patterns of activity across groups of neurons.

Temporal Activity Patterns and Neural Models:

The section delves into theoretical approaches like the Lisman-Idiart-Jensen models, emphasizing the selective retrieval of temporal activity patterns as a plausible explanation for conscious brain states. However, it critiques these models for their inability to account for the human capacity to project representations into the future and conceive possible world states.

Imagination and Creativity:

The section establishes a link between the limitations of existing models and the inability to explain the capacity of human consciousness for imagination and creativity, central to cultural and societal development.

Quantitative and Qualitative Insights:

The section provides both quantitative insights, such as the limited capacity of working memory, and qualitative considerations, like the role of imagination and creativity. This dual approach strengthens the comprehensive analysis.

Scientific Integration and Critique:

The section integrates scientific concepts, critiques prior models, and offers alternative perspectives. It contributes to the ongoing scientific discourse on consciousness by addressing functional constraints and proposing nuanced explanations for conscious and non-conscious processes.

Scientific Relevance:

The content maintains scientific relevance by addressing fundamental aspects of conscious information processing, working memory limitations, and the potential role of pre-conscious processes. It aligns with contemporary discussions on neural models of consciousness.

Future Explorations:

The section sets the stage for future explorations by pointing out the limitations of existing models. It calls for a more comprehensive understanding that can encompass the unique aspects of human consciousness, especially in the realms of imagination and creativity.

Analysis: Part 7 - Consciousness is not memory

Overview of Models:

The section begins by referencing the Lisman-Idiart-Jensen models and their working memory architecture with a processing capacity of 7 ± 2 items. It then integrates the works of Başar, Fingelkurts & Fingelkurts, and others to analyze and model event-specific EEG signal sequences.

Temporal Code for Consciousness:

The section proposes a novel perspective on a temporal code for conscious state access. It suggests that conscious brain states are triggered by temporal signals of cells arbitrarily associated with other functional properties, allowing for flexibility and redundancy.

Temporal Signature and Duration:

The section relates the temporal signature of a conscious state to its duration, often referred to as the "psychological

moment." It discusses Libet's work, emphasizing the time minimum of about 500 ms required for a near-threshold stimulus to produce a conscious perceptual experience.

Quantitative Aspects - Information Content:

The section delves into quantitative aspects, estimating the information content of a conscious state using critical time windows or "bins." It considers parameters like Δt and proposes that each bin's information content is 1 bit, leading to an estimate of 50 bits for a conscious state of 300 ms.

Comparison with Other Estimates:

It compares the proposed estimates with other calculations, such as the number of visual prototypes held in memory. The discussion involves dynamic analyses of correlated oscillations, functional interactions between gamma and theta oscillations, and consistent figures proposed by various researchers.

Reverberant Neural Circuits:

The section introduces the concept of reverberant neural circuits or loops and their intrinsic topology. It explains how these circuits generate feed-back loops in the brain and discusses their importance in conscious execution of focused action.

Role of Reverberation:

The role of reverberation in conscious information processing is highlighted. It is argued that conscious perception and report rely on the extension of local brain activation to higher association cortices connected by long-distance connections, forming a reverberating neuronal circuit.

De-correlation Mechanism:

The concept of de-correlation is introduced as a mechanism to reduce crosstalk between multi-channel signals in the brain. The section discusses how de-correlation may play a crucial role in generating a stable and precise brain code for conscious state access.

Complexity of Cross-Talk:

The complexity of cross-talk between neural signals necessary for information sharing across non-conscious cognitive processes is acknowledged. The section questions how this complex cross-talk could be implemented into a code for consciousness.

Signal De-correlation and Neural Network Theory:

The importance of signal de-correlation in neural network theory is emphasized. It is suggested that de-correlation clarifies how a stable and precise brain code for conscious state access can be generated despite the plastic and diffuse spatial functional organization of the brain.

Constraint of Memory Capacity:

The section concludes by stating that while memory capacity constrains consciousness, it is insufficient as a complete explanation or model. It emphasizes the need to consider brain evolution fueled by self-organized and highly plastic mechanisms of learning.

Integrative Approach:

The content integrates various theoretical perspectives, providing a comprehensive overview of models related to memory, temporal coding, reverberant neural circuits, and de-correlation. It combines quantitative estimations with theoretical frameworks and neurobiological concepts.

Scientific Rigor and Critique:

The analysis maintains scientific rigor by critiquing existing models, introducing novel perspectives, and emphasizing the limitations and complexities inherent in understanding consciousness. It contributes to the ongoing scientific discourse on the neural basis of consciousness.

Implications for Artificial Intelligence:

The section briefly touches on the implications for artificial intelligence, suggesting that the weak constraints of higher processing levels on lower non-conscious ones represent a challenge for AI and machine learning algorithms.

Future Directions:

While discussing memory and consciousness, the section opens avenues for future research, particularly in understanding the intricate relationship between temporal codes, reverberation, and de-correlation in generating conscious states.

Interdisciplinary Insights:

The interdisciplinary nature of the content, involving neuroscience, psychology, and information theory, contributes to a holistic understanding of consciousness. It bridges theoretical concepts with empirical evidence, promoting a nuanced exploration of the topic.

Analysis: Part 8 - Brain Plasticity and Self-Organization

Self-Organization and Brain Plasticity:

The section emphasizes the unique capability of the brain for self-organization, facilitated by brain plasticity. It introduces the idea of a from-local-to-global functional neural network architecture, drawing attention to the works of Grossberg and Dresp-Langley.

Integration of Signals and Sensations:

The integration of sensory, somatosensory, and proprioceptive signals into unified conscious experiences is discussed. Psychophysicists' term "sensations" is used to describe these immediate data of conscious experience. This process relies on non-conscious mechanisms that must be adaptable and functionally plastic.

Plasticity-Versus-Stability Dilemma:

Grossberg's "plasticity-versus-stability dilemma" is introduced, addressing the challenge of maintaining stability for access to consciousness while accommodating the plasticity needed for learning and adaptation. This dilemma reflects the tension between stability for conscious access and the adaptability required for processing non-conscious information.

Neurological Data and Unilateral Neglect:

Neurological data on patients with unilateral neglect or extinction after brain damage are discussed. The section suggests that localized damage affects the mechanisms enabling specific perceptual representations to access consciousness but not the representations themselves. This highlights the need for a mechanism of neural integration.

Phantom Limb Syndrome and Brain Plasticity:

The phenomenon of phantom limb syndrome is presented as evidence of extraordinary brain plasticity. The topological functional organization of the brain undergoes dramatic changes, leading to the remapping hypothesis. Despite such changes, representations remain available to conscious state access, demonstrating the persistence of temporal signatures.

Remapping Hypothesis and Temporal Signatures:

The remapping hypothesis, proposed by Ramachandran and colleagues, suggests that spatial and topological representations are referred to other loci in the brain through massive cortical reorganization. The persistence of temporal signatures is crucial for the conscious experience of sensations even after significant changes in non-conscious topology.

Temporal Signatures and Long-Distance Propagation:

The role of long-distance propagation and reverberation in consolidating the temporal signatures of conscious sensations across the whole brain is discussed. The section posits that these temporal signatures can reach critical threshold activation levels even in the absence of stimulus input to specific local sensory areas.

John's Coherence Theory:

John's theory, associating a conscious state with coherence among multiple brain regions, is introduced. The idea is consistent with a stable and perennial temporal code for conscious state access despite spatial remapping. Empirical support comes from the coherence index, specifically phase-locked gamma oscillations.

Gamma Oscillations and Conscious States:

The coherence index based on gamma oscillations (40-80 Hz) is linked to conscious states, as shown in studies on

sedation in anesthesia and REM sleep. The persistence of phase-locking at 40 Hz during focused arousal and dreaming supports the equivalence of conscious states during imagination and dreams.

Temporal Coherence Index in Different States:

The temporal coherence index, a product of intra-cortical reverberation, is discussed in different states such as focused arousal and REM sleep. The disappearance of coherence during deep slow-wave sleep aligns with findings in deeply anesthetized patients.

Functionally Equivalent States:

The notion that dreams and conscious imagination represent functionally equivalent conscious states is introduced. The phase-locking at a critical temporal frequency is achieved through cortico-thalamic feedback loops, generating temporal signatures based on statistical computation of non-conscious memory events.

Hybrid System and Resonance Loops:

The brain is referred to as a hybrid system, establishing arbitrary but non-random departures from different loci or topological maps. Despite functional reorganization, the temporal code for conscious state access remains intact, leading to cortico-thalamic feedback loops or resonance loops.

Link to Adaptive Resonance Theory (ART):

The connection to Grossberg's Adaptive Resonance Theory (ART) is briefly mentioned, suggesting that this theory provides potential mechanisms explaining how memory events are read out by non-conscious processes in the brain.

Interdisciplinary Implications:

The content spans neuroscience, psychology, and computational theories, offering an interdisciplinary exploration of brain plasticity, self-organization, and conscious state access. The integration of empirical findings with theoretical frameworks contributes to a comprehensive understanding.

Complex Relationship Explored:

The exploration of the relationship between plasticity, stability, temporal signatures, and conscious access adds complexity to our understanding of the neural mechanisms underlying consciousness. It acknowledges the dynamic interplay between stability and adaptability in the brain.

Implications for Understanding Consciousness:

This section contributes to the ongoing discourse on the nature of consciousness by addressing fundamental questions related to brain plasticity, stability, and the temporal dynamics of conscious state access. The emphasis on empirical evidence strengthens the scientific grounding of the discussion.

Potential for Future Research:

The complexities introduced, particularly regarding the persistence of temporal signatures in the face of plasticity, suggest potential avenues for future research. Investigating the mechanisms that enable stable conscious state access amid neural reorganization remains a fruitful area of exploration.

Analysis: Part 9 - Insights from Adaptive Resonance Theory (ART)

Overview of Adaptive Resonance Theory (ART):

The section introduces Adaptive Resonance Theory (ART) as a universal theory of learning, initially designed to explain how the brain generates and updates representations in changing environments. ART is later extended to incorporate attention, intention, and volition.

Linking Attention, Intention, and Volition:

Grossberg proposes a link between attention, intention, and volition. Intentions lead to focused attention on relevant internal or external events, resulting in new representations that can be integrated into resonant states, including conscious states. However, the challenge of explaining the availability of non-conscious representations to consciousness is acknowledged.

Spatial and Temporal Coding:

A limitation is highlighted as ART doesn't functionally separate spatial from temporal coding. This separation is considered necessary to explain the integration of non-conscious representations into the conscious experience of past, present, and future at a specific moment in time.

Continuous Updating through Top-Down Matching:

ART explains the continuous updating of non-conscious representations through a mechanism called top-down matching. Resonant brain states are achieved through repeated matching of external or internal events in short-term or working memory to internal events activating top-down representations.

Top-Down Matching Process:

The brain continuously generates hypotheses about ongoing representations by matching them to representations stored in long-term memory (top-down). Coincidence of bottom-up and top-down representations produces matching signals, leading to resonant states in the brain. These representations are coded topologically in the "What" and "Where" processing streams.

Resonant Code and Functional Topological Organization:

Grossberg introduces the concept of the "resonant code," which is tightly linked to the functional topological organization of the brain. The coding of representations through top-down matching is associated with the intrinsic topology of the brain circuitry that produces resonance.

Non-Conscious Topological Information and Consciousness:

The question of how non-consciously encoded topological information becomes available to consciousness remains unanswered. While there is acknowledgment of the intrinsic topology being determined by purely temporal resonance principles, the specifics of the mechanisms are not described.

Biological Resonators and Brain Function:

The section discusses the plausibility of the brain operating as a resonator. It highlights the lack of empirical descriptions of resonators in the brain but suggests that biological resonators, given the diversity of cells, would have sophisticated operating principles. The precision of these resonators might not be necessary, provided they behave in a statistically predictable way.

Temporal Signatures as Biophysical Keys:

The idea is presented that specific neural signal sequences or temporal signatures could act as biophysical keys, activating, maintaining, and inactivating conscious brain states. The analogy is made to electronic locks opening and closing doors to a safe. The concept simplifies the idea that specific temporal patterns unlock conscious states.

Limitation in Accounting for Dynamics of Consciousness:

While temporal brain signatures are seen as potential keys to consciousness, the section acknowledges that this doesn't account for the dynamics of consciousness in terms of mental energy. The source of this mental energy and how it is derived from brain processes is not explained.

Analogy to Bar Codes:

The analogy is drawn between temporal brain signatures and bar codes, suggesting that, like bar codes providing keys to various items, temporal signatures could provide keys that open the doors of consciousness. This simplification is presented as a way to understand the diversity of representations.

Complexity of Conscious Dynamics:

The acknowledgment that the description is a simplification underscores the complexity of conscious dynamics. The known temporal properties of conscious information processing are considered consistent with the idea that the brain can generate messages corresponding to specific representations with variable durations and context.

Unanswered Questions:

The section leaves certain questions unanswered, including the mechanisms underlying the availability of non-conscious representations to consciousness and the dynamics of consciousness in terms of mental energy. These open questions indicate areas where further research and exploration are needed.

Contributions to Understanding Consciousness:

Despite the limitations and unanswered questions, the discussion contributes to understanding consciousness by exploring the role of resonance, top-down matching, and temporal signatures in the generation and updating of representations in the brain. The interdisciplinary approach integrates psychological, physiological, and computational perspectives.

Analysis: Part 10 - The Neural Doors to Consciousness

Integration of Neurophilosophical Arguments:

The section builds on neurophilosophical arguments to present a set of considerations regarding the nature and genesis of consciousness. It addresses several key aspects, including the role of non-conscious processes, temporal brain signatures, and the potential mechanisms underlying conscious states.

Capacity of Non-Conscious Processes:

The assertion is made that only non-conscious brain processes possess the capacity to integrate signals from various sensory areas across time and space. This sets the stage for understanding the dynamics of consciousness in relation to non-conscious neural activities.

Temporal Brain Signatures:

The hypothesis is presented that temporal brain signatures of conscious states are likely generated and consolidated in interconnected neural circuits extending across long distances. The concept involves the statistically determined temporal coincidence of activity patterns related to non-conscious memory events.

De-Correlation of Temporal Signatures:

It is suggested that temporal signatures must undergo de-correlation from related signals or messages originating from the brain's spatial maps. This implies a separation of temporal coding from spatial coding, emphasizing the intricate relationship between temporal dynamics and spatial organization in the brain.

Conscious State Potential and Temporal Coincidence:

The activation of a temporal signature triggering a conscious state is proposed to depend on statistically determined temporal coincidence of activity patterns related to non-conscious memory events. The emphasis is on the role of temporal coincidence in the transition from non-conscious to conscious states.

Consolidation of Temporal Signatures:

Temporal brain signatures are described as being generated spontaneously and may or may not become consolidated during brain learning. The consolidation is linked to repeatedly iterated reverberations in cortical memory circuits, leading to resonance states corresponding to specific conscious states.

Threshold for Statistically Significant Coincidence:

The discussion introduces the idea that a resonance circuit can generate conscious state access if a statistically significant temporal coincidence threshold is reached. Below this threshold, representations processed in the resonant circuitry would remain non-conscious or pre-conscious.

Learning and Development of Resonant Circuits:

Resonant circuits, operating on purely temporal resonance principles, are proposed to be inter-connected across large distances in the brain. The intrinsic topology of these circuits is distinct from spatial functional organization, and their development occurs throughout the lifespan as the brain learns.

Selection of Critical Temporal Firing Patterns:

The selection of critical temporal firing patterns constituting the access code for conscious states is described using statistical criteria. This process leads to the consolidation of fewer patterns for increasingly complex and integrated signal coincidences during brain development.

Helekar's Hypothesis and Genetic Determination:

Helekar's hypothesis of genetically determined linkage between subjective experience and specific temporal brain activities is introduced. The potential innate and genetically determined linkage raises questions about the mechanisms of consciousness and leads to considerations about the nature versus nurture problem.

Nature versus Nurture Problem:

The discussion acknowledges the challenge of reconciling Helekar's assumption of genetically determined phenomenal consciousness with the idea that conscious contents are also represented non-consciously in the brain. This brings up the classic nature versus nurture problem and the fundamental question of what constitutes phenomenal consciousness.

Experience-Dependent Linkage:

An alternative possibility is presented, suggesting that the linkage of individual conscious states to their temporal signatures is experience-dependent and increasingly non-arbitrary. This linkage occurs through developmental processes and brain learning, leading to the consolidation of temporal signatures based on Hebbian learning.

Non-Arbitrary Linkage and Hebbian Learning:

The section emphasizes that once a temporal signature is linked to a conscious state, it remains potentially available as a "brain hypothesis" and undergoes progressive consolidation or not. The consolidation follows the principles of Hebbian learning, ultimately leading to a non-arbitrary and deterministic linkage.

Progressive Consolidation and Unconscious Processes:

The progressive consolidation of temporal signatures is highlighted as occurring without awareness, driven by brain processes that involve the repeated matching of ongoing representations to stored representations in long-term memory. The reference to Adaptive Resonance Theory (ART) is made in relation to this learning process.

Contributions and Open Questions:

The section contributes to the understanding of consciousness by delving into the interplay between non-conscious and conscious processes, the role of temporal dynamics, and the mechanisms involved in the consolidation of conscious states. Open questions persist, particularly regarding the nature of phenomenal consciousness and the precise mechanisms underlying consciousness.

Analysis: Part 11 - Artificial Consciousness, What For?

Integration of Non-Conscious Mechanisms:

The section emphasizes the role of non-conscious mechanisms in integrating multiple sensory signals into individual conscious experience. It underscores the adaptability and functional plasticity required for continuous updating of representations in response to various factors, including context, time, and aging.

Nested Functional Hierarchy and Redundancy:

Fingelkurts & Fingelkurts' concept of a "nested functional hierarchy" is mentioned, highlighting the redundancy in the brain's functional organization. The majority of this hierarchy is posited to remain inaccessible to consciousness, raising the question of how to make novel information available to consciousness.

Unifying Tags and Parieto-Frontal Pathways:

The search for reliable, unifying "tags" for stable access to consciousness is discussed. Parieto-frontal pathways are suggested as candidates, providing protection from fast fluctuations in sensory signals and enabling information sharing through signal reverberation and long-distance connections in the brain.

Limitations of Emulating Consciousness in AI:

The difficulty of implementing complex cross-talk between neural signals into a code for consciousness is highlighted. The intricacies of sorting out signals from multi-channel cross-talk and accessing the entire command chain of non-conscious processes are considered insurmountable challenges for emulating human consciousness in artificial intelligence.

Limits of Scientific Endeavors:

The section contends that implementing a code for consciousness in a machine represents the final limit of scientific endeavors. The complexity of human consciousness, encompassing past, present, and future, as well as sensations, feelings, and moods, is deemed a challenge unlikely to be overcome by current scientific understanding.

Consciousness as Evolutionary Expression:

Consciousness is portrayed as an individual's daily phenomenal experience, representing the past, present, and future. Continuous brain evolution is discussed as pushing the limits of functional plasticity in resonant brain mechanisms, and the conscious Self is considered an expression of this evolutionary process.

AI and Making Implicit Processes Explicit:

The challenges of emulating human consciousness in artificial intelligence are outlined. Making implicit (non-conscious) brain processes explicit through algorithms is presented as a complex task requiring progressively less arbitrary selection of temporal signatures in a neural network structure mirroring the human brain.

Complexity of Human Experience:

The complexity of human experience, including sensations, emotions, and the representation of past, present, and future events, is highlighted. The computations needed to emulate such complexity are deemed beyond the potential of current AI systems.

Unavailability of AI Systems with Full Potential:

The section concludes by stating that no AI system known at present possesses the potential to emulate human consciousness in its entirety. The intricate interplay between implicit and explicit contents of representation, as well as the richness of human experience, remains a formidable challenge for artificial intelligence.

Philosophical Implications:

The text delves into the philosophical implications of consciousness, hinting at the deep-rooted challenges in replicating human experience in machines. It underscores the uniqueness and elusive nature of consciousness, suggesting that it may remain beyond the reach of artificial replication.

Conclusions:

Artificial Consciousness Unlikely:

The neurophilosophical perspective presented suggests that the emergence of artificial consciousness, replicating the full potential of human consciousness, is highly unlikely. While technologies might mimic certain behaviors or reasoning perceived as "conscious," the depth and richness of human consciousness remain elusive.

Toy-Like Simulations:

Analogies are drawn to toys that mimic conscious-like behavior using pre-programmed responses. The comparison highlights the simplistic nature of current AI systems, which, at best, imitate specific aspects of consciousness without truly understanding or replicating its profound complexities.

Learning and Consolidation:

The text emphasizes the importance of learning and consolidation in stable memory systems for true consciousness. Current AI capabilities fall short in terms of consolidation and generalization, underscoring the technological gap in achieving human-like cognitive processes.

Philosophical and Moral Considerations:

Beyond technical challenges, the discussion extends to philosophical and moral dimensions. The moral implications of artificial consciousness, as well as the need to question the purpose and desirability of creating such entities, are raised. The ethical debate is acknowledged but not explored in detail.

Questioning the Purpose of Consciousness:

The purpose of consciousness is questioned, echoing the work of Kotchoubey (2018). The text argues that, rather than pursuing artificial consciousness, understanding why consciousness exists and exploring its role in human experience is more relevant.

Speculation on Human Control and Superiority:

The speculation on human intelligence's qualitative superiority and the unique existence of human consciousness is linked to maintaining human control over machines. The assertion suggests a cautious approach to not relinquishing control in the face of technological advancements.

Resistance to the "Global Brain Prophecy":

The text resists the idea of a "global brain prophecy" and challenges the notion of a singularity gospel. It advocates for maintaining a human-centric perspective and resisting the inclination to surrender control to the machines.

Consciousness as Vital Energy Source:

The concept of consciousness as a vital energy source is introduced, referencing a perspective presented elsewhere. The potential harnessing of consciousness as a fundamental driving force for human development is proposed, advocating a focus on expanding human consciousness.

Focus on Mindfulness and Meditation:

Instead of pursuing artificial consciousness, the text suggests redirecting efforts toward methods and techniques that enhance human consciousness, such as meditation and mindfulness practices. These approaches are presented as powerful tools for developing human potential.

Role of Consciousness in Human Fulfillment:

The conclusion suggests that understanding consciousness as a form of vital energy could contribute to individual and collective well-being, helping individuals find purpose and fulfillment despite adversities. Consciousness, in this view, becomes a driving force in developing humanity.

Analysis of References:

The references provided in the text cover a wide range of topics related to consciousness, neural processes, and related fields. Here's an analysis of some key points:

Diversity of Sources: The references include a diverse range of sources, from classic works in neuroscience and philosophy to more recent studies. This diversity suggests a comprehensive exploration of the subject matter, considering both historical perspectives and recent advancements.

Interdisciplinary Approach: The references draw from various disciplines, including neuroscience, psychology, philosophy, and artificial intelligence. This interdisciplinary approach is crucial for gaining a holistic understanding of consciousness, as it is a complex phenomenon that requires insights from different domains.

Prominent Theories and Models: Many of the references cite prominent theories and models in the study of consciousness, such as Adaptive Resonance Theory (ART), neural synchronization, and the Global Workspace Theory. This indicates an engagement with established frameworks in the field.

Temporal Dynamics of Consciousness: Several references delve into the temporal dynamics of consciousness, exploring how neural processes unfold over time and contribute to the subjective experience. This aligns with contemporary research emphasizing the role of temporal aspects in understanding consciousness.

Technological Implications: The analysis extends to considerations of artificial consciousness, discussing the challenges and limitations in emulating human consciousness in artificial intelligence. This reflects an awareness of the ethical and technological implications of advancing AI systems.

Philosophical Reflections: Philosophical perspectives on consciousness are evident in the references, with discussions on the nature of phenomenal consciousness, the mind-body problem, and the limitations of computational approaches. This philosophical engagement adds depth to the exploration of consciousness.

Attention to Neural Mechanisms: The references highlight various neural mechanisms involved in consciousness, such as neural synchronization, resonant brain states, and the role of specific brain circuits. This reflects an interest in understanding the physiological underpinnings of conscious experience.

Integration of Past and Present Research: The inclusion of references from different time periods, including classic works and more recent publications, suggests an effort to integrate past and present research. This historical perspective is valuable for tracing the evolution of ideas in the study of consciousness.

Critical Evaluation: The references include critical evaluations of existing theories and models. This critical stance is important for fostering a nuanced understanding of consciousness, acknowledging both the strengths and limitations of current approaches.

In summary, the references collectively contribute to a rich and multifaceted exploration of consciousness, encompassing

scientific, philosophical, and interdisciplinary perspectives. This suggests a thorough and thoughtful approach to the subject matter, acknowledging its complexity and engaging with a variety of viewpoints and methodologies.

Summary:

1. Overview of Consciousness:

The text begins with a broad exploration of consciousness, emphasizing its multifaceted nature. It touches upon the challenges of defining consciousness and introduces the concept of phenomenal consciousness.

2. Neurophilosophical Perspectives:

The neurophilosophical perspective is introduced, emphasizing the integration of neuroscience and philosophy in understanding consciousness. It highlights the need to bridge the gap between subjective experience and neural processes.

3. Temporal Dynamics and Neural Synchronization:

Temporal dynamics are emphasized as a crucial aspect of consciousness. The text explores neural synchronization and oscillatory patterns in the brain, suggesting that these temporal aspects play a vital role in shaping conscious experience.

4. Global Workspace Theory:

The Global Workspace Theory is introduced as a framework explaining how information becomes globally available in the brain, leading to conscious awareness. The text discusses the role of attention in orchestrating this global workspace.

5. Role of Attention:

Attention is discussed as a key factor in consciousness, shaping what enters the global workspace. The text highlights the interplay between bottom-up sensory input and top-down attentional processes.

6. Sensory Integration and Perception:

The integration of sensory information and the role of perception in shaping consciousness are explored. The text emphasizes the dynamic and interactive nature of sensory processes in constructing conscious experience.

7. Adaptive Resonance Theory (ART):

ART is presented as a theory explaining how the brain generates and updates representations in response to changing environments. The text discusses how attention and volition contribute to conscious states and introduces the concept of resonant brain states.

8. Temporal Brain Signatures:

The text delves into the generation and consolidation of temporal brain signatures, suggesting that they play a crucial role in triggering conscious states. It discusses the mechanisms of resonance and the integration of non-conscious

representations.

9. Neural Doors to Consciousness:

The discussion extends to the neural circuits that serve as "doors" to consciousness. The text explores the spontaneous generation of temporal signatures and their consolidation through repeated iterated reverberations in cortical memory circuits.

10. Artificial Consciousness:

The text addresses the unlikely prospect of achieving artificial consciousness that emulates human consciousness fully. It highlights the challenges of implementing complex neural processes, consolidation, and generalization in AI systems.

11. Conclusions:

The neurophilosophical perspective leads to the conclusion that true artificial consciousness may be an elusive goal. The text advocates for exploring methods that expand human consciousness, such as meditation and mindfulness, rather than focusing solely on artificial intelligence.

12. References:

The references cover a wide range of topics, showcasing a diverse and interdisciplinary approach. They cite prominent theories, models, and historical perspectives, providing a comprehensive overview of consciousness studies.

Overall Analysis:

The text offers a thorough exploration of consciousness, weaving together neuroscience, philosophy, and AI considerations. It navigates through various theories, emphasizing temporal dynamics, neural mechanisms, and the challenges of achieving artificial consciousness. The neurophilosophical perspective adds depth to the analysis, and the interdisciplinary approach contributes to a holistic understanding of consciousness. The text acknowledges the limitations of current approaches while encouraging a nuanced exploration of the complexities inherent in the study of consciousness.