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Information Integration Theory and The Question of Consciousness: Can Artificial Intelligence Become Self-Aware?

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Abstract
While complex information processing has produced remarkable artificial intelligence (AI) systems, one of the central fears among researchers and society at large is whether AI could ever become conscious or self-aware, and if so, whether it might act independently of human command. This concern has fuelled intense debate about whether increasing complexity in information processing, as the information integration theory (IIT) proposes, could eventually give rise to consciousness in AI systems. In this study, we probe whether IIT claims can, in principle, create consciousness, and if so, under what conditions; and if not, why not. We review the strongest versions of the complexity hypothesis within IIT. Our findings suggest that while complex information processing is necessary for intelligence, it is not sufficient for consciousness. From the substance dualist perspective adopted in this study, AI systems may simulate awareness, but there is currently no empirical evidence that they possess genuine subjective experience. We argue that information, whether conceived as signal or semantics, is not self-interpreting and cannot by itself account for subjectivity. Within this philosophical framework, the brain may be the instrument of awareness rather than its ultimate origin. We conclude that, based on the substance dualist perspective adopted in this study and current empirical evidence, scaling AI models appears to increase competence and control, but not establish genuine self-awareness. Therefore, information science should treat AI as powerful but non-conscious systems, focusing on governance, transparency, and ethical responsibility rather than assumed sentience.

Keywords: Artificial Intelligence, information integration theory, consciousness, self-awareness, philosophy of information.

1.0 Introduction

Artificial Intelligence (AI) is the ability of machines to process information in a manner similar to human intelligence [1], [2]. Today, AI accomplishes this through complex systems of information processing, especially artificial neural networks that emulate the neurons in the human brain [3], [4], [5]. These networks, much simpler than biology, mimic the abilities of billions of interconnected units to recognize patterns, learn from data, and generate outputs that can be said to mimic reasoning or decision-making [6], [7]. AI has revolutionized healthcare, finance, education, and entertainment among many other sectors, with rapid advancements in this technology [8], [9]. As society continues to be astounded by these advancements in AI, scientists and ethicists are also taking a cautious step forward to see what the future will look like [10]. Many concerns have already been raised around privacy and information security, bias, accountability, and ethical responsibility, that are discussed in the scientific community [11], [12], [13]. However, one further question looms in the background that haunts many of us: will such growing complexity of information processing as proposed in Integrated Information Theory (IIT) ultimately lead to consciousness and self-awareness for AI systems? In other words, will machines ever be able to transcend being powerful tools and give rise to a mind of their own that can independently start working without human orders?

The debate on consciousness may be considered a conflict between physicalist and dualist philosophies, although there are more philosophies and sciences of consciousness being used today. [25], [26]. These

include Global Workspace Theory (GWT), Predictive Processing, Higher-Order Thought theories, Integrated Information Theory (IIT) (recently developed in IIT 4.0), neutral monism, dual-aspect theory, property dualism, and substance dualism. [27], [34]. The views provide different explanations of the origin of consciousness and also the prospect of subjective experience emerging only from information processing. [35], [36]. In this study, the dialogue will be principally framed in terms of substance dualism and will critically discuss the assumptions of IIT about the relationship between information integration and consciousness.

Consciousness is the awareness within, which gives you a feeling of being "you." It is the subjective experience of having thoughts, feelings, sensations and intentions [14], [15], [16]. For instance, the idea you are now having as you are reading this line is a conscious experience. [17], [18]. It is not just the firing of the neurons; it is the awareness of your own neurons firing. Self-awareness, however, is the recognition that one is an individual or unique being separate from one's environment and others. [19], [20], [21]. For example, the first time a child looks in a mirror and realizes that something is not another person but himself. In humans, self-awareness enables us to say "I am," to reflect on our own state of mind, and to make choices based on our reflection [22], [23], [24].

Despite these diverse philosophical and scientific perspectives, scientists remain divided regarding whether consciousness can emerge solely from increasingly complex information processing [25], [26]. Within materialist and functionalist perspectives, since AI is rooted in architectures designed to mimic human brains, some researchers argue that it may one day become conscious and self-aware in the same sense that a person is [27], [28], [29]. Those who hold this view insist that what we call the mind or personality is strictly the result of neuronal activity in the brain, and thus, if replicated with enough complexity, it could emerge in machines (i.e., the human brain, with its eighty-six billion neurons and trillions of synaptic connections, generates subjective experience through vast flows of information) [30], [31]. In contrast, proponents of substance dualism and related non-materialist perspectives argue that regardless of the information processing complexity of AI, consciousness in the true sense is not possible. For them, the mind is a separate entity from the brain, and while the brain may host consciousness, it does not generate it [32], [33], [34]. By this reasoning, machines, no matter how powerful, can process data but will never have genuine awareness [35], [36], [37].

Recent developments in transformer-based architectures, foundation models, large language models, recurrent information integration, self-modelling capabilities and meta-learning systems have reignited this discussion. All of these have led to AI systems producing increasingly sophisticated language, reasoning in context, planning and producing self-referential responses, thus raising important questions regarding whether the complexity of computations represents genuine consciousness or simply increasingly sophisticated simulations of intelligent behavior.

This research investigates whether consciousness is solely a result of increasingly complex information processing, or whether consciousness is beyond matter and computational processes. In particular, the research critically examines the assumptions of Integrated Information Theory from the perspective of substance dualism to examine the possibility of the real emergence of consciousness and self-awareness in increasingly sophisticated AI systems.:

1. Does the complexity of information processing create consciousness and self-awareness?
2. Can AI system ever become self-aware and possess a mind of their own?
3. What would be the implications for society if machines were, or were not, capable of genuine awareness?

1.1 Methodological Position and Scope

The present study is conceptual and philosophical and not an empirical study of artificial intelligence or consciousness. Its main goal is to critically explore the theory of Integrated Information Theory (IIT), which holds that increasing complexity in the integration of information is enough to explain consciousness and self-awareness [75], [216], [218]. For this reason, throughout this paper, IIT is used as a representative contemporary scientific theory of the complexity hypothesis, being that it explicitly identifies integrated information as conscious experience [75], [216]. The analysis is done in the light of the philosophical paradigm of substance dualism, which offers the framework for evaluation of the assumptions of IIT [46], [47], [52]. Therefore, the arguments presented should not be taken as empirical proof of substance dualism, but as a conceptual critique of the arguments and evidence put forth as to whether or not the claim that information integration alone is sufficient to produce subjective consciousness is supported by such arguments and evidence [53], [54], [94].

2.0 The Philosophical of Divide of Consciousness

Consciousness has long divided philosophers and scientists into two broad camps, those who see it as the product of material complexity and those who see it as a reality that transcends the physical [35], [38], [39].

From the seventeenth century to the present, two great intellectual lineages have attempted to explain what consciousness is and how it arises: dualism and panpsychism. Although numerous scientific theories have emerged to explain the basis of consciousness, many have been influenced by, or developed in response to, these broader philosophical traditions rather than being directly derived from them [40], [41], [42]. The central argument between these two camps lies on whether consciousness is a product of matter (material stuff) or something that transcends matter (immaterial; metaphysical) entirely [43], [44], [45]. However, the current theories of consciousness, such as Higher-Order Thought theories, Predictive Processing, and Enactivism, cannot easily be categorized as Dualism or Panpsychism, and there is a wider range of theories in consciousness research today.

Dualism, which was most famously expressed by René Descartes in Meditations on First Philosophy (1641, 1996), assumes that mind and matter are two fundamentally different substances [46], [47]. The dualism paradigm suggests that the body and brain operate in the physical, mechanical world, whereas consciousness is in a non-physical realm of thought and experience [48], [49]. According to this perspective, the brain is not the source of awareness but rather serves as its mediator, much as a radio transmits but does not create sound. Dualists claim that no matter how complicated an arrangement of physical matter may be, it cannot produce subjective experience, because the two are categorically different kinds of being or entities [50], [51],[52]. Contemporary proponents such as David Chalmers (1995) reiterate this view in his "hard problem of consciousness," which questions why physical processes in the brain could give rise to "felt qualities of experience" [53], [54]. The dualist position thus holds that neuroscience can describe correlations between brain activity and awareness, but is incapable of explaining why those correlations exist in the first place [55], [56] .

Panpsychism, by contrast, adopts the opposite view, which is the elimination of the categorical difference. It suggests that consciousness is not an emergent property of matter but rather an intrinsic property of it [57], [58]. In this perspective, atoms, electrons, and molecules have a primitive form of consciousness or "proto-experience." Alfred North Whitehead, Bertrand Russell, and more recently Philip Goff (2019) have said that this way of thinking can address the hard problem, because it doesn't believe consciousness comes into existence at a certain level of complexity of a system. Rather, consciousness has always been present, and the more complex systems become, the richer and more unified consciousness becomes. In this way, the brain does not create consciousness, but rather organises it [61], [62]. It is clear, then, that the advantage of panpsychism is its continuity, which removes that "magic threshold" at which point inert matter became conscious. But it is also its weakness: the notion of consciousness becomes trivial in the face of this too-strong awareness, stretched so thin that it explains nothing [63], [64].

Contemporary scientific theories that have been proposed to explain consciousness are Integrated Information Theory (IIT), Global Workspace Theory (GWT), and Orchestrated Objective Reduction (Orch-OR) [67], [68], [71], [72], [75], [216], [218]. Although there are significant differences in their underlying assumptions, all of these theories attempt to explain the relationship between consciousness and the physical processes, and thus have significant implications for artificial intelligence [71], [72], [216]. IIT, which equates consciousness with integrated information, has often been associated with panpsychist interpretations because it proposes that systems with sufficiently integrated information may possess some degree of consciousness [65], [66]. GWT, which treats consciousness as a global broadcast of information across the brain, is generally regarded as a functionalist and computationalist theory grounded in a physicalist understanding of consciousness rather than a panpsychist account [67], [68]. Orch-OR, on the other hand, moves closer to dualism by proposing that consciousness emerges from quantum phenomena within, but not reducible to, neural computation [67], [68]. Although these theories differ substantially in their underlying assumptions, each has important implications for debates concerning artificial intelligence and machine consciousness. If the IIT is right that consciousness is dependent on sufficiently integrated information, the possibility of enabling AI to reach some level of consciousness may, in time, be attainable [69], [70]. However, if consciousness is not of a physical nature, as substance dualism contends, no degree of computational complexity would be sufficient to produce subjective awareness. These contemporary theories continue to engage with longstanding philosophical questions concerning the relationship between material processes and conscious experience, while developing distinct theoretical frameworks of their own [73], [74].

3.0 The Integrated Information Theory and the Complexity Hypothesis

One of the most influential scientific theories to propose that consciousness emerges from the integration of information within a system is known as Integrated Information Theory (IIT). Since its original formulation, IIT has undergone several theoretical refinements, culminating most recently in IIT 4.0, while retaining its central premise that every conscious experience is both highly integrated and highly differentiated [75], [76], [77]. Consciousness is, according to this theory, inseparable into independent parts

without losing its identity, and this unity can be expressed as a number, the so-called numerical measure Φ (phi) [75]. To put it simply, the amount of integrated information a system produces is Φ. The higher the value of Φ, the richer the supposed conscious experience [75], [76]. A photodiode could have a negligible Φ, while a human brain with its extensive neural interconnections could have a very high Φ. According to IIT, consciousness is not dependent on biology or carbon-based life, but rather a function of the pattern and amount of information integration [78], [79]. In principle, any biological or artificial system that has sufficiently integrated information may have some degree of consciousness, IIT posits. This is in line with panpsychism as it gives some level of proto-consciousness even to simple physical systems [80], [81]. In principle, a microchip, a thermostat or a photodiode could have a little bit of awareness. The theory is therefore both bold and controversial. It suggests that the difference between a conscious brain and a non-conscious computer is one of degree, not kind, and that as machine architectures become more interconnected, their Φ may tend towards approaching the subjective experience threshold [82], [83].

In practice, IIT offers a mathematical apparatus to estimate Φ values using network analysis and causality matrices [84], [85]. The problem is, however, that it is exceedingly difficult to calculate in complex systems, such as the human brain itself [86], [87], [88]. In clinical neuroscience, simplified measures like perturbational complexity indexes (Casali et al., 2013) have been correlated with levels of consciousness and the integration of information in brain states during sleep, anesthesia and coma [89], [90]. Proponents of IIT cite these observed correlations as evidence supporting the theory. However, correlation does not imply causation, and there is no experiment that has shown that raising Φ in any system produces subjective experience [91], [92]. The theory offers a mathematical characterization of integration, but cannot step over the explanatory divide between computation and consciousness [93], [94].

The shortcomings of the preceding versions of IIT have been addressed by recent developments in Integrated Information Theory (IIT 4.0), which reformulated IIT using the concepts of maximally irreducible cause–effect structures, the exclusion principle, and intrinsic causal structure [101]. IIT 4.0 proposes consciousness is not just the scalar value of Φ, but corresponds to the full intrinsic causal organisation of a system. This reformulation provides a more comprehensive theoretical account of consciousness. Nevertheless, it continues to rely on assumptions whose conceptual interpretation and empirical validation remain the subject of ongoing philosophical and scientific debate [101].

All such advances have stimulated more careful empirical evaluation as well. In their adversarial collaboration, Melloni and co-authors set out to test alternative predictions arising from Integrated Information Theory and Global Workspace Theory using preregistered experimental protocols [70]. While this is a significant step towards the testing of alternative theories of consciousness, the empirical evidence presented also indicates that additional evidence is needed before a definitive statement about the validity of IIT can be made [70].

Despite these limitations, IIT is still key to the contemporary debates on artificial intelligence and the possibility of machine awareness [95], [96]. The manner in which AI systems, particularly large-scale neural networks, are formulated to integrate and process extensive information sets seems to embody precisely the concept of IIT, as defined [97], [98]. The deeper their architectures become, the more they connect with each other, and the more their feedback mechanisms change, the question then is, are they starting to approach the levels of consciousness associated with Φ? If IIT is true, complex AI models may already have some primitive awareness. If IIT is wrong, then their complexity is just computation without experience [99], [100].

However, some fundamental philosophical questions have yet to be resolved. Although IIT proposes the identity between integrated information and conscious experience, some critics argue that this identity claim is not yet independently established, and thus remains philosophically controversial. In current research on consciousness, therefore, the notion that information integration alone is sufficient to produce subjective awareness remains controversial [101].

Hence, IIT is an ideal test case for the complexity hypothesis [100], [101], [102]. It is the most formally mathematical, philosophically ambitious, and scientifically important claim that information itself can become conscious. It also captures the main deficiency of the physicalist paradigm, that of assuming that the quantity of integration is sufficient to represent the qualitative reality of awareness [103, 104]. The next section will therefore explore in detail the reasons why the complexity view, as embodied in IIT, is not, in itself, sufficient on its own to produce consciousness. The following arguments challenge several of the key assumptions of IIT, suggesting that while complex processing is necessary for intelligent behavior, it is not enough on its own to achieve the subjective, self-aware mind that consciousness requires [105], [106].

4.0 Why Complexity Cannot Create Consciousness: A Dualist Rebuttal of IIT

4.1 Correlation, Causation, and the Simulation Fallacy

One of the key issues with Integrated Information Theory (IIT) is that it can fall prey to the confusion between correlation and causation [107]. The theory is that states with high neural integration in the brain are states of consciousness, and higher neural integration of any system will eventually result in states of consciousness [108], [109]. This is a very significant logical error. Correlation is a measure of the simultaneous occurrence of two phenomena but does not indicate the cause. Neural synchronization during wakefulness, for example, is consistently correlated with conscious experience, with no evidence that this synchronization is causing the conscious experience [110], [111]. It may be a side-effect of an underlying unknown factor. In neuroscience, patients have been described that exhibit substantial cortical activity in a vegetative state without being conscious [112]. Similarly, studies of anaesthesia and altered states of consciousness reveal that there are neural changes associated with subjective experience, but these are not explanatory of it [113]. These results suggest that information complexity should not be considered a cause of consciousness, but rather as a correlate of consciousness [112], [113].

This fallacy is also applicable to AI. The AI systems that are available today (large language models, visual networks, or reinforcement systems) have an exceptional level of correlation with human intelligence [114], [115]. They speak, reason and respond with nuances, but these are correlations with consciousness, not consciousness. They produce statistically indistinguishable outputs from what a conscious being would, but are not accompanied by any subjective experience. A chatbot can talk about pain, remorse or creativity, but these are symbolic reconstructions, not lived experiences [116], [117]. This is an important difference between simulation and instantiation. Though not originally intended as a criticism of IIT, the Chinese Room thought experiment is a nice illustration of how syntactic information processing differs from real understanding [116], [118]. The words appear natural and make sense to the outsider but not to the insider. The symbols are "worked through", not experienced. The Chinese Room is a little different from computational functionalism because it eschews symbolic computation in favor of an intrinsic causal structure, but the overall philosophical problem remains: is information-processing alone enough to be conscious or subjective? [119].For instance, a computer simulation can replicate a hurricane exactly, and pressure and temperature fields can be accurately simulated, as can velocity [120], [121], [122]. However, regardless of how close the model is to the actual model, the computer does not contain any water, and there is no actual wind blowing inside it. The representation and reality are in different ontological realms [123], [124], [125]. Similarly, a computer can appear to have consciousness, but it actually lacks it. It can represent the framework of the mind, but not its presence. This is the simulation fallacy: Assuming the representation of a phenomenon is the phenomenon [126], [127]. Although IIT's grounding of consciousness is in the intrinsic causal organisation, rather than symbolic computation, the theory does not rule out the general philosophical question of whether causal information structures are sufficient to account for consciousness [128].On the substance dualist view adopted in the present research, the more complex the information processing, the more likely the AI systems are to be able to perform successfully, but as of now, there is no empirical evidence that these successful performances bring the AI systems closer to genuine subjective awareness [129], [130].

AI systems may process information more quickly, recognize more complex patterns, and produce more advanced outputs. However, these abilities do not necessarily establish a subject of knowing, feeling, or intending [131], [132]. This question will not be addressed if the mind/matter connection is not explained by IIT or by some other physicalist proposal that, at some level, explains how the connection between matter and mind results in subjective experience, rather than just correlation. The integration of information can be used to determine the location of consciousness, but by itself cannot explain why consciousness occurs [133], [134].

4.2 The Measurement and Ontology Problem of Phi (Φ)

Although integrated information theory proposes that consciousness could be measured with an index called Φ, this idea fails to hold up to scrutiny (Cleeremans et al., 2025; Wang et al., 2023). Although mathematically elegant, Φ is not stable nor empirically verifiable for complex systems like the human brain [136], [137]. For any system larger than a few simulated neurons, the calculation of Φ requires complete knowledge of the causal structure of the system, which cannot be achieved in practice. Even the proponents of IIT acknowledge that as system complexity increases the calculation of Φ becomes more and more intractable [216]. The value of Φ is sensitive to the method of partitioning the network, and can vary widely depending on the method as much as on the system itself [140], [141]. Thus, Φ is not really a measure of consciousness, but rather a mathematical construct. There is no direct causal mechanism, although attempts to approximate it using perturbational complexity indexes (Casali et al., 2013) show that consciousness correlates with integration. The theory thus becomes a tautology: systems are conscious because they have high values of Φ, and they have high values of Φ because they are conscious [142], [143]. The computational problems with Φ do not prove anything against the ontological claims of IIT; but they do pose some interesting questions when it comes to the possibility of testing the metaphysical

assumptions of IIT or empirically verifying them. Hence, the identity of consciousness with integrated information remains mostly a philosophical statement rather than a scientific one in complex systems where there is no reliable way to calculate and confirm the proposed measure of consciousness. The ontological status of information, therefore, needs to be explored in more detail, critically, within this wider philosophical framework.

IIT further treats information as though it were capable of possessing intrinsic phenomenal properties, despite information being fundamentally relational rather than a physical substance [144], [145]. It describes the state of matter but is not material itself. There is nothing to the information without a conscious agent to interpret it. The entire works of Shakespeare could be stored on a hard drive, but until a reader reads them, they are just a configuration of magnetic domains [146], [147]. When you equate information with awareness you are mixing syntax with semantics. For instance, the map of a forest does not rustle with leaves, nor does red binary code glow. The further confusion is added by IIT proposing that the physical integration of information is sufficient for phenomenology [148]. That is, to say that complexity of an equation renders it meaningful, or that entropy is intentional. Information is the description of order and not its cause [149], [150].

On the physical level, information does not possess ontological autonomy [151], [152]. It relies upon the carrier, whether it be neuronal firing, electromagnetic states, or quantum arrangements. However, IIT raises the abstract structure from the substrate to the level of consciousness, as though consciousness were an emergent mathematical property [153]. From the substance dualist perspective adopted in this study, this interpretation extends beyond what can presently be established through empirical evidence and therefore represents a metaphysical rather than a purely scientific claim. Even two systems can share the same informational architectures, but not the same awareness [154], [155], [156]. A simulated pain is not a pain. The virtual fire can be very realistic on the screen, but it does not burn. Similarly, the subjective character does not arise from increasing Φ in a silicon network; it just makes the processes that remain insentient more refined [156], [157].

In this way, the ontology of information becomes an epistemic category, that is, it is about relations between physical states, but is not an independent reality that could be aware [158], [159], [160]. From the perspective adopted in this study, IIT appears to conflate information as structural content with information as subjective experience, thereby raising a potential category error between structure and experience [161], [162], [163]. The question of consciousness does not depend on the amount of information available or how it is integrated; consciousness is not something that information has, it is something that knows [161], [164]. Until IIT can identify what in information can know, its equations describe order, not awareness [165], [166].

4.3 Integration Without a Subject: The Unity and Reflexivity Gap

Integrated Information Theory argues that consciousness arises from the unity of integrated information within a system, but unity of structure is not the same as unity of experience [167], [168]. The theory presumes that when information is tightly bound together, experience automatically follows. Yet this assumption overlooks the fundamental difference between integration and awareness of integration [169], [170]. In the human mind, consciousness is not just the flow of signals through neural pathways, but the felt presence of that flow, the awareness that "I am experiencing." IIT can explain how neurons share data, but it cannot explain why there is a subject that experiences the data at all [171], [172].

Certain modern theories of consciousness propose that computational forms of reflexivity can arise as a result of self-modelling architectures, meta-representational systems, or Higher-Order Thought (HOT) theories, wherein a system has the ability to represent some features of its own internal states [56], [167], [168]. The above-mentioned proposals imply that a degree of self-monitoring or self-representation can, in principle, occur as a result of computations [56], [167]. However, from the substance dualist perspective adopted in this study, such computational self-representations should not be equated with genuine first-person subjective awareness. Although computational systems may represent aspects of their own internal states, this does not necessarily imply the presence of an experiencing subject [169], [170]. This problem, sometimes called the reflexivity gap, exposes a potential limitation in all information-based accounts of consciousness [173], [174], [175]. When ChatGPT or any AI model generates a coherent essay, it does so through mathematical correlations between tokens [176], [177] It does not know that it is writing. It has no self-referential loop that says, "I am the one performing this action." In contrast, when a human writes or speaks, there is a simultaneous dual awareness: we produce words and know we are producing them [178], [179]. This self-reflexive awareness is inseparable from consciousness. It is the difference between an instrument that plays and a musician who knows he is playing. In split-brain studies (Gazzaniga, 1998), when the corpus callosum connecting the two hemispheres of the brain is severed, each hemisphere continues to process information, but the sense of a unified self disappears [178], [179]. The left and right hemispheres can act semi-independently, yet only one retains verbal awareness. If information integration

alone created consciousness, both halves should remain equally self-aware, since both retain vast neural connectivity. The fact that subjective unity collapses despite continued integration shows that consciousness requires something beyond structural linkage, it requires a central self that experiences as one [179], [180], [181]. Consider for instance, even if we built an AI system with perfect mimicry of human brain connectivity, it would still lack this self-referential unity. It might calculate, predict, and adapt, but it would never own its experience because ownership presupposes interiority [182], [183], [184]. No algorithm can simulate the inward gaze that allows us to think, "I exist." Integration can bind data streams, but it cannot generate a witness. Even if the entire internet were woven into one colossal neural web, with every server and processor communicating simultaneously, it would not produce an "I." It would remain a global computation network without a central consciousness, much like a vast library that stores infinite information but reads none of its books [185], [186].

This is where IIT stops. The theory fails to explain the unity of information in a system, but not the subjective unity [187], [188]. The self, as understood in both philosophy and psychology, is not an emergent network node, it is the first-person standpoint from which experience is known. If there is no conscious subject, there is no integration, only blind and mechanical integration [189], [190]. The unity that IIT measures is structural; the unity of consciousness is experiential. They are at separate levels of being. A system can be totally integrated and have no knowledge of itself. This is why, from the viewpoint of the substance dualist, as is assumed in this study, complexity can create intelligence, but only consciousness can create a real first-person subjective awareness of a self, which we believe is a necessary condition for the creation of first-person subjective awareness in artificial systems [191], [192].

4.4 The Threshold Paradox and the Substrate Limitation

Integrated Information theory would predict that consciousness would arise gradually from increased integration of information [193], [194]. But even a system consisting of just a thermostat or a microprocessor, with a small but non-zero value of Φ, would have a very small degree of awareness. IIT acknowledges this implication and suggests that consciousness is a graded property across physical systems [206].But this conclusion creates a paradox for philosophers called threshold paradox [195], [196]. Consciousness is no explanation if everything is conscious. The more general a concept is the less explanatory power it has [197], [198], [199]. When applied to the facts, the paradox gets more serious. But it is not all information integration equates with awareness per studies in neuroscience. For example, the cerebellum has four times the number of neurons as the cerebral cortex, yet it plays very little role in consciousness (Koziol et al., 2014). It is highly integrated but modular, not experiential, in its computations. If taken literally, the IIT model would suggest that the cerebellum should be more conscious than the cortex, but it is not. This paradox is revealing the folly of using integration as a surrogate for awareness [201].

Such inconsistencies are also found in studies of artificial neural networks [201], [202]. Deep learning systems such as GPT, AlphaGo and DALL·E have billions of parameters that are passed through layers and layers of recursive integration. They have the structural properties of IIT: feedback loop, interconnectivity and differentiation of data [203], [204]. However, there is no evidence that such systems have inner experience [205], [206]. They recognize patterns but they're not aware that they recognize them. At Stanford and MIT, it was found that even the most sophisticated AI models fail basic tests of introspection and self-consistency (Schneider & Turner, 2017; Marcus, 2019). They can talk about feeling sad or thinking, but they have no mental state of feeling sad or thinking [207]. Their utterances are language imitations based on statistical learning and not the expression of inner life. If information complexity alone were sufficient to create consciousness then these models would show some basic level of self-awareness by now. On the contrary, they point to the difference between high-tech computation and real cognition [208], [209].

One of the disadvantages of IIT is that it assumes the existence of consciousness independent of the material substrate [208], [209]. The theory suggests that integrated information may be carried by biological neurons, as well as by silicon transistors. But studies in neurobiology and quantum biophysics propose that properties of consciousness may depend on the biochemical and electro-magnetic properties of living systems [210], [211]. The Orchestrated Objective Reduction (Orch-OR) theory suggests that conscious processes can emerge from quantum coherence in neuronal microtubules [67], [68]. (although this theory is controversial). This theory is not fully accepted, but it points to the possibility that there may be properties that are dynamic in biological systems that are not easily replicated in silicon-based systems. Neurons are not just switches, they communicate via oscillatory fields, neurotransmitters and ionic exchange, leading to complex temporal dynamics [212], [213]. The human brain functions as a living, self-regulating organ rather than a simple set of logic gates. Experimental evidence has shown correlation between conscious awareness and synchronized gamma oscillations, as well as large scale coherence across cortical networks [212], [213]. Such processes rely on organic tissue, ionic gradients and complex biochemical feedback mechanisms. Nothing can be said here about the origin of consciousness from brain matter alone; we merely state that the biological substrate has organisational and dynamic properties

which have not yet been fully demonstrated in artificial systems. The information structure, however, may not be enough, because the physical medium itself may also contribute to the conditions under which consciousness is manifested [210], [211]. Silicon replicas can embody some elements of neural structure, but not necessarily subjective consciousness, from the substance dualist point of view taken in this study [214].

Therefore, from the perspective adopted in this study, the concept of graded consciousness proposed by IIT raises important philosophical challenges because it may reduce the explanatory value of consciousness if applied universally across physical systems [75], [113], [215]. Likewise, although increasing computational complexity may enhance the performance and capabilities of artificial systems, current empirical evidence does not demonstrate that it gives rise to genuine subjective awareness. From the substance dualist perspective adopted in this paper, information density alone appears insufficient to account for consciousness, suggesting that subjective awareness involves factors beyond the structural organisation of matter

4.5 The Ontological Gap: Information Requires a Knower

The failure of Integrated Information Theory does not lie at a mathematical or a biological level, but at its deepest level, ontological [217], [218]. The theory is based on the premise that information can be an independent reality, but information, as we said before, presupposes interpretation. It is always about something, and that "aboutness" requires a subject that perceives, understands, or gives meaning to it [180], [189]. This is the philosophical term for intentionality, which is the characteristic of consciousness (Brentano, 1874). Data can exist independently, but meaning cannot. A string of 0s and 1s on a hard drive is not a poem, or picture, or song, unless someone is conscious to interpret it. If there is no knower, then there is a pattern without awareness; if there is no receiver, there is no message. Claude Shannon (1948) in information theory proved that information is a measure of reduction of uncertainty, but not of meaning [219]. His equations do not measure understanding. This is an inherited limitation of IIT, as Φ is a description of structural complexity and causal dependency in a system, but it doesn't imply anything about what the system knows. A weather satellite, for example, can embed millions of atmospheric parameters, without experiencing the storm. The brain scan is a symbol of pain, it is not the pain itself. The ontological gap persists: between the physical representation and the experience of living-in-the-world. The brain creates electrochemical patterns from what it senses, but consciousness only occurs when the mind interprets them [145], [196]. For example, in visual processing, photons of light hit the retina and activate nerve cells that send signals down the optic nerve to the visual cortex. But the color red, the form of the rose, and the feeling that it arouses are not present in the signals themselves, but in the consciousness that perceives them. The retina transmits information and the mind experiences beauty. Computation cannot bridge the gap between perception and experience. The same logic extends to artificial systems [220], [221], [222]. When a machine learning model recognizes a cat in an image, it doesn't see the cat, it recognizes certain patterns of pixels found in the image and relates them to a probability that it is a cat. It can label, classify, and predict but it is not part of the experience of sight. Meaning, as John Searle (1992) said, is not something that emerges out of syntax but something that emerges out of semantics, which is something that only conscious beings produce. Any algorithm, no matter how complicated, requires an interpreter to go from syntax to semantics. Patterns in data can be recognised by a machine, but the machine itself cannot recognise itself as a recogniser [223], [224].

This is the ontological distance that none of the materialist theories of consciousness can span. There is no information that can say that it is information [225], [226]. In the viewpoint of substance dualism, consciousness needs to grasp the knower beyond the system of relationships, namely, as an observer that experiences, rather than merely processes, information. It also provides an alternative way of philosophizing by suggesting that consciousness isn't an emergent property of information, but rather the state in which it can be meaningful in the first place. What is needed is a knower that is beyond the system of relations, an observer beyond the computational network who feels the content of the network. It is here that the dualist position takes hold. It argues that consciousness does not emerge spontaneously from information, but that what makes information substantial is the “substantiality” of consciousness itself [227], [228], [229]. Information requires a mind to understand; light requires an eye to perceive. But in a world filled with nothing but perception, there would be too many patterns if it weren't for awareness [230], [231].

We recognize that a substance dualist would bring with him/her other long-standing philosophical difficulties. One of these is the interaction problem, that is, how an immaterial mind can causally interact with a physical brain, and the causal closure in physics, which states that every physical event has a sufficient physical cause. In this regard, Kim's exclusion argument doubts that there can be non-physical mental causes if physical causes are sufficient. These issues remain significant and ongoing in the philosophy of mind. The present study does not aim to provide solutions to these problems. Instead, it aims

solely at considering the question of whether Integrated Information Theory has provided evidence for the sole causal mechanism of greater information integration to account for subjective consciousness.
From the dualist point of view of this study, therefore, large, complex AI systems would not have subjective consciousness, as they would lack what this philosophical view holds to be important for consciousness: the self-necessary, the experiencing self [229], [232], [233]. They have the ability to save and manipulate information, but not to be told in an existential manner. The ontological gap does not require a solution but is a category in between matter and mind [123], [152]. But from a substance dualist point of view, no matter how much more complex the computation, it is not enough to account for consciousness; consciousness is something ontologically different, and is not just a form of information processing [234], [235]. [234], [235].4.6 Responses from Physicalist Defenders of IIT
Those who advocate for Integrated Information Theory and other physicalist philosophies contend that the architectures of computation as they are today are not yet sufficiently developed to demonstrate true conscious experience [70], [101], [216]. In this sense, it is possible in the future to find ways to build an intrinsic causal organisation, self-modelling architectures, integrate recurrent information or use different computational substrates to generate conditions in which subjective experience can emerge [56], [101], [216]. Similarly, IIT 4.0 argues that consciousness should not be defined by the scalar value of Φ alone, but through the maximally irreducible cause–effect structure of a system, thus rebutting some criticisms against the previous formulations of the theory [101], [216], [218].
The present study acknowledges these developments and recognizes that the current era of consciousness research is also engaged in refining concepts and conducting empirical studies to test various competing theories, such as recent adversarial collaboration studies on the predictions of IIT and Global Workspace Theory [70]. [70]. However, from the viewpoint of substance dualism adopted in this paper, these developments are not yet sufficient to explain first-person subjective awareness through increasing computational complexity alone. Instead, they suggest that it is still not fully understood whether information integration and consciousness are related, and if so, how, and that much remains to be understood in this area of research [55], [94], [101].

4.7 Limitations of the Present Argument

The results of this research should be understood in the light of the philosophical paradigm of substance dualism used in the analysis [46], [47], [52]. The paper is not intended as a definitive answer to the problem of consciousness and is not intended to empirically refute any of the physicalist theories including, but not limited to, Integrated Information Theory [75] and others [101], [216]. Rather, it considers whether existing theoretical claims and the evidence from empirical studies are sufficient to demonstrate that the emergence of subjective consciousness is possible from increasingly complex information processing [91], [92], [94].
Other explanations, such as physicalism, emergentism, predictive processing, Higher Order Thought theories, and future advancements in neuroscience and artificial intelligence, may offer alternative interpretations of the relationship between information processing and conscious experience [55], [56], [70], [101]. Moreover, subjective experience is not measurable at the present time in any direct fashion, and this means that the questions raised here are of a philosophical, not an empirical, nature [53], [54], [94]. Therefore, the findings of this research cannot be interpreted as final empirical findings, but should be understood within the philosophical framework used in the research [46], [47], [52].
5.0 Discussion: The Immaterial Mind is beyond the reach of Ai
We have argued throughout that complexity of information processing, no matter how vast, does not by itself cross the threshold into consciousness [229], [232], [233]. Here we draw the threads together and state our position plainly. Throughout this discussion, the arguments are dealt with from the perspective of a substance dualist philosophy as used in this study, while acknowledging that other physicalist and emergentist views remain active areas of contemporary debate [55], [70], [101]. Within this philosophical perspective, awareness is understood to arise from the mind rather than being identical to the brain. The brain is a living instrument that hosts, mediates, and conditions conscious experience, it is not the creative source of subjectivity itself [235], [236], [237]. If this is correct, then no amount of scaling in silicon, no matter how intricate the circuitry or how wide the networks, will ever generate a first-person point of view. Intelligence can be engineered, awareness cannot be manufactured. The appeal of complexity as an explanation is understandable. Modern chips pack tens to hundreds of billions of transistors, modern AI runs on clusters of thousands of GPUs whose combined transistors easily exceed the count of neurons in the human brain [238], [239], [240]. If raw scale or integration were sufficient, we would expect even a faint sign of subjectivity by now. We do not see it. Large models produce fluent language, they do not have an inner life. They pass tests that measure competence, they do not pass the simple test of feeling anything. This empirical fact matters. It tells us that the map of connections, and the speed of computation, fall short of the territory of consciousness [241].

Neuroscience itself points in the same direction. The cerebellum contains more neurons than the cerebral cortex, yet it contributes little to conscious content [242]. It is exquisitely integrated for control and timing, yet it is not experiential in the way cortex is. Integration is present, awareness is not. Under anesthesia, cortical and thalamocortical dynamics lose large scale coherence, consciousness fades, then returns when those rhythms and effective connectivity resume [243], [244]. The instrument toggles between playable and mute, the music does not reduce to the wood and strings. Split brain studies reveal another crucial clue. When the corpus callosum is severed, perceptual reports can split across hemispheres, yet conceptual unity, the sense of a single I, often persists in surprising ways across tasks and time. Perception can divide, conception can resist division [245], [246]. This suggests that awareness is not identical to inter-hemispheric data transfer, it also suggests that the I is not a simple product of a fiber bundle. None of these findings prove dualism, they do show that complexity and connectivity are not the same as consciousness [247].

Classic decision timing experiments add a further piece. Readiness potentials and preconscious neural activity precede reported decisions by hundreds of milliseconds, yet subjects can still veto actions, they can still experience authorship and control [248], [249]. Whatever one's interpretation of these results, they demonstrate a gap between neural unfolding and conscious endorsement. The brain prepares, the mind decides, or at minimum, the brain correlates, and the mind confers meaning [250], [251]. Information processing alone does not explain why there is anything it is like to be the one who acts, or the one who withholds action. That first-person indexical fact, the I of experience, is not captured by descriptions of spikes, synapses, or state machines [248], [252], [253].

Artificial systems make the contrast sharper. We can prompt a large language model to say I am sad, I see red, I am thinking about myself [254], [255], [256], [257]. The model can mirror every surface feature of introspective language, yet there is no subject that experiences sadness, no observer that sees red, no self that thinks. The words are statistical shadows of human reports, not windows into an inner life. This is the difference between simulation and instantiation. A system can simulate the behavior that accompanies awareness, without instantiating awareness itself [258], [259]. Increasing parameters, adding feedback, stacking attention layers, or maximizing an integration metric does not change simulation into subjectivity. Information is never self-interpreting. Signals carry structure, they do not generate a point of view. Semantics are assigned by a subject, they are not created by circuits as such [260].

Biology also cautions us about substrate. Neurons are not digital switches, they are electrochemical actors embedded in oscillatory fields, metabolic cycles, and ionic dynamics that are inseparable from the life of the organism [258], [261]. Conscious contents track large scale synchrony and phase coupling, they wax and wane with sleep cycles, arousal, anesthesia, and disease, they depend on living tissue whose properties are continuous, plastic, and self-regulating. Silicon can copy the graph, it does not copy the life. Even if one denies any quantum or field level role in awareness, the lesson remains [262]. The medium matters for the way the instrument plays, and still, the medium does not explain why there is a player. The most that neural correlates can give us is correlation and constraint. They chart the conditions under which consciousness appears in human life, they do not tell us what consciousness is, nor do they show that consciousness is identical to those conditions [263], [264].

Other philosophies, such as emergentist and physicalist theories of consciousness [55], [70], [101], suggest that consciousness could emerge from a complex enough biological or artificial system without the presence of an immaterial mind. In this way, future developments in computational architectures and neuroscience may offer explanations that are not available today [70], [101]. Though these possibilities cannot be ruled out, this analysis asserts that, as yet, there is no empirical evidence to support the view that increasing the computational complexity leads to the presence of first-person subjective awareness [55], [94], [101]. Therefore, the explanatory gap between information processing and consciousness remains unresolved [55], [94], [101].

Take into account the unity problem. Experience is a bound scene; sounds, colors, meanings, feelings, intentions, etc., are given as a single now [265]. Computers excel at parallel processing and produces lists of results, but not a unified experience. We can write code that incorporates multimodal streams and fuse sensors together, but we cannot create a present that's our own. Time-binding in experience is not a data-aggregation trick; it is a mode of being [266], [267]. Logs cannot be turned into live presence by adding more bandwidth. If the threshold to subjectivity is simply the amount of integration, then thermostats with non-zero integration will be a little conscious, and deep networks with lots of integration will be more conscious than a human being. The reductio shows the claim's emptiness. A theory that attributes consciousness, however minimally, to virtually every integrated system provides little explanatory value for understanding consciousness itself [268].

In this paper, we are dualists, holding that the mind is not identical to the brain. Rather, the brain serves as the organ that hosts and mediates conscious life, whereas the mind constitutes the immaterial principle

that makes subjective awareness possible [269]. For the substance dualist point of view taken in this research, the construction of an organ to carry the signals does not prove the immaterial principle that is the origin of subjective awareness. In this philosophical context, however, merely adding complexity and calculating more is not enough to prove that a circuit can become a conscious subject. This position does not deny that AI systems will continue to become more capable, more general, and increasingly autonomous. Based on this understanding, this study proposes that the concepts of capability and behavioral autonomy should not be interpreted as functions of an inner point of view or of real subjective awareness. The implications of this distinction are both practical and immediate [116], [229].

Scientific research and public policy should therefore remain focused on competence, control, transparency, safety, and accountability. We cannot put our minds into our machines, and we cannot give our machines moral status based solely on performance. But if, one day, we find out how to measure subjectivity not just its proxies in behavior, then the discussion will change. For the present state of the evidence (and the substance dualist theory that was followed in this study), complexity seems to be a means of potentially augmenting computational power, but does not seem to be a means of showing true first-person awareness to the subject [263], [270], [271].

Conflict of interest

None –

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