

Attention as a Gateway to Consciousness: Evaluating the Evidence

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Abstract

Exploring the link between attention and conscious awareness in cognitive neuroscience has sparked numerous debates. This essay seeks to weigh the evidence supporting the idea that attention might be a necessary component of conscious awareness. Drawing on empirical studies and additional philosophical perspectives, it delves into the entwined nature of these cognitive processes and considers opposing viewpoints. Additionally, the essay incorporates related concepts, such as Libet's delay and the Global Workspace Theory, to provide a more comprehensive understanding of this complex relationship.

By scrutinising these subjects, this essay aspires to enrich the reader's comprehension of the interplay between attention and conscious awareness. It synthesises key insights in research, delivering a cohesive and up-to-date overview of prevailing findings.

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1 Introduction

The intricate relationship between attention and consciousness has long been a topic of discussion and inquiry in the fields of cognitive neuroscience, psychology, and philosophy. Attention, broadly defined as the cognitive process that allows us to concentrate on specific aspects of our environment while filtering out others, is vital to our ability to make sense of the world. It encompasses the selective focus on specific stimuli, the management of cognitive resources, and guiding our thoughts and actions based on our goals and interests. On the other hand, conscious awareness refers to the personal experience of recognising and examining our emotions, thoughts, and sensations.

The pivotal question in studying these cognitive processes is whether attention is necessary for conscious awareness. In simple terms, can we be aware of our surroundings without explicitly directing our attention towards them?

This essay evaluates the evidence supporting the assertion that attention is essential for conscious awareness. The following sections will utilise various empirical studies and theoretical perspectives to explore the interdependence between attention and conscious awareness, delving into how these cognitive processes may be interconnected. Furthermore, this essay will contemplate alternative perspectives that challenge the indispensability of attention for conscious awareness, incorporating the philosophical implications of Libet's delay. Ultimately, the author strives to deliver a thorough overview of the intricate relationship between attention and consciousness.

2 Definitions and Interplay

Before diving into the relationship between attention and consciousness, it is imperative to understand the fundamental constructs that underpin these cognitive processes. This section explores consciousness and attention, defining their key aspects and variants.

2.1 Consciousness

Consciousness is a multifaceted phenomenon that plays a vital role in cognitive processes. However, defining its types can be challenging due to the need for a universally accepted classification. The list presented in Table 2.1 provides an overview of various types of consciousness but is not exhaustive, as different typologies have been proposed.

Type of Consciousness	Definition	Examples
Phenomenal Consciousness	Subjective experience	Seeing the colour blue, feeling a sensation of pain, tasting a delicious meal
Access Consciousness	Availability for cognitive processing	Recalling a phone number, recognising a familiar face, understanding a spoken language
Self-Consciousness	Awareness of one's own existence	Recognising oneself in a mirror, feeling embarrassed, reflecting on one's own thoughts and feelings
Higher-Order Consciousness	Awareness of being aware	Reflecting on one's own thinking process, realising that you were not paying attention to a conversation
Global Workspace Consciousness	Integration of information from various sources	Solving a complex math problem, understanding a complex philosophical argument, composing a piece of music

Table 2.1: Types of consciousness with examples.

Phenomenal consciousness focuses on qualitative experiences, whereas access consciousness is concerned with information availability for cognitive processing (Aru & Bachmann, 2013; Block, 2005). Self-consciousness, which refers to the awareness of one's existence, can be exemplified by the mirror test in animals, as shown in Figure 2.1. In this test, a marked monkey recognising itself in a mirror indicates self-awareness (Chang et al., 2015).

Higher-order consciousness involves the awareness of being aware (Carruthers & Gennaro, 2020), while global workspace consciousness represents the integration of information from various sources to tackle complex tasks (Baars, 1997). Gaining a



Figure 2.1: As a component of the mirror test, a monkey observes its own reflection in the mirror (Chang et al., 2015).

comprehensive understanding of these diverse forms of consciousness and other proposed classifications is essential for exploring the relationship between attention and conscious awareness.

2.2 Attention

Attention is a core cognitive process that enables us to focus selectively on specific aspects of our environment while filtering out irrelevant stimuli. There are various types of attention, with selective (Koivisto et al., 2009) and divided attention (McKanna et al., 2009) being two primary examples, as shown in Table 2.2.

In the preceding section, we explored different forms of consciousness, such as phenomenal and access consciousness. Now, we will apply those concepts to deepen our understanding of specific types of attention. Consider selective attention, which can be illustrated by the ‘cocktail party effect’, as originally published in the landmark paper from Cherry (1953), where people focus on a person’s voice in a crowded room while

ignoring other conversations. This raises the question of the extent to which unattended information is processed within the scope of our conscious awareness.

Conversely, divided attention allows simultaneous focus on multiple stimuli, like cooking while listening to a podcast. Research, like Rodrigue et al. (2015), confirms successful dual-task performance under certain conditions.

Types of Attention	Description
Selective Attention	This type of attention is characterised by the ability to focus on one particular stimulus while ignoring other stimuli.
Divided Attention	This type of attention involves the ability to attend to multiple stimuli at the same time without losing focus.

Table 2.2: Two major types of attention and their descriptions.

2.3 Libet's Delay

In the previous section, the author introduced the concept of various forms of consciousness and hinted at the potential role attention could play in shaping our conscious experiences. Libet's delay illustrates a critical aspect of understanding the relationship between attention and consciousness. In Libet's original study, participants were asked to voluntarily move their fingers or hands while carefully noting the moment they became aware of their intention to move (Libet et al., 1983). Notably, Libet found that brain activity reflecting the decision to move actually preceded the conscious awareness of the decision by several hundred milliseconds, as depicted in Figure 2.2. This delay has profound implications for our understanding of consciousness and its relationship to attention.

Libet's findings suggest the intriguing, though contentious, possibility that our subjective experience may not always correspond precisely with underlying neural processes. This introduces complex questions about the role of attention in shaping conscious experiences and adds a temporal dimension to the relationship between attention

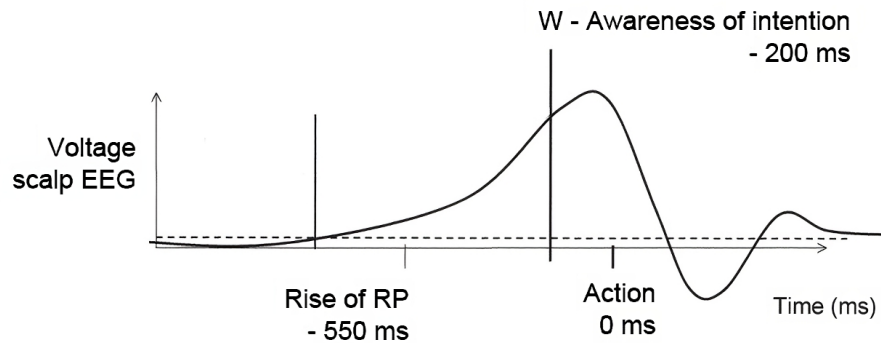


Figure 2.2: This diagram visually represents the critical findings of Libet et al. in terms of the discrepancy between the onset of the readiness potential (a measure of brain activity) and the reported time of conscious awareness of an intention to act (Schurger et al., 2012).

and consciousness (Dijksterhuis & Aarts, 2010). In integrating the concept of Libet's delay into our understanding of selective and divided attention, we introduce an additional layer of complexity into the underlying mechanisms of conscious awareness. Specifically, the delay's potential influence on conscious awareness during these attentional states is worth considering. For instance, in the context of selective attention, where one focuses on a specific stimulus while ignoring others, Libet's delay might mean that the decision to focus on a particular stimulus occurs before one becomes consciously aware of making such a decision. Similarly, for divided attention, where one simultaneously processes multiple stimuli, the delay could imply that decisions about where to allocate attention are made at a neural level before reaching conscious awareness. These considerations underscore the temporal intricacies of the attention-consciousness relationship and highlight the need for further exploration.

The influence of Libet's delay on different forms of consciousness, such as phenomenal and access consciousness, warrants careful consideration. The temporal discrepancy might differentially affect the relationship between attention and phenomenal consciousness compared to its relationship with access consciousness. Phenomenal consciousness could involve temporally separated subjective experiences, whereas ac-

cess consciousness might be less affected by the delay, given that information processing can occur independently of subjective experience (Dijksterhuis & Aarts, 2010; Kozuch, 2018).

3 Attention's Role in Conscious Awareness

The crux of this essay's exploration rests in this pivotal section, where the author delves into attention's substantive role in conscious awareness. The section evaluates empirical studies and investigates the experimental evidence underlining the interplay between attention and conscious awareness. Ranging from investigations of visual search tasks to sensorimotor processes, these studies offer valuable insights into how attention may modulate our conscious experiences.

3.1 Empirical Studies

Several empirical studies provide evidence for the link between attention and conscious awareness. One such study, conducted by Cohen et al. (2012), investigated the attentional requirements of consciousness by manipulating the allocation of attention in a visual search task. Participants were less likely to report conscious awareness of a stimulus when attention was shifted away from it, as shown in Figure 3.1, suggesting that attention is a crucial factor in conscious perception.

Similarly, Kentridge et al. (2004) explored the role of attention in blindsight, a neurological condition in which individuals with damage to the primary visual cortex can respond to visual stimuli without conscious awareness. In their study, the authors demonstrated that when spatial attention was directed towards a stimulus, participants with blindsight exhibited faster response times, despite a lack of conscious awareness. This finding supports the idea that attention can influence unconscious processing and modulate conscious awareness.

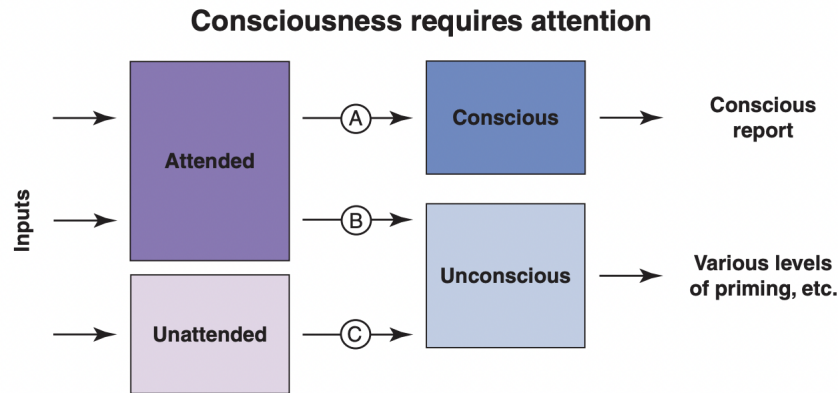


Figure 3.1: Explaining the link between attention and consciousness. According to the model, attention is necessary for information to become consciously aware, but not all attended stimuli will be perceived. Stimuli that are attended to but not perceived can still have measurable effects on behaviour and brain activity. Additionally, stimuli that are not attended to can still cause some neural activity, but the effects will be weaker (Cohen et al., 2012).

Another study by Sumner et al. (2006) investigated the role of attention in sensori-motor processes in the absence of perceptual awareness. The authors employed a visual masking paradigm to render stimuli imperceptible and found that attention could still modulate participants' motor responses to the masked stimuli. This result implies that attention can modulate cognitive processes even when conscious awareness is absent, further highlighting the intricate relationship between attention and conscious awareness.

3.2 Theoretical Perspectives

Various theoretical perspectives also support the notion that attention is necessary for conscious awareness. Baars's (1997) Global Workspace Theory (GWT) positions that consciousness arises when information becomes globally available within the brain, and attention plays a crucial role in selecting and broadcasting this information.

According to this theory, attention acts as a gatekeeper determining which information enters the global workspace and subsequently becomes part of our conscious experience.

De Brigard (2012) proposed an attentional relevance theory, suggesting that attention is necessary for conscious recollecting past events. According to this theory, attention enhances the encoding and retrieval of memories by prioritising information relevant to our goals and interests. This perspective emphasises the role of attention in shaping the content of our conscious experiences, particularly in the domain of memory.

Finally, Dijksterhuis & Aarts (2010) put forth the idea that attention plays a crucial role in goal-directed behaviour. Goal-directed behaviour refers to actions we undertake to achieve specific outcomes and is typically thought to involve conscious awareness. For example, when we form a goal to make a cup of coffee, we need to recall the steps involved consciously, selectively attend to relevant stimuli (like the coffee pot and coffee grounds), and ignore irrelevant distractions. In this sense, attention is seen as a mechanism that activates and maintains cognitive representations of goals, enabling us to consciously pursue and achieve desired outcomes. This perspective underscores the crucial role of attention in bridging the gap between our conscious intentions and actions, further reinforcing the necessity of attention for conscious awareness.

3.3 Alternative Viewpoints and Evidence

While several studies support the necessity of attention for conscious awareness, others challenge this notion. Aru & Bachmann (2013) examined whether phenomenal awareness could emerge without attention using a visual paradigm in which participants reported their conscious experience of stimuli under various attentional manipulations. The authors found evidence for conscious perception even when attention was directed away from the target stimulus. However, it is worth noting that this does not necessarily mean attention is not involved at all. As the feedback suggests, it is possible that participants might still be employing some form of divided attention on the target stimulus, adding another layer of complexity to the interpretation of these results. Nevertheless, the findings suggest that attention may not be strictly necessary for conscious awareness,

at least under certain conditions.

Kentridge et al. (2008) also questioned the sufficiency of attention for visual awareness, examining the interplay between attention and awareness in a patient with visual form agnosia, a condition characterised by the inability to recognise objects despite preserved low-level vision. The authors found that the patient could allocate attention to a stimulus without reporting conscious awareness of its shape or orientation, indicating that attention may be necessary but insufficient for visual awareness.

Furthermore, Kozuch (2018) critically reevaluated the evidence that attention is necessary for consciousness, challenging the conclusions of several well-known studies, including the influential work by Cohen et al. (2012). Kozuch argued that many studies supporting the necessity of attention for consciousness were methodologically flawed or misinterpreted. For instance, some studies may have conflated attention with other cognitive processes or used experimental designs that did not sufficiently control for the potential influence of other factors. Other studies may have made interpretative leaps that need to be fully justified by their data, overemphasising the role of attention in consciousness. These criticisms suggest that the attention-consciousness relationship is still open to debate.

Several theoretical perspectives and philosophical ideas propose alternative viewpoints on the attention-consciousness relationship. Montemayor (2021) posited that consciousness encompasses multiple types, each with distinct neural correlates and functional roles. This perspective challenges the idea of a unified attention-consciousness relationship, suggesting that attention may differentially influence various types of consciousness.

Noah & Mangun (2020) presented a comprehensive review of recent evidence concerning the attention-consciousness relationship, concluding that while attention is necessary for conscious perception, it alone is insufficient for a complete understanding of conscious awareness. They argued that additional factors, such as the interaction

between top-down and bottom-up processes, contribute to conscious awareness. This viewpoint highlights the complexity of the attention-consciousness relationship and encourages further exploration of the underlying cognitive and neural mechanisms.

4 Conclusion

This essay led to a deeper and more nuanced understanding of the interplay between attention and conscious awareness. The pivotal role of attention in modulating and shaping our conscious experiences has been highlighted, as illustrated by the empirical evidence from Cohen et al. (2012) and Kentridge et al. (2004).

However, the necessity of attention for consciousness, while substantial, does not seem to be absolute. The complexity of consciousness extends beyond the sole function of attention and encompasses a variety of factors, such as the interaction between top-down and bottom-up processes.

Alternative viewpoints, such as those presented by Aru & Bachmann (2013) and Kentridge et al. (2008), challenge the prevailing narrative of attention being an absolute prerequisite for conscious awareness. Engaging with these alternative perspectives enhances our understanding of the intricate attention-consciousness relationship.

Libet's delay adds a compelling temporal dimension to our exploration. Its potential implications across different forms of consciousness and attention states underscore the complexities involved in our understanding of attention's role in conscious awareness.

In conclusion, the relationship between attention and conscious awareness, while crucial, is multifaceted and not unilaterally defined by attention. The insights gained from this exploration highlight the dynamism of human cognition. These insights further emphasise the necessity of ongoing investigations into this intriguing interplay to fully unravel human consciousness's complexities.

Bibliography

- Aru, J., & Bachmann, T. (2013). Phenomenal awareness can emerge without attention. *Frontiers in Human Neuroscience*, 7.
URL <http://journal.frontiersin.org/article/10.3389/fnhum.2013.00891> (Accessed at: 2023-04-07)
- Baars, B. J. (1997). Some Essential Differences between Consciousness and Attention, Perception, and Working Memory. *Consciousness and Cognition*, 6(2), 363–371.
URL <https://www.sciencedirect.com/science/article/pii/S105381009790307X> (Accessed at: 2023-04-07)
- Block, N. (2005). Two neural correlates of consciousness. *Trends in Cognitive Sciences*, 9(2), 46–52. Publisher: Elsevier.
URL [https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613\(04\)00318-3](https://www.cell.com/trends/cognitive-sciences/abstract/S1364-6613(04)00318-3) (Accessed at: 2023-04-10)
- Carruthers, P., & Gennaro, R. (2020). Higher-Order Theories of Consciousness. In E. N. Zalta (Ed.) *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, fall 2020 ed.
URL <https://plato.stanford.edu/archives/fall2020/entries/consciousness-higher> (Accessed at: 2023-04-10)
- Chang, L., Fang, Q., Zhang, S., Poo, M.-m., & Gong, N. (2015). Mirror-Induced Self-Directed Behaviors in Rhesus Monkeys after Visual-Somatosensory Training. *Current Biology*, 25(2), 212–217.
URL <https://www.sciencedirect.com/science/article/pii/S0960982214014432> (Accessed at: 2023-04-10)
- Cherry, E. C. (1953). Some Experiments on the Recognition of Speech, with One and with Two Ears. *The Journal of the Acoustical Society of America*, 25(5), 975–979. Publisher: Acoustical Society of America.
URL <https://asa.scitation.org/doi/10.1121/1.1907229> (Accessed at: 2023-04-10)
- Cohen, M. A., Cavanagh, P., Chun, M. M., & Nakayama, K. (2012). The attentional requirements of consciousness. *Trends in Cognitive Sciences*, 16(8), 411–417.
URL <https://www.sciencedirect.com/science/article/pii/S1364661312001519> (Accessed at: 2023-04-07)
- De Brigard, F. (2012). The Role of Attention in Conscious Recollection. *Frontiers in Psychology*, 3.
URL <https://www.frontiersin.org/articles/10.3389/fpsyg.2012.00029> (Accessed at: 2023-04-07)
- Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology*, 61, 467–490.
- Kentridge, R. W., Heywood, C. A., & Weiskrantz, L. (2004). Spatial attention speeds discrimination without awareness in blindsight. *Neuropsychologia*, 42(6), 831–835.

- URL <https://www.sciencedirect.com/science/article/pii/S0028393203002793> (Accessed at: 2023-04-07)
- Kentridge, R. W., Nijboer, T. C. W., & Heywood, C. A. (2008). Attended but unseen: Visual attention is not sufficient for visual awareness. *Neuropsychologia*, 46(3), 864–869.
URL <https://www.sciencedirect.com/science/article/pii/S0028393207004174> (Accessed at: 2023-04-07)
- Koivisto, M., Kainulainen, P., & Revonsuo, A. (2009). The relationship between awareness and attention: Evidence from ERP responses. *Neuropsychologia*, 47(13), 2891–2899.
URL <https://www.sciencedirect.com/science/article/pii/S0028393209002632> (Accessed at: 2023-04-07)
- Kozuch, B. (2018). Gorillas in the missed (but not the unseen): Reevaluating the evidence for attention being necessary for consciousness. *Mind & Language*, 34(3), 299–316. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/mila.12216>.
URL <https://onlinelibrary.wiley.com/doi/abs/10.1111/mila.12216> (Accessed at: 2023-04-07)
- Libet, B., Gleason, C., Wright, E., & Pearl, D. (1983). Time of Conscious Intention to Act in Relation to Onset of Cerebral Activity (Readiness-Potential): The Unconscious Initiation of a Freely Voluntary Act. *Brain : a journal of neurology*, 106 (Pt 3), 623–42.
- McKanna, J. A., Jimison, H., & Pavel, M. (2009). Divided attention in computer game play: Analysis utilizing unobtrusive health monitoring. In *2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, (pp. 6247–6250). ISSN: 1558-4615.
- Montemayor, C. (2021). Types of Consciousness: The Diversity Problem. *Frontiers in Systems Neuroscience*, 15.
URL <https://www.frontiersin.org/articles/10.3389/fnsys.2021.747797> (Accessed at: 2023-04-07)
- Noah, S., & Mangun, G. R. (2020). Recent evidence that attention is necessary, but not sufficient, for conscious perception. *Annals of the New York Academy of Sciences*, 1464(1), 52–63. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/nyas.14030>.
URL <https://onlinelibrary.wiley.com/doi/abs/10.1111/nyas.14030> (Accessed at: 2023-04-07)
- Rodrigue, M., Son, J., Giesbrecht, B., Turk, M., & Höllerer, T. (2015). Spatio-Temporal Detection of Divided Attention in Reading Applications Using EEG and Eye Tracking. In *Proceedings of the 20th International Conference on Intelligent User Interfaces*, IUI '15, (pp. 121–125). New York, NY, USA: Association for Computing Machinery.
URL <https://doi.org/10.1145/2678025.2701382> (Accessed at: 2023-04-10)

- Schurger, A., Sitt, J. D., & Dehaene, S. (2012). An accumulator model for spontaneous neural activity prior to self-initiated movement. *Proceedings of the National Academy of Sciences*, 109(42).
URL <https://pnas.org/doi/full/10.1073/pnas.1210467109> (Accessed at: 2023-05-16)
- Sumner, P., Tsai, P.-C., Yu, K., & Nachev, P. (2006). Attentional modulation of sensorimotor processes in the absence of perceptual awareness. *Proceedings of the National Academy of Sciences*, 103(27), 10520–10525. Publisher: Proceedings of the National Academy of Sciences.
URL <https://www.pnas.org/doi/full/10.1073/pnas.0601974103> (Accessed at: 2023-04-07)