

## A REVIEW ON DISSOCIATIVE PERSPECTIVE OF ATTENTION AND CONSCIOUSNESS

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### Abstract

**Purpose of the study:** To answer the two existing controversies regarding attention and consciousness as brain processes. 1) Can one be aware of objects or events without attending to it? 2) Can one attend to objects or events without being aware of it? And also how top-down attention and awareness have opposing functions.

**Methodology:** This article is a systematic review of the relationship between visual attention and awareness. An extensive elaborate study on concepts relating to attention and consciousness dissociation has been done. In this article we also narrow it down to experimental design that requires independent manipulation of each. Which include top-down attention and awareness aspect of consciousness?

**Main Findings:** Many researches have been put forward supporting the independent nature of attention from awareness using sophisticated experimental and physiological shreds of evidence. On the other hand, some researches still stick to the contemporary common-sense notion of no awareness no attention. Our evaluation suggests an independent nature of attention and awareness.

**Application:** This article intends to give a clear perspective of the ongoing debate on the relationship between attention and consciousness. Simplification of both umbrella terms will give basis for building more empirical evidence.

**Novelty:** Further, this article put forward studies on both sides of debate aiming to bridge the gap to get a conclusive outlook in the future.

**Keywords:** *awareness, attention, dissociation, top-down attention, cognitive debate.*

### INTRODUCTION

Our cognition comprises various phenomena carrying out unique functions, but it's difficult to functionally separate them at both behavioral and neural levels beholding intricate neural bonding. Rather this intricacy makes the work of researcher more challenging and crucial. [Mole \(2008\)](#) suggested that this growing dissatisfaction amongst scientists upon the relationship shared between attention and consciousness is becoming haunting. Most philosophical early works on attention in itself implied to be a study of consciousness ([James, 1890](#)). [Posner \(1994\)](#) felt a need to drift from philosophy to experimentation, and the findings have always surprised us with not so ideal common sense view held earlier.

This essay intends to bridge the gap between contemporary and modern work in the area focusing more on the evolution of the definition of attention and consciousness based on the debate. Suppose you are in a hurry and you need to find keys on your desk, it obvious that "keys" occupy your focus among rest of the stuff on the desk and thus at the same time your awareness too, but let say during your search simultaneous question about other things on the table like, "Was there a pen on the table?" Or "what color was the pen?" etc. is put up to you, you will be able to answer some of them without even having a focused gaze at the pen. This might turntable for you on an existing definition that points on the necessity of awareness for attention and vice versa. To understand this example better first one should perceive that awareness, in general, is the entire plethora of stimulus in your visual field while attention is focused on specific things based on your needs, interest, etc. Theory and reality thus stand apart, based on simple introspection as sole measure of consciousness and other contemporary resources some scholars suggest a tight and dependent relation between attention and awareness ([Brigard & Prinz, 2010](#); [Cohen, Alvarez, & Nakayama, 2011](#); [Cohen, Cavanagh, Chun, & Nakayama, 2012](#); [De Brigard, 2010](#); [Mack, 2003](#); [Merikle & Joordens, 1997](#); [Mole, 2008](#); [Posner, 2008](#); [Regan & Noë, 2001](#)). In mid of the contemporary techniques used to satisfy the common-sense notion of the relationship, [Braun & Julesz, \(1998\)](#) came up with a dual-task paradigm that objectively helped to manipulate attention and awareness independently in an experimental scenario. Even another paradigm like priming paradigm, voluntary involuntary attention experiment help to establish a more scientific ground. These recent studies using sophisticated physiological evidences in support of behavioural evidences have cumulated a different proposal stating an independent nature underlying different neuronal processes ([B J Baars, 1999](#); [Bernard J Baars, 1997](#); [Boxtel, Tsuchiya, & Koch, 2010](#); [Bussche, Brussel, & Brussel, 2012](#); [Dehaene & Naccache, 2001](#); [Fei-fei, Koch, & Perona, 2005](#); [Kentridge, Heywood, & Weiskrantz, 1999](#); [Lamme, 2003](#); [Tsuchiya & Koch, 2009](#); [Vanrullen, Reddy, & Koch, 1973](#)).

Since long "no consciousness no attention" and vice-versa has been considered as a common-sense notion ([Mole, 2008](#)). But as our research horizon is growing we need to rethink it. Consciousness is not merely automated and blinded respond to environmental stimulus rather it has a unique way of processing. ([Marchetti, 2018](#)) Explained consciousness produces information rather than just transmitting and even information produced are meaningful which is individuated. Whereas

attention possesses a spatial quality and direction, thus self and attention are necessary but not sufficient for conscious processing. Consciousness studies have come far from being just a philosophical term, today major challenge stand on grounds on consensus of empirically measuring it and identifying neural correlates of it ([Overgaard, 2017](#)).

## CURRENT PERSPECTIVE ON TERMS ATTENTION AND CONSCIOUSNESS

The rationale behind understanding the relationship between attention and consciousness has an interesting fact that has to be answered when attentional cues are not consciously perceived is it still able to bring a certain amount of alertness or cognitive functioning? But before entering into the debate we shall see aspects of attention and consciousness that are considered in order to resolve this tussle. Consciousness as a whole in one experiment is impossible to consider and manipulate so order to set the stage for future work.

### Contemporary view on Attention and Consciousness

[Posner \(2012\)](#) clarified various aspects of consciousness, bifurcating aspects of consciousness help scientist to pick ideas for further experimentation.

- Firstly the level of consciousness these include various brain and body states which decide our capabilities to respond (Coma, sleep, awake, vegetative state), the idea that alert state makes us conscious automatically is not true as in vegetative state evidence of arousal has been found but not awareness. So in order to experimentally formulate a study design for understanding the relationship between both, the state aspect of consciousness is not being manipulated directly. Because at this stage it is experimentally very difficult to formulate such designs where data can be acquired with participants in coma or sleep.
- Second is the sensory awareness that is defined by the knowledge of the surrounding environment, we hold the notion that we are fully aware of our environment thou our focused awareness is on our internal thoughts, studied on awareness have differentiated overall knowledge of the surrounding (ambivalent awareness) and focused knowledge of the scene (focal awareness) (Iwasaki, 1993). Thus sensory awareness helps us to carry out cognitive functions like discrimination, categorization, etc. And this cognitive function has been taped in dual-task experimental designs to check the relation between attention and awareness.
- Lastly, the volition aspect of consciousness that is the human intentional voluntary consciousness that guides us to the stimulus we react to. beside

Each following type of consciousness according to Posner overlaps with those for a distinct type of attentional networks of alerting, orienting and execution respectively. Most recent studies has been found that despite high frequency chromatic flicker in an ANT task, fails to reach awareness still producing an alerting and orienting effect proving the evidence for no overlap of consciousness levels with certain attentional aspects ([Lu, Cai, Shen, Zhou, & Han, 2012](#); [Mudrik, Faivre, & Koch, 2014](#)). A sceptical view on conscious prevailed among scientist, as it can be accepted that despite and attentional allocation some form of cognitive functions like simple discrimination task, recognition task, etc. as in case of finding keys could be performed but while reporting the observed object to others an immediate demand of conscious awareness sets in. So, [Block \(1996\)](#) gave the concept of Phenomenal and Access consciousness, he explained P-consciousness is as the result of sensory experience that does not involve any cognition while A-consciousness rational and reflective form of conscious for which reportability is the key element. Both are aspects of the same awareness and even if it could not be put into empirical investigation for so long, preconceive notion on dependent relation has to be mended ([Phillips & Phillips, 2018](#)).

While when attention as a whole was considered to study the relationship with consciousness, evidence showed that some kind of attention was always associated with consciousness at various levels and conditions ([Marchetti, 2012](#); [Posner, 2012](#)). [Chica & Bartolomeo \(2012\)](#) then dissected attention into exogenous/bottom-up and endogenous/ top-down, while they studied the ruling of consciousness in each of attentional aspect and found that top-down attention can exclusively found to be dissociated with attention in many aspects. This kind of results were further subjected to various experimental evidence claiming endogenous attention is neither necessary nor sufficient for conscious agreeing ([Boxtel, Tsuchiya, & Koch, 2010](#); [Fei-fei et al., 2005](#); [Jennings, 2015](#); [Koch, 2013](#); [Li, Vanrullen, Koch, & Perona, 2002](#)).

### Evidence of double dissociation of attention and consciousness

As attention and awareness we see is an umbrella term. Both include various sub-classifications in order to manipulate them separately and see how one is associated with others. Various paradigm like Dual Task ([Fei-fei et al., 2005](#); [Reddy, Moradi, & Koch, 2007](#); [Vanrullen et al., 1973](#)), spatial allocation task ([Eimer & Grubert, 2014, 2015](#); [Grubert, Grubert, & Eimer, 2016](#)), attentional blink ([Elliott, Baird, & Giesbrecht, 2016](#); [Shapiro, Raymond, & Arnell \(1997\)](#)), priming paradigm ([Bussche, Hughes, Humbeeck, & Reynvoet, 2010](#)), oddball phenomena ([Snyder, Gregg, Weintraub, & Alain, 2012](#)) etc. extensively study various aspects of attentional relationship with consciousness. These studies thou hold a very valid point showing a dissociative relation but a little compromised due to our limitations as a living being has been brought forth. Some researchers have claimed that a state of no consciousness is nearly impossible to achieve in normal condition and so is a state of attention, so we must say then these both are counterbalancing each other and corrected the term consciousness as “awareness” and absence of attention as “near-absence of attention”.

To explain the double dissociation between attention without consciousness and consciousness without attention, [Koch & Tsuchiya \(2006\)](#) have given a fourfold concept of the relation amongst the two. And stating various behavioral measures and neurological evidence claims the dissociation

- *Top-down attention that gives rise to consciousness*, the idea that being attentive in order to gain consciousness of any stimuli, has gained support from the work of [Mack and Rock's, \(1999\)](#). Their work on changed blindness is the failure to experience potential dramatic changes that would otherwise be noticed. Studies on inattentive blindness showed that failure to experience other stimuli when attention is focused elsewhere ([O'Regan & Noe, A. 2001](#); [Jensen, Yao, Street and Simons, 2011](#)). Both this paradigm pointed on diverse attentional demands at the conscious level, CB required focused attention to detect the change while IB required diffused attention to notice the unexpected change ([Rensink & Columbia, 2009](#)), working memory and reportability are also included in this matrix,
- In the second fold, he puts *top-down attention in the absence of consciousness* which includes cases like priming, adaptation, visual search. [Dehaene & Naccache, \(2001\)](#) showed that attention has to determine effect on not only consciousness but also unconsciousness and so both cannot be identified as same, in case of visual search, for example, searching a particular book amongst the pile tends us to pay attention to an invisible book and its features so this clearly throws light that attention does not necessarily engage consciously.
- Thirdly is the consciousness in the near absence of attention, many of the recent scholars have experimentally and using neuroimaging has found this to be true for gist, iconic memory, pop-out search, gender discrimination. [Boxtel, Tsuchiya, & Koch, \(2010\)](#) explained based on experimental evidence. Attentional blink experiments in which failure to report the second target when two targets are presented in rapid succession stated that attention cannot be a sufficient condition to enable consciousness ([Shapiro 1997](#)). [Koch & Tsuchiya, \(2006\)](#); [Li et al. \(2002\)](#) showed natural scene vs unnatural scene detection while simultaneously working on an attentionally demanding task, ([Reddy, Reddy, & Koch, 2006](#); [Vanrullen et al., 1973](#)) found well performance of color and gender discriminative function in dual-task. ([Taylor & Fragopanagos 2007](#); [Fei-Fei et al., 2002](#)) said subject use multiple foci of attention in order to perform in dual-task, ([Houtkamp & Braun, 2010](#)) experimented on colour and orientation discriminative task and found color discrimination does not require attention while orientation required, various other dual-task experiments have found that we can be conscious in near absence of attention, the major challenge in testing this hypothesis is to create a situation of no attention which is rather an impossibly challenging in humans.
- And lastly ([Koch & Tsuchiya, 2006](#)) gave a matrix of no attention and no consciousness phase which is zombie-like behaviour, afterimage comes in a recent study ([Boxtel et al., 2010](#)) independently manipulated awareness and attention in afterimage induction and perception phase by inducing a attentional distractor at fixation and found that attention decreases the afterimage and awareness increases, thus finding an opposing relation between attention and consciousness.

### Underlying neural mechanism

The above arguments well establish the fact the visual awareness and visual attention can be dissociated. Brain studies have pointed out the distinct neural activation in experiments probing both attention and consciousness manipulation, a cumulative-information model has been suggested as both involve a different neural pathway for processing feeding to single decisional processing which acumen to dependent nature ([Tallon-Baudry, 2012](#)). MRI scan during aware and unaware stimulus revealed a large amount of activity was clustered in temporoparietal junction (TPJ) which is formally associated with awareness, activity was also observed in other attentional areas (ventral attentional network and frontoparietal area) but no activity was seen in area connecting it ([Webb, Igelström, Schurger, & Graziano, 2016](#)). Comparative brain imaging and EEG techniques on humans and monkeys, with electrophysiological recordings at the single-cell level in awake monkeys, provide information on reliable neural correlates on existence of conscious versus nonconscious perceptual processes ([Lamme 2003](#)). Consciousness activation in brain is solely independent of attention but extent to which these recurrent interactions involve other executive space depends on attention and determines whether or not a conscious report is possible about the sensory experiences, and not whether the sensory experience exists, and this makes the relationship intricate ([Lamme, 2004](#)).

### GENERAL CONCLUSION AND DISCUSSION

With keeping in mind the limitations state of a complete absence of attention and consciousness cannot be achieved, the best way to resolve this issue is seeing and understanding it at various interactional levels of each of their sub-classifications. And even using different sense modality not restricting to only visual awareness. This article intends to inspire the researchers for further conceptual and empirical work in this area. Understanding the proper definition for these kinds of work is very important as attention and consciousness are both very widely used terms in a variety of ways. Untangling this relation is the necessary step toward uncovering the neuronal basis of both attention and consciousness.

### Limitation and study forward

In this article, a connection between the contemporary and present views on the relationship between attention and awareness has been brought in light. As cognitive science research its horizon, the exact neural connections need to be explored. While this paper restricts to top-down attention and awareness aspect of consciousness for empirical

manipulations, but more aspects can be reflected for a wider perspective. Each aspects of attention and consciousness should be put to test for global understanding. And for this an inter-disciplinary research team can innovate better.

### Application of the study

Firstly it will help to settle the ongoing debate and encourage more research work in concern area, Secondly, with the advancement in artificial intelligence, where a steel being can perform many mental functions like a human but needs to be commanded. The scientist is now working toward artificial consciousness, which would make machine more human-like. Again some call it a “utopia”, so what, even robot were utopian sometime. So understanding its relation with attention will help entangle the neuronal complexity.

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