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Review Article

Relation Between Visual Attention and Consciousness: An Overview

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Abstract

In the field of consciousness, disagreements between the theories of recurrent processing and global neural workspace have generated a lot of discussion. Here, we concentrate on the suggested connection between consciousness and attention, which is one of the main differences between these theories. Examining current empirical data, we contend that both theories offer important insights and that some of each theory's components can be combined. Many studies have suggested a close relationship between attention and consciousness. They also suggested that without attention, we are not able to be aware of any objects. On the other hand, some research findings suggested that we can manipulate attention in the absence of consciousness. Some research paradigms, i.e., in-attentional paradigm, dual task paradigm, and priming paradigm, are used for a better understanding of the relation between attention and consciousness. We also focus on an object without being aware. This controversy leads to the question of whether we can attend to an object without being aware of it or not. In the present study, we reconcile the ongoing debate of the relation between attention and consciousness.

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INTRODUCTION

Our visual system becomes aware of diverse semantic and relevant stimuli in the environment. The human cognitive system is involved in the process of selecting, filtering, and analyzing of information. This type of processing is accomplished by various cognitive subsystems, one is attention. The attention system included the following in this processing: Top-down (endogenous) and bottom-up (exogenous) attention, as well as spatial attention to locations, sensory characteristics, moments in time, or complete perceptual objects. On the other hand, consciousness can be defined as the state of arousal and refers to our awareness of innovative thoughts, feelings, sensations, and our visual environment. Baars (1997) introduced a variety of content that can include forms of consciousness i.e. visual images, silently talking to us, our memory of life events, our perception of the world, activities of daily life, and our view toward others. Recent research reported that visual attention and awareness are related to each other. This does not suggest that everything that is attended by our visual system is accessible to visual awareness, or vice versa. This is a debated view on how

visual attention may interconnect with visual awareness. One way to enhance our understanding is that visual attention may be independent of visual consciousness. The present study tried to examine the exact nature of the relation between attention and consciousness. First, discuss the basic concept related to attention, consciousness, and the relationship between attention and consciousness.

Attention

With its hundred billion neurons and several hundred trillion synaptic connections, the human brain is recognized for its remarkable complexity and processing speed. Using a distributed neural network, it can process and transmit large amounts of data in milliseconds. Our visual system was once thought to be capable of successfully decoding complex pictures in as little as 100 milliseconds (Rousselet *et al.*, 2004). However, current research suggests that this processing can be completed in very little as 13 milliseconds (Potter *et al.*, 2008). Despite the processing speed of the human visual system, it's the capacity to process information about multiple visual objects simultaneously (Cowan, 2011). The human visual system has produced two solutions to this problem. The first is various levels of raw data capture since the image on the retina is only processed in full detail at the fovea, while at the periphery, where receptors are more widely distributed, the area of processing demonstrative of the visual periphery on the cortex is smaller and information is consequently much less (White *et al.*, 1992; Wilson, *et al.*, 1990) and data is consequently much more indelicately sampled (Wolfe, 1994). The second is to selectively process incoming data (Wolfe, 1994). A simple experiment will show this reduced processing power. This limited processing ability can be revealed with a simple experiment. Our environment gives rise to a large amount of sensory information that is more than our brain can process at the same time. The most important stimuli in the physical world are selected for processing by the human sensory system, while less relevant information is ignored. This process of selecting information is referred to as visual attention. Top-down or endogenous attention and bottom-up or exogenous attention is the two most common classifications for visual attention. Top-down attention refers to internal driven factors to stimuli based on prior knowledge, willful plans, and current goals while externally driven factors to stimuli that are salient because of their inherent properties relative to the background are referred to as bottom-up attention. Neurophysiological studies have revealed new information about the neural pathways and processes of top-down and bottom-up attention in over the past few years. Several studies described attention as a collection of mechanisms that underlie our understanding of the world and enable us to control our thoughts and feelings voluntarily (James, 1980; Dember & Warm, 1979; Yantis, 2000; Posner & Rothbart, 2007). Physical properties of the stimulus (size, intensity, velocity, etc.), collative characteristics of the stimulus (novelty, surprise, incongruity, etc.), and responses related to individual orientation also influence attention (Dember & Warm, 1979). Attention is a basic cognitive function that serves as a stepping stone into the field of attention and awareness. As a result, it has become a growing field of psychology and neuroscience (Posner & Rothbart, 2007).

Content of consciousness

In normal circumstances, awareness almost has content. Each of us can be fully conscious, dream, sleep deeply, or be anaesthetized. These are common modes of consciousness. On the other hand, we can be conscious of different things like a dog, a piece of paper, the taste of coconut, and many other things in their more general forms. It is information about the environment or the person, one's bodily and mental states. As a result, we are aware when we feel pain, perceive an object, visualize an image, recall a memory, or have an imaginary thought. Therefore, the content of one's awareness can refer to an external, physical object as well as an inner feeling, image, thought, or act of violation. The content of awareness can be real or fictitious. It is not about an object or an image, but about a person's identity; self-awareness can be a distinct perception or a diffused sensation with no clear-cut identification (Rao, 2008).

Attention and consciousness

The relationship between visual attention and consciousness is a matter of great interest and ongoing controversy among scholars. Selective attention and consciousness are two aspects of the brain process that are deeply intertwined. Scholars believed that we are aware of what we attend to. However, when we shift our attention away from an event or object, we lose awareness of its characteristics and attributes. Usually, what exceeds the threshold of visual awareness is the result of an attentional step. That is, attention and awareness are inextricably linked together. Although the consequences of attention are assumed to reach consciousness, the attentional mechanism itself is likely to be largely unconscious (Crick & Koch, 2003). Some authors have recently argued that attention and consciousness are distinct processes and share distinct mechanisms (Iwaski, 1993; Crick & Koch, 2003; Naccache *et al.*, 2002; Lamme, 2003; Cavina-Pratesi *et al.*, 2010; Bachman, 2006; Dehaene *et al.*, 2006). This brings up the question of the causal relationship between these two processes. Does consciousness necessarily require attention? Despite of, good evidence indicates that consciousness cannot exist in the absence of attention (Dehaene, et al, 2006). Consciousness aims to investigate conceptual bases (Block, 2005), ontological grounds (Chalmers, 1996), and psychological grounds (Tulving, 1993). Filtering, anterior and posterior brain circuits, bottom-up (exogenous attention) and top-down (endogenous attention) factors are all studied in the context of attention (Posner & Peterson, 1990). A two-by-two taxonomy proposed by Koch and Tsuchiya (2007) and claimed that top-down attention and consciousness are two distinct phenomena that can be separated from each other. More precisely, they differentiate four states: 1. Attention with consciousness 2. Attention without consciousness 3. Consciousness in the near absence of attention 4. Independent manipulation of attention and consciousness. A great number of authors claimed that there is proof of awareness without attention. Dual-task paradigm such as scene categorization (Li, 2002; Koch & Tsuchiya, 2007),

gender discrimination (Reddy, *et al.*, 2004), and face identification (Reddy, at al., 2006) experimentally support that consciousness can be present in the near absence of attention (Koch & Tsuchiya, 2007; Li, *et al.*, 2002). Several studies reported that the attention and consciousness can be manipulated independently (Kanai & Kubawara, 2006; Bahrami, *et al.*, 2007; Bussche et al, 2010). These studies demonstrated that attention can be directed without conscious awareness, consciousness occur in the near absence of attention and both can be manipulated independently with each other.

CONCLUSION AND FUTURE DIRECTION

Many of the leading theories regarding the neural basis of consciousness give the idea to be opposing. Each may contribute key insights to the relationship between attention and consciousness. Determining the exact relationship between attention and consciousness may provide a path towards achieving a comprehensive concept. Future studies should fully explore the space created by various manipulations of attention and stimulus strength, while considering a wider field of theories as well as individual components of each theory. Thus, attention is one of the basic phenomena where we attend stimulus without being conscious while analyzing of any information consciousness play an important role. This finding also concerned with different area of psychology i.e. cognitive psychology, neuro-psychology. Present review paper also expands the area of top down attention and consciousness and gives theoretical support of the field of cognitive psychology.

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