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Type 2 blindsight and the nature of visual experience

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ABSTRACT

Blindsight is a kind of residual vision found in people with lesions to V1. Subjects with blindsight typically report no visual awareness, but they are nonetheless able to make above-chance guesses about the shape, location, color and movement of visual stimuli presented to them in their blind field. A different kind of blindsight, sometimes called type 2 blindsight, is a kind of residual vision found in patients with V1 lesions in the presence of some residual awareness. Type 2 blindsight differs from ordinary visual experience in lacking the particularity, transparency and fine-grainedness often taken to be essential to visual experience, at least in veridical cases. I argue that the case of type 2 blindsight provides a counterexample to the view that these characteristics are essential to veridical visual experience and that this gives us reason to resist the view that visual experience is essentially a perceptual relation to external objects. In the second part of the paper I argue that the case of type 2 blindsight yields important insights into the effects of attentional modulation on perceptual content and that cases of attentional modulation of appearance are not at odds with the view that the phenomenology of visual experience flows from its content.

1. Introduction

Blindsight occurs as the result of damage to the striate cortex (V1) which results in a scotoma, or region of blindness in the visual field (Perenin & Jeannerod, 1975; Poppel, Held, & Frost, 1973; Weiskrantz, Warrington, Sanders, & Marshall, 1974). Individuals with a scotoma typically report no visual awareness of visual stimuli presented to them in their blind field. But they nonetheless have a preserved ability to correctly guess the attributes of visual stimuli when forced to respond. Blindsight subjects have been shown to make above-chance determinations of the motion, location, form and wavelength of stimuli they report not seeing (Stoerig & Cowey, 1992; Weiskrantz, 1986). The exact mechanism underlying blindsight is unknown but it is believed that in most cases of blindsight the retinal information is projected to subcortical structures that project directly to extrastriate regions, thus bypassing V1. It remains a possibility that some blindsight subjects present with spared islands of V1 that carry information from subcortical structures to extrastriate regions. For example, one patient RD with extensive, unilateral lesions of VI was found to have complete blindness in the right lower quadrant and residual vision in the right upper quadrant that probably was due to spared islands of functional tissue in V1 (Barbur, Watson, Franckowiak, & Zeki, 1993). However, the majority of blindsight subjects do not seem to have any spared islands in striate cortex that could explain the residual visual abilities (Zeki & Ffytche, 1998).

Although blindsight was originally defined as visual abilities in the absence of reported visual awareness, some subjects have been found to have residual conscious awareness in their affected hemifield despite extensive V1 lesions. These

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patients appear to have residual vision for stimulus attributes that they are unaware of, but they show residual awareness of the presence and direction of fast moving and/or high-contrast visual stimuli, and this awareness often positively correlates with their abilities to discriminate (Barbur et al., 1993; Zeki & Ffytche, 1998). The observation that some blindsight subjects have a form of residual awareness has resulted in a division of blindsight into type 1 and 2 (Weiskrantz, 1998a, 1998b). In type 1 blindsight a subject with lesions to V1 has residual vision in the absence of reported awareness; in type 2 blindsight subjects with lesions to V1 have a form of residual awareness that is positively correlated with their residual visual abilities. Type 2 blindsight is also known as Riddoch syndrome, named after army officer George Riddoch, who found motion awareness in the scotomatous fields in soldiers with lesions to striate cortex but no abilities to characterize other attributes of the visual stimuli (Zeki & Ffytche, 1998). Riddoch's patients would report seeing the motion of objects but would claim that they had no distinct shape or color or that they had an appearance that they would describe as 'shadowy grey' or 'like a shadow'. One patient reported being able to determine the color of the stimulus when the stimulus was white and another denied seeing motion but reported that he knew when something had moved through his hemianopic field.

To what extent the phenomenology of blindsight is like degraded normal vision is still debated (Azzopardi & Cowey, 1997; Overgaard, Fehl, Mouridsen, Bergholt, & Cleeremans, 2008; Weiskrantz, 2009; Overgaard & Grünbaum, 2011; Brogaard, 2012). However, there is a growing consensus that type 2 blindsight is a kind of veridical visual experience (Ffytche & Zeki, 2011; Zeki & Ffytche, 1998). Here I will argue that the case of type 2 blindsight casts doubt on certain dogmas about the nature of visual experience. Though it's disputed whether the phenomenology of visual experience is constituted by external objects, it is widely held that the core phenomenology of visual experience can be given by citing the external object that gave rise to it (Brewer, 2007). Visual experience is furthermore said to be transparent in the sense that we see through any internal features of the experience and see only the external object and its visually perceivable property instances (Harman, 1990; Tye, 2002). Finally, it is often said that visual experience differs from thought in that maximally determinate properties are presented in visual experience (e.g., carmine as opposed to red), whereas determinable properties are presented in thought (e.g., red as opposed to carmine) (Bermudez, 1995; Brewer, 2007; Peacocke, 1992). However, type 2 blindsight appears to differ from other types of veridical visual experience in all of these respects. In type 2 blindsight subjects typically report that they are aware of 'something' or have a feeling that 'something is happening' but they deny being directly aware of the external object that triggered their experience. The external object is experienced as occluded by shadows or blackness. The reason type 2 blindsight differs from ordinary visual experience in terms of particularity, transparency and fine-grainedness may be that it is generated by an alternative visual pathway that bypasses V1. V1 has been found to be crucial for generating brightness perception (Morland et al., 1999). Type 2 blindsight cases thus give us reason to resist a view of visual experience as essentially object-involving, transparent and maximally fine-grained. Given that these characteristics are not essential to visual experience, we will have to rethink the proposal that visual experience is fundamentally a matter of being directly perceptually related to an external object. In the second part of the paper I argue that the case of type 2 blindsight yields important insights into the effects of attentional modulation on perceptual content and that cases of attentional modulation of appearance are not at odds with the view that the phenomenology of visual experience flows from its content.

2. Type 2 blindsight

Residual awareness in blindsight subjects was already reported when the first cases of blindsight were published by Larry Weiskrantz and others (Weiskrantz, 1986). However, researchers originally sought out experimental conditions that would eliminate the residual awareness. It was found that eliminating type 2 awareness sometimes resulted in an improvement in performance (Weiskrantz, 1986). Since the first reported cases of the condition, there have been numerous studies of residual awareness in blindsight subjects. In some cases, type 2 blindsight may be the result of spared islands of activity in V1. Subject RD, for example, was found to have abnormal conscious awareness of visual stimuli, including impoverished discrimination and unusual motion perception, describing moving lights as 'balls of fire' (Barbur et al., 1993). In this case the residual awareness might have been due to spared islands of activity in V1. However, activity in spared striate regions has been ruled out in most cases of blindsight. The widely studied blindsight subject GY was found to have large lesions to striate cortex GY that could not fully account for his residual visual abilities or the residual awareness under high contrast/high speed conditions (Barbur et al., 1993; Weiskrantz, Barbur, & Sahraie, 1995). It is widely thought that GY's residual vision in the absence of awareness involves direct projections from subcortical areas to extrastriate regions. Using an fMRI paradigm Zeki and Ffytche (1998) found that both fast-moving stimuli associated with awareness and slow-moving stimuli not associated with awareness in GY led to activity in V5/MT but at different levels of intensity. They also found covariation in the dorsal stream (area V3 and the parietal cortex) as well as the right middle frontal gyrus, but it is unclear to what extent this activity contributed to GY's residual awareness and visual abilities. On the basis of the data from studies of GY and other subjects with both type 1 and type 2 blindsight Zeki and ffytche (1998) hypothesized that the two conditions are manifestations of a single mechanism under different experimental conditions. V5/MT receives its input directly from V1 (Cragg, 1969) but there are also projections to this area directly from the lateral geniculate nucleus (LGN) (Benevento & Yoshida, 1981; Fries, 1981; Yukie & Iwai, 1981) and via the superior colliculus projecting to the pulvinar nucleus, which in turn projects to V1 (Benevento & Standage, 1983). So, a likely mechanism underlying type 1 and type 2 blindsight is that direct projections to V5/MT from subcortical regions bypassing V1 can result in vague conscious awareness of motion or residual