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Don't be fooled! Attentional responses to social cues in a face-to-face and video magic trick reveals greater top-down control for overt than covert attention

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ABSTRACT

People's attention is oriented towards faces, but the extent to which these social attention effects are under top down control is more ambiguous. Our first aim was to measure and compare, in real life and in the lab, people's top-down control over overt and covert shifts in reflexive social attention to the face of another. We employed a magic trick in which the magician used social cues (i.e. asking a question whilst establishing eye contact) to misdirect attention towards his face, and thus preventing participants from noticing a visible colour change to a playing card. Our results show that overall people spend more time looking at the magician's face when he is seen on video than in reality. Additionally, although most participants looked at the magician's face when misdirected, this tendency to look at the face was modulated by instruction (i.e., "keep your attention on the cards"), and therefore, by top down control. Moreover, while the card's colour change was fully visible, the majority of participants failed to notice the change, and critically, change detection (our measure of covert attention) was not affected by where people looked (overt attention). We conclude that there is a tendency to shift overt and covert attention reflexively to faces, but that people exert more top down control over this overt shift in attention. These finding are discussed within a new framework that focuses on the role of eye movements as an attentional process as well as a form of non-verbal communication.

1. Introduction

What we see is strongly influenced by what we attend to, and it is a truism that visual attention is controlled in two basic ways. One is exogenously, through bottom-up stimulation from the external world (Itti & Koch, 2001), and the other is endogenously, through top-down internally generated intentions (e.g., Folk, Remington, & Johnston, 1992). Traditionally, these two forms of attentional control have been investigated using simple stimuli, such as light flashes or computer beeps (Posner, 1980). However, more recently, biologically meaningful stimuli have been used as they seem to be prioritized by the attention system, and are governed by principles that were not necessarily captured by those generated from studies using simpler nonsocial stimuli (Birmingham, Bischof, & Kingstone, 2009; Kingstone, Smilek, & Eastwood, 2008).

To date, however, the bulk of the research studies with social stimuli have themselves been conducted in a fairly socially impoverished manner, with the standard experiment framed around a single participant sitting alone in a testing room looking at social stimuli, e.g., pictures of people. What these studies have revealed is that people prioritize faces, especially the eyes (Birmingham, Bischof, & Kingstone, 2008) and that people reflexively attend to where the eyes of a face are looking (Friesen & Kingstone, 1998). Moreover, it is clear that all faces are not treated equally, with people prioritizing faces on video that are speaking (Foulsham & Sanderson, 2013), suggesting that the effect of social stimuli on visual attention extends to dynamic auditory stimulation. Nevertheless, there do appear to be some important limitations to these lab-based investigations, the most notable one being that the results derived using images of social stimuli often fail to extend to real life situations composed of people. For example, Laidlaw, Foulsham, Kuhn, and Kingstone (2011) have shown that when a stranger is in a room people are far less likely to look at that person than if that person was presented on a computer screen, despite the fact that the image of the person on the computer was far smaller

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and less salient than that of a real person. Similarly, Gallup et al. (2012) have demonstrated that in real life people tend to avoid looking where someone else is looking (unless they can do it discreetly), which conflicts with lab-studies reporting that people automatically attend to where eyes in images are directed. In other words, the relationship between gaze direction and attentional shifts is far more complex in real life than lab-studies would suggest, a point driven home recently by Wu, Bischof, and Kingstone (2014, 2013) who revealed that when eating with another person, people use their eyes to communicate when they are about to take a bite of their food causing the other person to look away.

One overarching principle to emerge from these comparisons between life and lab is that in every day life people exert top-down control over attention in a manner that is often divergent to what has been observed in the lab. Our working hypothesis for why this disconnection exists is that in real life one's own eyes are used both to observe people and to communicate to them, just as their eyes are used to observe and signal to you and others. This dual function of one's eyes – observation and communication – is absent when one is simply looking at images of individuals. Because images of people neither observe one's gaze nor communicate back, one's own eyes merely serve to observe and do not communicate to the image (Wu et al., 2014). Thus, in the lab it is perfectly acceptable to stare at the eyes of a stranger's image, but in real life, this would be abnormal behaviour (Kingstone, 2009).

Accordingly, in the present study we were very sensitive to the fact that the manifestation of social attention may change dramatically as one shifts between lab and life, and therefore we chose a task – a magic trick to be precise – that we had good reason to believe would engage social attention in a similar manner when the magician was live as when he and the trick were shown on video. Kuhn and Land (2006), Kuhn, Tatler, and Cole (2009) have demonstrated repeatedly that a magician's trick that depends on social cues to misdirect attention is successful whether it is performed live or recorded and played back on video.

To date, measures of real world attention have been restricted exclusively to overt forms of attentional orienting, i.e., shifts in head and eye movements. While at first blush this seems reasonable, as people tend to look at what they attend to, it is well established that people can attend covertly to objects that are positioned at locations away from where their eyes are directed (for review see Smith & Schenk, 2012). What role covert attention plays in natural real world social attention is very much an open question and a crucial one that the present study investigates.

Magicians use misdirection to prevent people from detecting their secret methods (Kuhn, Caffaratti, Teszka, & Rensink, 2014), and many of these misdirection techniques involve manipulating both overt and covert attentional processes (for review see Kuhn & Martinez, 2012). For example, misdirection is not only effective in manipulating where people look, but it is also extremely effective at preventing people from perceiving visually salient events, which in turn provides a valuable index of covert attentional orienting (see Kuhn & Findlay, 2010). Of critical relevance to the present study, it has been demonstrated that misdirection can be used to study attention in the real world (Kuhn & Tatler, 2005), as well as in the lab (Kuhn, Tatler, Findlay, & Cole, 2008), which makes it an ideal tool to compare attentional processes in these different contexts.

Magicians use a wide range of social cues to misdirect attention (Kuhn et al., 2014). For example, directional gaze cues effectively orient overt and covert attention towards a looked at location (Cui, Otero-Millan, Macknik, King, & Martinez-Conde, 2011; Kuhn & Land, 2006; Kuhn et al., 2009). Here we investigate people's reflexive tendency to look at faces by exploiting a powerful social misdirection technique frequently used by magicians. Magicians often draw the spectator's attention towards their face by asking them a question whilst establishing eye contact. Amongst magicians it is commonly accepted that if you ask someone a question, that person will naturally look at your face (Tamariz, 2007). In other words, asking a person a direct question is a social cue that will trigger reflexive social orienting to the face.

In the present study, participants watched a magic trick, either live or on video, in which a magician used social misdirection (a question) to prevent observers from detecting a visually salient colour change. Change blindness is a term for a phenomenon whereby changes to an unattended item go undetected (Rensink, O'Regan, & Clark, 1997). Overt fixation is not sufficient for change detection because covert attention may be allocated elsewhere (e.g. Mack & Rock, 1998; Smith, Lamont, & Henderson, 2012). Whilst some changes can be missed when attended (Rensink, 2000), attention is necessary to notice changes to items, and therefore change detection provides a valuable index of attentional mechanisms that are independent of eye movement (i.e. covert attention).

Previous research indicates that people look at real people less than images (Laidlaw, Risko, & Kingstone, 2012), whilst others have found no difference between the two (Freeth, Foulsham, & Kingstone, 2013). We therefore further explored the conditions under which fixations to the face vary as a function of viewing condition (i.e. live vs. video). In order to assess the reflexivity of attentional orienting, we modulated participants' direct top-down attentional control by instructing half of the participants to avoid being distracted from the card trick. We expected that participants would be able to exert some degree of top-down control over the reflexive tendency to look at the magician's face when they were posed a question (e.g., Laidlaw et al., 2012). However, and of critical importance for the present study, how this instructed top-down control would vary as a function of context (live vs. video) and type of attention (overt vs. covert) was far from clear based on past work. Addressing these two issues were the focus of the present paper.

Unlike in the video context, in the live context the actor can see the participant, and thus there is scope for real social interactions. With regard to context (live vs. video), one prediction is that participants will be able to exert less instructed top-down control when the magician's social distracting question is presented live than in the video because live situations are more social (Freeth et al., 2013). Alternatively, as people are more inclined to look at faces on video than in live situations, instructed top-down inhibition may be less effective for video than live questioning.

As for the effect of social distraction on covert orienting, there are two clear-cut alternatives, derived from the fact that overt and covert orienting are linked but separable (Smith & Schenk, 2012). If overt and covert attention are always linked the overt orienting will be mirrored by covert orienting. On the other hand, if the two forms of orienting are separable, it is possible that the effect of top-down control and context will be very different for overt and covert attention.

In sum, the aims of the present study were twofold. First, we aimed to measure and compare in real life and in the lab people's top-down control over overt shifts in reflexive social attention to the face of another. Second, we chose a task that we anticipated would, qualitatively speaking, behave similarly in real life and in the lab, thereby enabling us to investigate how the presence or absence of a real person may modulate the control of reflexive shifts of covert versus overt attention. Finally, it is worth noting at the outset that in the present study our focus is on the functional relationship between overt and covert orienting, and as such we are agnostic as to whether overt and covert attentional orienting are driven by independent attentional mechanisms (e.g. Hunt & Kingstone, 2003), or a single mechanism in which covert attention