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Do humans spontaneously take the perspective of others?

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ABSTRACT

A growing number of authors have argued that humans automatically compute the visual perspective of other individuals. Evidence for this has come from the dot perspective task in which observers are faster to judge the number of dots in a display when a human avatar has the same perspective as the observer compared to when their perspectives are different. The present experiment examined the 'spontaneous perspective taking' claim using a variant of the dot perspective paradigm in which we manipulated what the avatar could see via physical barriers that either allowed the targets to be seen by the avatar or occluded this view. We found a robust 'perspective taking' effect despite the avatar being unable to see the same stimuli as the participant. These findings do not support the notion that humans spontaneously take the perspective of others.

1. Introduction

As humans, we often make conscious judgments concerning the mental state of other individuals in social situations. This occurs, for instance, when one wonders why a person is gazing at a particular location. Furthermore, the computation of other people's perspective is central to efficient social cognition. A number of authors have argued that certain types of 'Theory of Mind' processes can occur automatically such that they are fast and do not require controlled processing. The most notable example was reported by Samson, Apperly, Braithwaite, Andrews, and Bodley Scott (2010), who argued that humans rapidly and spontaneously compute the perspective of other individuals. They employed a paradigm that has become known as the dot perspective task, in which observers are presented with a human avatar (located in the centre of a virtual room) that looks either towards a left or right-hand wall. A number of discs are positioned on the two lateral walls and the participant is asked to judge the number of discs from either their own perspective or the avatar's perspective. The central manipulation concerns the consistency of the avatar's and participant's perspective; on some trials the avatar and participant can see the same number of discs whilst on other trials they see a different number. For example, if the avatar looks to the right-hand wall and one disc is located on each of the two walls, the avatar sees one disc and the participant, by virtue of being able to see the whole room, sees two. By contrast, if two discs appear on the right-hand wall and none on the left, both the participant and the avatar see the same number of discs (i.e., two). Samson et al. found that reaction time (RT) to make the disc number judgement was shorter when the viewpoint of the avatar was consistent with the participant's relative to when their viewpoints were inconsistent. The authors concluded that this consistency effect occurs because the computation of another person's perspective occurs spontaneously. In effect, the observer is said to compute what the avatar can see, and this representation includes the number of discs that can be seen. The knowledge about what the avatar sees then interferes with the observers' knowledge about the total number of discs present, thus increasing RT when the two are inconsistent.

The spontaneous visual perspective taking notion has not however gone unchallenged. For instance, Santiesteban, Catmur, Coughlan Hopkins, Bird, and Heyes (2014) argued that the avatars employed in the Samson et al. experiments act as a cue that shifts attention to one side of the display. That is, the cue was said to activate domain-general processes of spatial cognition. Indeed, the basic spontaneous perspective taking method is similar to the classic central cueing paradigm in which a cue, for instance a human face (a 'gaze cue'; Langton & Bruce, 1999), is located in the centre of a display and looks towards the left or right hand side. Furthermore, the critical comparison of the Samson et al. method, i.e., 'consistency-inconsistent' (of the avatar's and participant's viewpoint), maps directly onto the critical comparison in the central cueing paradigm, i.e., 'cued–uncued'. Although Samson et al. do include attentional cueing as a process that *contributes* to spontaneous perspective taking, a cueing effect could *solely* explain the basic effect. In support of their directional cueing hypothesis, Santiesteban et al. showed that a stimulus known to shift attention laterally (i.e., a centrally located arrow) induced consistency effects of comparable size to that of an avatar (see also Nielsen, Slade, Levy, & Holmes, 2015).

A problem however with the cueing hypothesis is that the perspective and cueing effects may operate independently but still generate a similar pattern of data. Thus, demonstrating that both arrows and

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avatars generate a consistency effect does not falsify the spontaneous perspective taking theory. As Firestone and Scholl (in press) have recently reminded us, "not only should you observe an effect when your theory calls for it, but you should also not observe an effect when your theory demands its absence". The principal aim of the present work was to test the claim that perspective taking is indeed spontaneous, as argued by Samson et al. (2010), by setting up a scenario in which visual perspective taking should not occur. As with the original experiment of Samson et al., participants were presented with an avatar located in the middle of a display that looked either towards a left of right hand wall. Importantly, the ability of the avatar to see the stimuli that generate the basic perspective taking effect was manipulated by the positioning of physical barriers either side of the avatar. On 'non-seeing' trials these barriers fully occluded stimuli presented to the left or right whilst, on 'seeing' trials the barriers included window-like features allowing the stimuli to be seen by the avatar (see Fig. 1[1]). The use of physical barriers to manipulate what an agent can see is common when assessing mentalising in non-human animals (e.g., Hare, Call, & Tomasello, 2001). Clearly, if the avatar's perspective is spontaneously taken, no Samson et al.-like effect should occur when the avatar is unable to see the inducing stimuli.

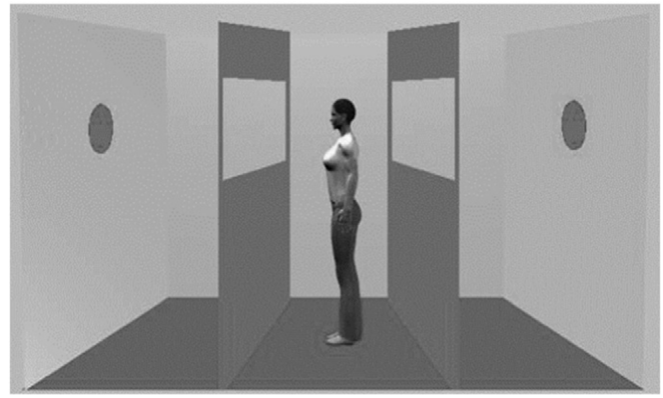

Fig. 1. Stimuli used in the experiment. The example shows a trial in which the avatar's view is inconsistent with that of the participant. We as the viewer can see the two discs but the avatar can only see one. The example also shows barriers in the 'seeing' condition; the avatar can see one of the walls. In 'non-seeing' trials the 'windows' of the barriers are closed.

2. Method

2.1. Participants

There were 24 participants who took part in exchange for course credit.

2.2. Stimuli and apparatus

The virtual room was 19.6° wide and 12° high. A male or female human avatar (7.8° in height) was located in the centre and always faced to the left or right-hand wall. Barriers were located to the left and right of the avatar and were approximately the same height as the room and were 1.8° wide. The barriers were solid on half the trials and thus prevented the avatar from seeing the wall being faced. On the remaining trials the barriers had a section cut out, allowing the wall to be visible. On the left and right-hand walls were a number of red discs (0, 1, 2, or 3) measuring approximately .7° in height. On 50% of trials, the avatar faced towards the same number of discs that the participant could see, whilst on the remaining trials the avatar faced towards a different number of discs. This manipulation is the same as Samson et al.'s (2010) 'consistent'–'inconsistent' manipulation. However, note that when the barriers occluded the avatar's lateral view, the participant's view was of course never consistent with the avatar's. We therefore consider this as manipulating whether the avatar faced towards the same or different number of discs as that of the participant. The room and barriers together with a black fixation cross were present as background throughout the entire experiment. As with Samson et al., male observers were presented with a male avatar and female observers were presented with a female avatar. The experiment was run on an Apple eMac computer linked to a CRT monitor.

2.3. Design and procedure

A within-participant, 2×2 factorial design was employed. The first factor manipulated whether the avatar faced towards the same number of discs that the participant could see or faced towards a different number ('same' vs 'different'). The second factor manipulated the avatar's vision of the room's left and right hand walls ('seeing' vs 'non-seeing'). Each trial began with the presentation of a number ('1', '2', or '3') located in the centre of the display for 750 ms. This informed the participant of the disc number in the display that needed to be verified on the current trial. For instance, when the number '2' appeared, this informed the participant that they will need to decide as quickly as possible whether or not two discs are present in the display. This number either matched the number of discs presented in that trial or did not match. This number disappeared for 500 ms after which the avatar and discs appeared until the participant responded. The beginning of a trial was initiated by the participant's response on the previous trial. The participant was asked to press a left-hand button if the disc number matched the number shown at the beginning of the trial or a right-hand button if they did not match. Observers were seated approximately 70 cm from the display and asked to respond as quickly as possible whilst keeping errors to a minimum. The visibility condition was blocked. Blocking this factor meant that attribution of what the barriers allowed the avatar to see did not need to occur trial-by-trial. At the beginning of each block, participants were shown an example of the relevant barrier and explicitly told that the avatar could either see or not see the wall and discs faced depending on which barrier was presented. There were 288 trials in total, 144 of which were match trials and 144 non-match trials. Half of the trials were 'same' and half were 'different'. For both matching and non-matching trials, there were 48 trials in which one disc was present, 48 trials in which two discs were present, and 48 trials in which three discs were present. We did not include what Samson et al. called 'filler' trials in which no discs were presented. Otherwise, our method closely replicates the aspects of Samson et al. critical to generating a spontaneous perspective taking effect. Twenty-four practice trials were given. Apart from the visibility condition which was blocked, and presentation order counterbalanced, all trial types were presented in a random order.

2.4. Check for the validity of our visibility manipulation

Because our experiments were concerned with the central claim of Samson et al., i.e., rapid computation of what *others* see, we did not include trials used by Samson et al. in which participants were asked to take the perspective of the avatar. Indeed, *spontaneous* computation of others' perspective should not require observers to occasionally assume this perspective. This was alluded to recently by Schurz et al. (2015) who argued that separating (i.e., 'blocking') trials in which participants are required to take their own perspective from trials in which they are required to take the avatar's perspective is more likely to index spontaneous perspective taking. Indeed, presenting both trial types within one block is likely to induce participants to explicitly (i.e., non-

[1] We are extremely grateful to Dana Samson for providing us with all her stimulus images, even though we only requested one example as a template to generate our own.