Activity in areas MT+ and EBA, but not pSTS, allow prediction of perceptual states during ambiguous biological motion

Joris Vangeneugden, Raymond van Ee, Karl Verfaillie, Johan Wagemans, Hans Op de Beeck

Multistable stimuli provide a powerful instrument to probe for correlates of subjective perception. By keeping the input to the visual system constant, perceptual fluctuations can be directly related to the underlying neural process. Previous fMRI studies, employing e.g. binocular rivalry or structure-from-motion (Sterzer et al., 2009), did report a number of retinotopic regions actively representing the content of visual awareness. Here, we extended those findings by investigating how well activity patterns in lower- and higher-tier visual regions can be used to predict perceptual states during bistable biological motion displays. Particularly, we were interested in the neural representations of the three-dimensional orientation of human figures. The stimulus consisted of a walker with white cylinder-like primitives substituting limbs, shown in a 45° *view* either to the left or the right, which can be perceived as *facing* toward or away from the observer. Disambiguation can be achieved by adding a shading component to the cylinders.

Prior to scanning we assured that our subjects (N=10) (a) perceived the in-depth walker as perceptually bistable by adding perspective, (b) with average perceptual alternations between 10 and 30 s and (c) did not show any eye movement differences between percepts during fixation and free viewing for a 360 s presentation of the ambiguous walker.

In a first scan session we mapped early visual areas (V1 and V2), category-selective areas (EBA/FBA, FFA/OFA, MT+, PPA/TOS and LOC/pFus) and the posterior part of the superior temporal sulcus (pSTS) using standard localizers. In a second scan session we presented our in-depth walker, either unambiguously (4 runs, 18 s blocks), or ambiguously for 240 s, pre- and succeeded by unambiguous blocks (8 runs), varying in *view* (left vs. right) or *facing* direction (toward vs. away from the viewer). Multi-voxel pattern analysis revealed that both EBA and MT+, and to a lesser extent FFA and OFA, but not pSTS, contain information regarding the perceived *facing* direction, irrespective of the *view*. Moreover, we were able to accurately predict *facing* direction in the ambiguous epochs based on the information present in the disambiguated runs for the former two regions. Again, classifications based on the activity patterns in pSTS were at chance level. In light of current models of biological motion perception (Giese and Poggio, 2003; Lange and Lappe, 2006) our results suggest that information about the perceived *facing* direction of a moving human figure is already present at relatively early stages (MT+ and EBA) and not at the end-stage (pSTS).