# Double dissociation between the extrastriate body area and the posterior superior temporal sulcus during biological motion perception: converging evidence from TMS and fMRI

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Our brains engage numerous regions when exposed to biological motion, with the posterior superior temporal sulcus (pSTS) being the primary locus. However, most of the supporting evidence stems from studies that contrasted intact with position-scrambled point-light animations. This approach leaves unclear the exact functional role of not only this region, but also of other co-activated regions, including hMT+ and the extrastriate body area (EBA). Here, we set out to determine the specific roles of pSTS and EBA during biological motion perception, focusing on walker orientation and walking direction. To obtain converging evidence, we conducted separate TMS and fMRI experiments within the same subjects (N=12). Two separate tasks were used in the TMS study: walker orientation and walking direction. In the orientation task, subjects identified the facing direction of a "point-light" walker (left vs. right). In the direction task, subjects identified walking direction (forward vs. backward). Task performance was compared before and after applying repetitive offline TMS (1Hz) over EBA and pSTS (based on fMRI-guided stereotaxy). In the fMRI study, EBA and pSTS were mapped in separate scans using standard localizers. Subsequently, runs with point-light walkers (2 facing orientations * 2 walking directions) were subjected to Multi-Voxel Pattern Analysis, determining the amount of static (orientation) and dynamic (direction) information present within EBA and pSTS. Both TMS and MVPA revealed a strong double dissociation between inferred functions of EBA and pSTS. Disrupting EBA impaired performance on the walker orientation task, while leaving walking direction performance intact. In contrast, disruption of pSTS processing resulted in the opposite effect ($p<.001$). Similarly, EBA BOLD response revealed significant walker orientation information and no walking direction information, while (again) pSTS BOLD response displayed the opposite pattern ($p<.005$). We provide converging and causative evidence that dissociates EBA (static body processing) from pSTS (dynamic body sequence processing) during action perception.