Proactive Gaze Behavior: Which Observed Action Features Do Influence The Way We Move Our Eyes?

Alessandra Sciutti[1], Francesco Nori[1], Marco Jacono[1], Giorgio Metta[1], Giulio Sandini[1], Luciano Fadiga[1,2]
[1]Robotics, Brain and Cognitive Sciences Dep., Italian Institute of Technology, Genoa, Italy
[2]Section of Human Physiology, University of Ferrara, Ferrara, Italy

When subjects observe an object manipulation task, their gaze predicts forthcoming events rather than reactively tracking actor's motion (Flanagan and Johansson 2003, Falck-Ytter et al. 2006). Interestingly, when the same predictable object movement is not the result of human action, the gaze tends to exhibit much less prediction (Flanagan and Johansson 2003). The aim of our study was to understand which are the action features necessary for proactive gaze behavior to appear. We manipulated different parameters of the movement (length, speed and naturalness of the action), to evaluate the effects on observer' s gaze proactivity. Subjects sat in front of the experimenter at a 70 cm distance wearing an head mounted gaze tracker. The experimenter, whose motion was recorded by an Optotrak tracking system, performed an object stacking task. The possible distances travelled by the objects were 12, 24 or 48 cm in blocked presentations. The same movements were presented at a natural speed, at a slower pace and at a faster pace. To evaluate the relevance of motion naturalness, the objects was either (i) grasped naturally, (ii) grasped in an unnatural way (with the hand palm upward oriented), (iii) fetched using a pair of pliers, (iii) fetched with the same tool, but in an uncommon way (holding the tool from its tip). Our results indicate that gaze proactivity is quite robust to movement manipulations, suggesting that prediction is also extended to the observation of unusual actions, until they can be performed by a human actor. In a subsequent experiment we replaced the human demonstrator with a humanoid robot. The robot movement was biologically plausible and replicated the human one, so that we could assess the relevance of the actor's appearance on the observer's gaze behavior. The results are discussed in the framework of the mirror neurons direct matching hypothesis (Rizzolatti et al. 2001).

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