

**The role of gaze in bimanual reaching movement**  
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**Abstract**

It is well known that gaze provides guidance in the control of reaching. However, how this guidance is shared across two hands during bimanual reaching is still not well understood. In this study, we analysed the coordinated behavior of the eye and the hand movement during three-dimensional bimanual reaching toward a pair of targets. Twenty healthy subjects made self-tempoed, synchronous bimanual reaching movements toward a pair of targets of varying sizes, while their eye and hand movement were captured using electrooculography and motion capture. The captured hand movement data showed that the bimanual movements were made almost synchronously as instructed, but there were subtle asynchronies in their speed profiles. Eye movement data showed that the gaze shifted from one side to the other side about two times on average during the movement, but there were no consistent patterns that are shared across different subjects or different target sizes. In order to analyse the coupled behavior between the hand and the eye movements, we processed the eye movement data into a binary signal indicating which side—left or right—the eye was looking at for each time point, and divided the time course of reaching movement into distinct phases in such a way that each phase represents a period during which the gaze was consistently looking at one side. Finally, we focused on each pair of consecutive phases to see whether the movement of one hand was accelerated more compared to that of the other hand when the gaze shifted from one side to the other side. The result of the analysis showed that more than 80% of our experimental data can be explained by the mechanism that when the gaze was shifted to one side, the movement of hand on that side was accelerated more than that of the other hand. In addition, we found that this mechanism can be consistently observed for different subjects, various target sizes and hand dominance, supporting the generality of the mechanism. Based on these results, we propose the following common mechanism of the control of bimanual reaching: the gaze determines which side of the movement is prioritized during bimanual reaching.

**Keywords:** *Bimanual Coordination, eye-hand coordination, human sensorimotor control*