Visual perception in dynamic far aiming

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**Introduction**

Vision is one of the six sensory systems that we use to know and interact with our environment but it has been singled out as the most important form of exteroception for guiding action. The reason for this is probably that many human actions are directed at objects or targets beyond our immediate physical contact. The only link between these objects and us is the pattern of light reflected from their surfaces, and yet we identify and act upon them with great ease. No doubt, humans make significant strides in establishing appropriate relations between perceptions and actions at early stages of development. (Just think of the time and practice it takes a baby to be able to grasp an object within their reach.) But once the relations between perceptions and actions are better established, humans can be incredibly skillful at interacting with distant objects even when the constraints imposed on the interaction are severe and a high degree of precision is required.

In sports, there is an abundance of far aiming tasks, often with the purpose of scoring. Although it is evident that vision plays an important role in guiding far aiming actions, its exact role is often unclear. For example in static far aiming tasks such as rifle shooting, free throw shooting or billiards, the duration of the final fixation on the target before initiating the final movements correlates with expertise. In contrast, research has shown that in tasks that are more dynamic it is not so much the fixation duration that correlates with expertise but rather the timing of that fixation. These results beg the question *What role does vision play in guiding action?* One researcher (Gibson, 1966) proposed that the role of vision (or other sensory organs) is to detect patterns in the ambient array through stimulation of receptors. This detection of specific patterns leads to the perception of information that can guide actions. At the time, this was a radical theory because it proposed that perception was direct, or unmediated by cognitive processes, and it also highlighted the role of action in picking up visual information. In other words, it proposed that perception guides action and that action discloses perception in a cyclical bidirectional manner. Fast-forward three decades and researchers were terribly excited by the accessibility of eye-trackers; hefty glasses sometimes mounted on helmets which could show a researcher where the wearer was looking (or to be more precise, the direction where the wearer was looking). An enormously influential piece of research by Vickers in 1996 set the scene for the following two-decades of eye-tracking studies. Two decades looking at where sportspeople were looking without too much scrutiny over what role vision plays in guiding action. Elsewhere research by the Oudejans’ group (2002, 2006, 2007, 2008) contradicted both the findings and interpretations. While Vickers found long fixations *before* movement initiation, Oudejans found late fixations *during* the movement. In this talk we will explore and critically analyse the research on visual perception in dynamic far-aiming.

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