

Sports athletes use predictive saccades! But why?

In sports, high-level athletes are able to predict the actions of an opposing player. Interestingly, such predictions are also reflected by the athlete's gaze behaviour. In cricket, for example, a bowler bowls the ball in the direction of a batsman. The ball first bounces on the ground before the batsman tries to hit the ball with his bat. During the ball flight, players very often initiate two predictive saccades: one to the predicted ball-bounce point and a second to the predicted ball-bat-contact point. That means, they move their eyes ahead of the ball and "wait" for the ball at the new fixation location, potentially using their peripheral vision to update information about the ball's trajectory. In this study, we investigated whether predictive saccades are linked to the processing of information in peripheral vision and if predictive saccades are superior to continuously following the ball with foveal vision using smooth-pursuit eye-movements (SPEMs). In four experiments (Experiments 1a, 1b, 2a, and 2b), we first compared speed-discrimination performance when using foveal vision (during SPEMs) or peripheral vision (during fixations). We found that speed discrimination performance was better during pursuit than during fixation. In the next two experiments (Experiment 3 and 4), we evoked the typical eye-movements observed in cricket. Results show that the information gathered during SPEMs is sufficient to estimate when the target will hit the fixated location, and that peripheral monitoring does not help or is not used to improve this estimation. Finally, in the last experiment (Experiment 6), we show that it may actually be beneficial to use SPEMs to predict the TTC of a moving target rather than predictive saccades. Thus, predictive saccades that move fixation ahead of a target are unlikely to be performed to enhance the ability to peripherally monitor a moving target.