26 How do excellent batters look at the ball?

- Cognitive processes revealed by eye movements in batting -

Abstract

To achieve skillful batting in ball games, batters have to accurately judge ball trajectory and impact time, and quickly decide whether or not to swing, as well as flexibly control a bat. We are working to clarify these implicit (unconscious) cognitive processes in excellent batters through measurements of eye movements in realistic environments. A field measurement revealed that elite baseball batters including professionals often make predictive saccades, that is, quick eye movements to where the ball will be in front of the home plate, and the relationships between the ball and predictive saccades in terms of time and space differ according to batting results. These and other related findings will be useful not only for assessing cognitive features, such as visual processing and prediction, in top athletes but also for developing novel feedback and training methods to efficiently improve their performance and underlying implicit brain functions.

In baseball batting …

- Ball velocity in visual angle increases drastically (0～700˚ /s) around the home plate. Batters cannot keep their eyes on the ball through its full flight.
- Prediction is crucial to compensate for the delay due to visual and motor information processing (~0.2 s) and bat swing (~0.2 s).

What is a reasonable visual-motor strategy?

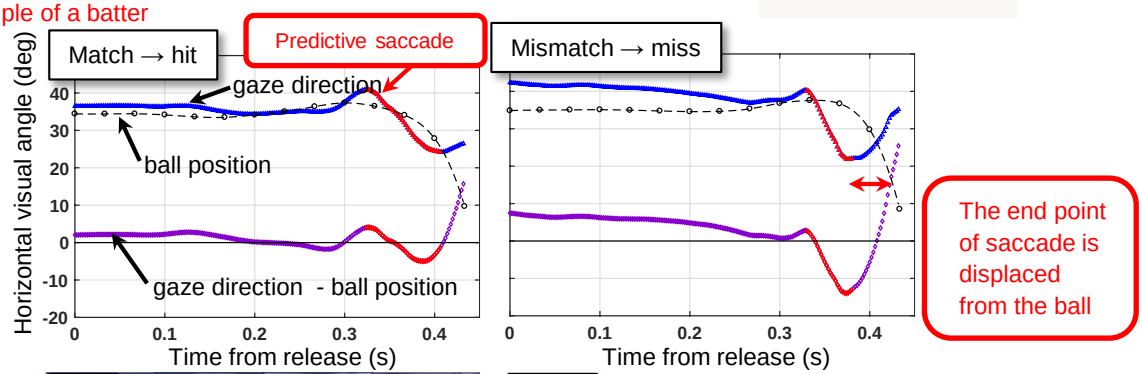
We examined eye movements of elite batters (including professionals) hitting random pitches of two types: a fast ball (130-140 km/h) and a curve ball (100-110 km/h).

A helmet equipped with a high-speed eye tracker

Field camera (30fps)

Eye tracker (500fps)

Example of a batter



- In most cases, batters kept their gaze with fixational-like eye movements on the ball in the early stages, and then started predictive saccades (quick eye movement) toward the ball.
- Predictive saccades reflect the prediction of ball trajectories and types of pitches.
- Predictive saccades may not be useful for acquiring visual information, but for controlling body movement.

References

[1] Y. Kishita, M. Kashino, “How do batters look at the ball? Revealing eye movement strategy in elite players,” *Annual meeting of Japan Society of Baseball Science* , 2017. (in Japanese)

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