Title

An EEG investigation of the neural correlates underlying the processing of kinematic and contextual information on anticipation in cricket batting

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Introduction

Anticipation refers to the ability to accurately predict the outcome of an opponent's actions ahead of the act itself. This ability is underpinned by the use of information from at least two broad sources, namely, the pick-up of low-level biological motion information from an opponent's movement kinematics (i.e., postural cues) and the use of high-level contextual information related to the event, such as game score or position of fielders. The neural correlates associated with the processing of these two information sources in expert athletes is yet to be investigated.

Methods

The neural activity in 15 expert and 15 novice cricket batters when anticipating deliveries from bowlers in a video-based simulation task was recorded using electroenchephalography (EEG). Altogether, 120 videos clips were displayed across three conditions, including 24 clips where participants were only exposed to contextual information (game situation and field setting), 24 clips where only kinematic information was provided (bowler shown) and 72 clips with both information sources provided. Trials were occluded immediately after the ball release and anticipation accuracy measured by marking predicted ball location on scaled diagrams. Time-frequency analyses were used to assess any changes in electrocortical activity.

Results

Initial results demonstrated that expert batters showed better anticipation accuracy across the three conditions. While there was no difference in anticipation accuracy between the kinematic and the contextual condition in the expert batters, the novices were better at anticipating in the kinematic condition compared to the contextual condition. Both groups were more accurate when both kinematic and contextual information sources were presented. The EEG data showed a decrease in the power of the alpha band (8-13 Hz) over sensorimotor areas in the kinematic condition, while in the contextual condition alpha synchronisation was observed over more frontal sites.

Discussion

Anticipatory expertise in cricket batting relies on the ability to successfully process both kinematic and contextual information, as shown by the experts' skill advantage across the three conditions compared to novices, whose performance relies largely on processing kinematic cues only. EEG results suggest that bottom-up mechanisms are engaged when anticipatory decisions predominantly rely on kinematic cues, while contextual information processing appears to be supported by frontal regions involved in higher cognitive mechanisms. Findings have implications for those interested in identifying and enhancing the neural mechanisms involved in anticipation in sport.