Motor expertise and action observation - Investigating perception-action links in soccer

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Introduction

- Expert athletes pick-up action relevant information from the opponent’s body posture even before key events, such as football contact, occur (e.g. Williams et al., 2002).

- Such visual expertise relies on specific perception-action links, which map observed actions onto the motor representations of the same actions in the observer (Schütz-Bosbach & Prinz, 2007).

- On a cognitive level, athletic expertise is signified by distinct memory structures, in which so-called Basic Action Concepts (BACs) provide the representational basis for the control of complex actions (Schack, 2004) -> mental skill representations.

- We hypothesize that the structure and functional quality of mental skill representations modulates the strength of the perception-action link in the observer.

Methods (I)

(1) Participants

- 18 soccer experts (23.5 years, 16 males) and 18 soccer novices (24.3 years, 13 males) participated. The experts played from regional level up to the 2nd division and had 16.3 years of experience.

(2) Perception task

- Pictures of players kicking a soccer ball to the left or right (kicking direction) were presented and participant’s task was to react with their left or right foot to a color cue (blue vs. red), shown either in front of the player’s face or on the soccer ball (cue location).

Results (I)

(3) Cognitive association task

- Mental skill representations for the soccer kick were assessed with the SDA-M method (c.f., Schack, 2004). Key-points were presented pairwise during a multiple sorting procedure, in which participants had to decide about the functional equivalence of two BACs.

(4) Basic action concepts (BACs) – in-step soccer kick

- \textbf{pre-kicking phase:}
  - BAC 1 = focusing on the ball, BAC 2 = place supporting leg beside the ball, BAC 3 = swing back of the kicking leg, and BAC 4 = opposite arm held up

- \textbf{main kicking phase}
  - BAC 5 = forward swing of kicking leg, BAC 6 = keep kicking foot straight and fixed, BAC 7 = instep kicks ball, and BAC 8 = upper body leans over the ball

- \textbf{post-kicking phase}
  - BAC 9 = focusing on the goal and BAC 10 = kicking leg swing through

Results (II)

- The size of motor activation (signifying the perception-action link) depended on participant’s expertise and their focus of attention (left graph).

- The strength of the perception-action link was modulated by the quality of mental skill representations (right graph).

Discussion

- We found that strength of the perception-action links is modulated by \textit{athletic expertise}, the \textit{focus of attention}, and the quality of participant’s \textit{mental representation structures}.

- For the first time, this provides direct evidence for the functional role that mental representations play in linking perception to action.

- These findings have further implications for expertise research in sport, but also for current theories of social cognition.

References