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Virtual goal- keeping: Understanding how perception influences decisions about action

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Abstract

According to Gibson's theory of direct perception, humans and animals perceive and interact with surfaces (e.g. grass), places (e.g. pitch), objects (e.g. ball) and events (e.g. a set-play) (Gibson, 1966). All these so called properties of the surrounding environment provide opportunities for action. This relationship between the environment and player and the ensuing action possibilities are known as affordances. Affordances are essentially the starting point for psychologists trying to understand how humans perceive, learn, and decide to act upon events they perceive to be taking place in their surrounding environment (Turvey, 1992). This area of psychology assumes a player-environment mutuality and reciprocity. As Gibson said we "move to perceive and perceive to move". Perceptual processes and action capabilities are therefore intricately linked and play a crucial role in the decision making process.

Virtual reality provides the perfect adjunct to study perception/action in sport. It is in essence a sophisticated interactive and immersive human-computer interface where a sensory environment (visual, haptic and/or acoustic) is simulated by a computer and is controlled by the interactive behaviour of the user. It is a versatile methodological tool that gives the experimenter complete control over complex environmental conditions and allows for an in-depth analysis of the user's behaviour. In psychology this technology is starting to be exploited as a means of treating phobias (VRET), monitoring behaviour of autistic children in virtual classrooms, rehabilitating stroke patients and most recently in testing perception/action capabilities in elite sports players (Bideau et al, 2006; Craig et al, 2006). The versatility of the VR platform means the technology can be easily applied to a multitude of sports.

For instance, the systematic variation of the visual information available to the players (e.g. the ball trajectory and/or the run-up of the attacking/defending player) will influence the way actions are guided. The objective of the research presented here is to determine *how* visual information picked up from the visual environment influences the actions and decisions being made by the players in the game of soccer. For instance, deciding when and how to move is very important when keeping goal in soccer. Goal-keepers must attend to pertinent visual information (player and ball) that will allow them to judge where the ball is going, to get their body in the right place at the right time. However, more and more teams are exploiting the free-kick scenario as an opportunity for scoring goals (Grant et al, 1999). This appears to be related to the free-kick specialists' ability to bend the ball around the defensive wall. Why do players try to put spin on the ball to make it curve? Does this deviation in the ball's trajectory make it more difficult for the goal-keeper to anticipate where the ball is going and subsequently control their actions to actually get there? In other words does spin give the attacker a competitive advantage?

This talk will present experimental work that shows how a deviation in the ball's trajectory significantly affects players' decisions about when and how to act (Craig et al, 2006). By immersing players in a virtual soccer stadium and allowing them to interact with realistic curved free kicks we show to what extent the lateral deviations in a ball's trajectory impact upon the decision making process (Dessing & Craig, 2010). An in-depth behavioural analysis allows us to model the behaviour of goal-keepers. By comparing expert and novice performance we also show how experts have learned to wait longer before making a move to stop the ball. The implications of these findings will be discussed in light of how the dynamics of the environment (e.g. ball heading direction) provide prospective information for the player and directly influence decisions players make about their future course of action.

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