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The Impact of Constraints on Visual Exploratory Behavior in Football

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Team sports offer a complex and dynamic environment in which skilled perception-action coupling is vital for successful performance. Visual exploratory behavior, in which the movement of the eyes, head and body allow perception of affordances provided by teammates and opponents, is a key component to skilled perception-action (Reed, 1996). This exploratory behavior informs a player about the environment and supports performatory behavior, in which the player interacts with and manipulates the environment (Gibson, 1979). Indeed in football, increased exploratory behavior before a player receives a pass leads to improved performance with the ball (Jordet, Bloomfield, & Heijmerikx, 2013).

A major determining factor to a player's ability to perform comes from the constraints of the task, which constantly change as the match evolves over time. Therefore, it is important to understand how certain task constraints influence a player's ability to perceive affordances and prospectively control their action. For example, a player will be differently constrained depending on how much space they have and whether they are in possession of the ball or not. This study aimed to determine the differences in players' visual exploratory behavior based upon the spatial constraints of the task and whether the player was in possession of the ball or not.

Method

Six experienced football players with a mean age of 22.5 (SD = 1.97) years volunteered to participate in a series of three versus three small sided games, in which the size of the pitch was modified to alter the constraints of the task. Three pitch sizes were created based on the area of the pitch occupied by each player. The control pitch was 47m × 23.5m, giving each player the same area of pitch as they normally can occupy in a full size, 11 versus 11 game. The small pitch gave each player approximately half the control playing area each (33.5m × 16.75m), and the large pitch gave each player approximately double the control playing area each (66.5m × 33.35m).

Players completed five games on each pitch size, and each game lasted for three minutes. Each game was video recorded, and the visual exploratory behaviors of each player were manually recorded by counting the number of times each player made a head movement in which the intention seemed to be to look

for a teammate, opponent or other environmental object relevant to the player's performance with the ball (Jordet et al., 2013). These visual exploratory behaviors were coded for when they were in possession of the ball and when they were not in possession of the ball. As players had possession of the ball for a much smaller percentage of play than when they did not have possession of the ball, data was time normalized to give a number of visual exploratory behaviors per second of play with and without the ball.

A two-way repeated measures ANOVA was run with within-subject factors of pitch size (control, small and large) and possession (in possession and out of possession), and outcome measure of number of visual exploratory behaviors per second. Planned simple contrasts of pitch size were run with the control pitch size as the reference pitch size. Alpha was set at 0.05 throughout.

Results and Discussion

Mean (SD) number of visual exploratory behaviors per second are reported in Figure 1. Analysis revealed a simple main effect of pitch size on visual exploratory behavior ($F(2, 10) = 8.537$, $p = .007$, $n^2 = .631$) and a simple main effect of possession on visual exploratory behavior ($F(1, 5) = 52.997$, $p = .001$, $n^2 = .914$), but no interaction effect of pitch size x possession. Planned simple contrasts revealed a significant effect for the first contrast, which indicated that players displayed more visual exploratory behavior in the small pitch size compared to the control pitch size, $F(1, 5) = 9.334$, $p = .028$, $n^2 = .651$). There was no significant difference in visual exploratory behaviors between the large and control pitch sizes.

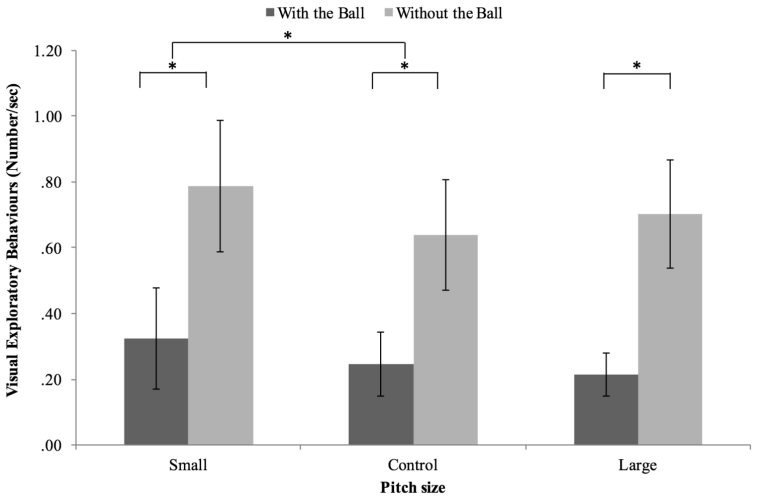

Figure 1. Mean (SD) number of visual exploratory behaviors per second according to pitch size when in possession and not in possession of the ball. *

indicates $p<0.05$.

There was a large difference in visual exploratory behavior between when players were in possession of the ball and when they were not. This finding can be attributed to (and provides further empirical support for) the difference between exploratory and performatory behavior. When players are without the ball, they visually explore their surroundings in order to detect affordances which can be utilized once possession is gained. Conversely, when a player has the ball, they must directly interact with the environment and act with the ball – for instance, in an attempt to create further affordances, such as an attacking opportunity. This interaction limits the opportunity to visually explore, as evidenced by the decline in visual exploratory behaviors when players had possession of the ball.

Players explored more frequently when playing on a pitch with less space per player compared to playing on a pitch with the same amount of space as a full-size, 11 versus 11 match. In this case, the small pitch size may have promoted players' visual exploratory behaviors in order to prospectively control actions with the ball in the more spatially and temporally constrained situation. That is, as players had less time and space when they received the ball, they performed more frequent visual exploratory behaviors before they received a pass, enabling earlier perception of affordances and therefore the ability to act more quickly after receiving the ball.

These results have important implications for the design of training. As the constraints of the task were shown to influence the visual exploratory behavior of players, it is important that coaches utilize these constraints to develop these behaviors during training. In this case, limiting the amount of available space was able to promote visual exploratory behavior. There are likely a multitude of other constraints that can promote and enhance the exploratory behavior of players. For example, pressure from opposing players, availability of passing opportunities, or position on the pitch. Identifying exactly which constraints promote exploratory behavior will be an important future research endeavor.

References

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