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Examining the influence of acute instructional approaches on the decision-making performance of experienced team field sport players

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Abstract

We examined the influence of instructions on decision-making accuracy using video simulations of game-specific scenarios in Australian football. Skilled performers (average age of 23.4 ± 4.2 y) differing in experience (range 0 to 339 AFL matches) assumed the role of the key attacker and verbally indicated their kicking decision. Participants were randomly stratified into three groups: (1) LOOSE (n = 15) – instructed to "keep the ball away from the loose defender"; (2) TTF (n = 15) – instructed to "take the first option"; and (3) NI (control) (n = 16) – given no instructions. Gaze behaviour for a subset of participants (n = 20) was recorded. In the scenarios with an even number of attacking and defensive players, the decision-making accuracy of LOOSE was greater than TTF. This difference was most evident for lesser experienced performers, highlighting that lesser experienced performers are more affected by instructional foci than experienced performers. Gaze behaviour was not affected by instructional foci, but visual search rate was greater in scenarios of greater player number and complexity.

Keywords: Australian football; Expertise; Visual search; Instruction; Perceptual-Cognitive skill.

Introduction

The phrase 'reading the play' is often used by coaches in team field sports where perceptual-cognitive skill is integral to performance. This colloquial expression describes an athlete's ability to anticipate future events and make appropriate decisions. A number of component processes have been identified as being important in the ability of athletes to "read the play". For example, the ability to attend to important information in the environment (Williams, Huys, Canal-Bruland, & Hagemann, 2009), recognise and recall patterns of play (Farrow, McCrae, Gross, & Abernethy, 2010), and make correct decisions (Vaeyens, Lenoir, Williams, Mazyn, & Phillippaerts, 2007) are all key characteristics of perceptual-cognitive expertise and in some way contribute to a team sport athlete's performance.

A relatively recent addition to contemporary decision making theory is evidence to suggest that individuals adopt simple heuristic-driven strategies (i.e. a mental shortcut that reduces decision-making time) to cope with the demands of complex scenarios such as those faced in team field sports. Raab and Johnson (2003) have argued that performers predominantly "take the first" (TTF) option generated when making decisions. This heuristic (i.e. the TTF heuristic) was based on evidence that 60% of participants took the first option as their final decision during handball game situations (Johnson & Raab, 2003; Raab & Johnson, 2007). In the same experimental series, it was demonstrated that participants' decision-making accuracy was better when only a few options were verbalised. As an example, those performers that generated one or two options made more correct decisions than when five or six options were generated. Consequently, it was suggested that if the first option is immediately taken, it is more likely that a correct decision will be made. Recent research has provided further support for this heuristic when making decisions in dynamic and time-pressured sporting situations (Hepler & Feltz, 2012).

Despite the extensive literature outlining the underpinning qualities of perceptual-cognitive expertise, there is a need to ascertain how these perceptual-cognitive skills can be facilitated in practical settings. There is a relative paucity of research to substantiate the influence that instructional sets have on facilitating decision-making performance. One exception is Raab (2003) who reported that an implicit learning approach was advantageous in low complexity situations. However, when the complexity was increased by manipulating perceptual and cognitive aspects of the display, explicit learning involving “if-then” decision-making rules (i.e. *if* a player does this, *then* you do that) enhanced performance. Others have examined the influence of visual instructions (i.e. highlighting key cues) to enhance decision-making performance over more traditional verbal instructions (Canal-Bruland, 2009; Kirlik, Walker, Fisk, & Nagel, 1996). Kirlik et al. (1996) demonstrated in novice American football players that visually highlighting the key cues in the environment reduced decision-making time compared to explicit instructions. However, in general, the interaction of pattern complexity, the skill level of the performer and the nature of the instructional set used remains poorly understood.

Thus far, few researchers have applied the notion of the TTF heuristic as an actual instructional approach to improve decision making in team field sports. For instance, would the instruction to “take the first option” benefit players’ decision-making performance in a team field sport such as Australian football? We explored this concept not as a test of the TTF heuristic per se, but rather a translation of the concept as an instruction for athletes. Although researchers have suggested that skilled athletes may adopt a TTF heuristic when playing team field sports, it is quite possible that the application of an instruction based on this concept may actually limit players’ decision making performance. The TTF heuristic is based on a paradigm that allowed athletes to search the display and verbally generate as many options as possible before making a decision – and this final decision was found to be the first option in 60% of cases (hence the use of TTF heuristic in coaching vernacular). In practice, while the application of this heuristic may be advantageous in some scenarios, if a player's attention is initially drawn to an incorrect option in other scenarios, then the wrong decision is likely to be made. In the case of team sports, there is evidence that the attention of players is often directed to teammates who provide the strongest movement (Farrow & Mann, 2006). Additionally, researchers have shown that eye movements are drawn towards object motion (Schutz, Braun, & Gegenfurtner, 2011). Consequently, under the guidance of the TTF instruction, players may be limited to passing the ball to players who make strong leads or movements yet are ultimately not tactically of value.

To assess the influence that the TTF instruction has on decision-making performance, it needs to be compared to another instruction that will likely cause the opposite behaviour. Given that the TTF instruction encourages players to search for the first clear option to pass the ball to, it needs to be compared to an instruction that will encourage players to search more widely before making a decision. A common instruction in Australian football is to "keep the ball away from the loose defender". Such an instruction is likely to increase attention to the loose defender prior to searching for the free player to whom the ball should be kicked. We compared the TTF instruction with this commonly used coaching instruction.

Player experience is another key factor that influences the effect that instruction has on performance. The performance of experts can be hindered when attentional focus instructions (i.e. step-by-step skill based instructions) are given, whereas novice performance benefits from instructions that guide attentional focus to the skill performance (Beilock, Carr, MacMahon, & Starkes, 2002). Furthermore, lesser experienced performers may be more influenced by instructions than experienced performers, as evident by their greater propensity to experience inattentional blindness (Furley, Memmert, & Heller, 2010). However, research examining the effect that performer experience has on the influence of instructions is scarce.

Therefore, the main aim of this study was to assess the influence of specific instructional foci on the decision-making accuracy of skilled performers when viewing complex, team-sport scenarios. One group was instructed to “take the first option” generated, a second group was instructed to “keep the ball away from the loose defender”, while a third group was given no instructions (control group). It was hypothesised that that the “take the first option” instruction would result in faster but poorer decision-making than the instruction to “keep the ball away from the loose defender” as it will likely cause players to make quick decisions based on where there is movement, rather than searching the display for the best option. This would be underpinned by more fixations to players making sharp movements and a lower visual search rate. In comparison, the LOOSE group was expected to fixate more on the loose defender and have a greater visual search rate than the other groups. Visual search patterns were measured using an eye movement recorder. A second hypothesis was that both instructions would result in better decision-making accuracy than the control group. This latter prediction was based on research examining the TTF heuristic and research highlighting the importance of attending to the loose defender in soccer (Helsen & Pauwels, 1992, 1993).

Another aim of the study was to examine the influence that instructions have on experienced performers compared to lesser experienced performers. For the purpose of this study, experience was defined by the number of games played in the elite national competition. The third hypothesis was that lesser experienced performers would be more influenced by instructional foci than their more experienced counterparts. This prediction was based on research that has examined the effect that performer experience has on the influence of instructions (Furley, et al., 2010).

Methods

Participants

Forty-six Australian Football League (AFL) players with an average age of 23.4 ± 4.2 y (range 18.8 to 34.6 y) participated. The group had played an average of 67 ± 86 games in the professional AFL competition (range 0 to 339 matches). Written voluntary consent was given by all participants. Approval for the research was given by the university's Human Research Ethics Committee.

Research design

The decision-making performance of participants was assessed in response to engagement with video-based, game-specific attacking scenarios, with gaze behaviour recorded during this task on a subset of participants using a head-mounted eye movement recorder. Participants were randomly stratified into three groups: LOOSE (n = 15, 7 having eye movements recorded) were given instructions to "keep the ball away from the loose defender"; TTF (n = 15, 6 having eye movements recorded) were instructed to "take the first option"; and NI (n = 16, 7 having eye movements recorded) were given no instructions. Stratification was performed by dividing the players into the three groups according to their decision-making ability as rated by the coaching panel. The five coaches that comprised the coaching panel all had at least Level 2 coaching accreditation in the AFL and were regarded as expert coaches. They rated the decision-making ability of each player on a three-point scale. The average score for each group was: LOOSE = 1.8 ± 0.7; TTF = 1.9 ± 0.8; and NI = 1.9 ± 0.8.

The playing experience of each participant was also taken into consideration. The level of experience was defined by the number of professional AFL games played (> 20 games = experienced, n = 26, *M* = 114.7 games, *SD* = 88.1; < 20 games = less experienced, n = 20, *M* = 4.6, *SD* = 5.3). Under this definition, experienced participants had also been training at professional AFL standard for at least four years, whereas less experienced players had not. The subsequent groups formed were Experienced-LOOSE (n = 10), Experienced-TTF (n = 8), Experienced-NI (n = 8), Inexperienced- LOOSE (n = 5), Inexperienced-TTF (n = 8), and Inexperienced- NI (n = 7). The majority of players in the experienced group were regular members of the 'first (i.e. best)' playing team, whereas the majority of players in the lesser experienced group usually played in the 'reserve (i.e. second tier)' team.

Filming procedure/scenario development

The game-specific scenarios were filmed during competitive training to provide greater realism of movements within each trial. The scenarios involved teammates (attacking players) moving in any direction to provide kicking options for the player with the ball (i.e. the participant), while defensive opponents attempted to run alongside attacking players to minimise their chance of receiving the ball. Half of the scenarios also featured an extra "loose" defender because this is a common tactic in Australian football. The scenarios were filmed using a Sony HDR-FX1E Digital Video Camera/Recorder (Sony Corporation, Japan) set on a tripod (2.2 m high), positioned 70 m from the goals on a 45 degree angle, next to the player with the ball. This filming perspective provided a wide viewing area that closely corresponds with the field of view typically observed by a player moving into their attacking area of the field (see Figure 1). The scenarios were later edited so that the trial occluded immediately prior to the ball being kicked.

All scenarios lasted three to four seconds and featured various ratios of attacking and defensive players. The scenarios varied in the expected decision to be made, with the correct decision pre-determined and agreed upon by the coaching panel. In order for the decision to be considered correct, an 80% agreement amongst coaches was required; less than 80% agreement resulted in that particular trial not being used. This resulted in 12 trials being used for testing, comprising two types of display: (i) 6 trials featured a 'loose' defender (*loose player display*), which included one 2 vs. 3 (i.e. 2 attackers versus 3 defenders), three 3 vs. 4, and two 4 vs. 5 scenarios; (ii) 6 trials featured the same number of attacking and defensive players (*even player display*), which included two 2 vs. 2, two 3 vs. 3, and two 4 vs. 4 scenarios. Split-half reliability analyses demonstrated that the inter-trial reliability of the 'loose' and 'even' displays were very strong (loose display, R = 0.94; even display, R = 0.85).

All scenarios were designed to challenge the players' knowledge of typical options that they are normally confronted with in a game. As the participants were elite players from the same squad, there were team rules that also provided a general framework for the players' decision-making selections.

Test procedure

Decision-making task. Participants sat 3.3 metres from a wall on which video scenarios were projected at a size of 1.6 m (width) x 1.2 m (height). Participants were told that the footage assumed the perspective of the player with the ball running towards goal. For each trial, the participants were required to verbally indicate which player they would kick the ball to, with responses recorded by the researcher. Participants viewed four practice video scenarios followed by the 12 test scenarios. Participants were required to verbalise their decision when they had made their choice or, at the latest, immediately after the video clip was occluded. This procedure ensured that responses were made within 2 s of the final frame being presented which was considered an appropriate time period.

Visual search characteristics. Twenty of the 46 participants were randomly selected from each instructional group to have their gaze behaviour recorded as they watched attacking scenarios. The Applied Science Laboratories Mobile-Eye recording system (Bedford, MA) indicated the direction that the eye was focused, through simultaneous online monitoring of the eye pupil centre and corneal reflection. The eye image and scene image were combined and saved on a DVCR tape. The sample rate was 25 Hz. Of the 240 video trials analysed, only 4 did not record correctly and, hence, these trials were removed from data analysis. A subset of the eye movement data was re-analysed to assess intra-rater reliability [intra-class correlation (3,1) ≥ 0.97 for each visual search variable]. Visual search behaviour was examined from the beginning of each trial until the end.

Dependent variables and analysis.

Decision-making accuracy – expressed as the percentage of decisions that were correct as decided by the coaching panel (in %).

Decision-making time – expressed in milliseconds as the time from the beginning of each video trial to the point when the participant began verbalising their decision. This was measured via video replay to a resolution of 40ms.

Definition of the visual search variables:

Mean number of fixations – a fixation was defined as a condition in which the eye remained stationary (1.5° of movement accepted) for a period of at least three frames (≥ 100 ms).

Mean fixation duration – the sum duration of all fixations in each trial, divided by the number of fixations.

Search rate – the mean number of fixations per second.

Fixation location – the percentage viewing time on various locations within the display.

Fixation location was coded using two systems, designed to allow comparison across the different types of trials:

(a) The first coding system involved dividing the display into locations (see Figure 1): (i) the first attacker and defender from the left of the screen (A1D1); (ii) the second attacker and defender (A2D2); (iii) the third attacker and defender (A3D3); (iv) the fourth attacker and defender (A4D4); (v) the loose defender; (vi) nearest side space; (vii) furthest side space; (viii) corridor space; (ix) goal square space; and (x) an unclassified area that did not match with the locations already coded. Subsequent analysis revealed that the four locations of 'space' were rarely fixated on by the majority of participants and, therefore, these four areas were combined to form a single location referred to as 'open space', while the 'unclassified' area was removed from data analysis because participants did not fixate on this area in any trials.

(b) The second coding system involved identifying the specific characteristics of each of the players in the display (i.e. A1D1, A2D2, A3D3, A4D4, and the loose defender) by recording their location and the strength of their movement (or 'lead'). Location was divided into three areas (also shown in Figure 1) – left field, centre field, and right field (see Raab & Johnson, 2007). The upper and lower thirds of the display were not included because these areas were never attended to. Each player's position was determined by their location at the beginning of the trial. Strength of any lead that occurred was either recorded as strong or weak. For the purpose of this study, a strong lead was defined as any sharp acceleration by an attacking player in any direction to provide a kicking option for the player with the ball (i.e. the participant). In comparison, a weak lead was defined as an attacking player moving slowly in any direction without any definitive purpose.

*** Figure 1 near here ***

Statistical tests

The analyses consisted of (1) non-parametric statistics for decision-making accuracy data and (2) parametric statistics for decision-making time and eye movement data. Peat and Barton's (2005) guidelines for assessing normal distribution were followed. Decision-making accuracy data were not normally distributed and, therefore, non-parametric statistical tests were used. Differences between the three groups in decision-making accuracy were examined when all players were included, and within the less experienced and experienced players, respectively. Since non-parametric tests were used, medians (*Mdn*) and inter-quartile ranges (*IQR*) were reported. Consequently, differences in decision-making accuracy were examined using the Kruskal Wallis test. If the main effect was significant, Mann Whitney-U tests were conducted as a post-hoc analysis using Bonferroni correction. The p value was adjusted to 0.017. For these data, Cramer's V was calculated to measure effect size.

Decision-making time, mean number of fixations, mean fixation duration and search rate were normally distributed. The distribution of fixation location data had a moderate positive skew and, therefore, required a square-root transformation to create normally distributed data (Tabachnick & Fidell, 1989). Thus, these data were analysed with parametric tests, and means (*M*) and standard deviations (*s*) were reported. Given the small sample size of each experienced and less experienced instructional group, these data were not examined between these groups.

Decision-making time was analysed using a one-way ANOVA while mean number of fixations, mean fixation duration, and search rate were examined through the application of a 3 (group) x 2 (display) mixed ANOVA. Group (LOOSE, TTF and NI) was the between-participants variable and display (*even player display* and *loose player display*) was the within-participant variable. Data on fixation location for each display were subjected to separate mixed ANOVA analyses. Group was again the between-participants variable and fixation location was the within-participant variable. Greenhouse-Geisser and Huynh-Feldt procedures were used to correct for violations of the sphericity assumption where appropriate (Girden, 1992). Since there were unequal sample sizes in each group, any significant main effects were further examined using Gabriel's post hoc tests (Field, 2009). Partial eta squared (η_p^2) values were calculated to report effect sizes for normal data. For all tests, significance was set at $p \leq 0.05$.

Results

Non-parametric statistics

Decision-making accuracy: All players

Even player display. The Kruskal Wallis test revealed a main effect for decision-making accuracy [χ^2 (2, N = 46) = 7.31, p = 0.03, V = 0.28], with post-hoc tests indicating greater accuracy for the LOOSE group (*Mdn* = 83.3%, *IQR* = 83.3 – 100 %) compared with the TTF group (*Mdn = 80.0%, IQR* = 66.6 – 83.3%), while neither of these groups was different to the NI group (*Mdn* = 83.0%, *IQR* = 66.7 – 83.3%). Whilst the median difference between the LOOSE and TTF groups was only 3%, the LOOSE group had a higher percentage accuracy in 5 of the 6 trials than the TTF group. Furthermore, 13 of the 15 participants from the LOOSE group had the same or higher percentage accuracy than all of the participants in the TTF group.

Loose player display. There was no main effect for decision-making accuracy [χ^2 (2, N = 46) = 2.70, p = 0.26, V = 0.17] among the LOOSE (*Mdn* = 83.3%, *IQR* = 83.3 – 100.0%), TTF (*Mdn* = 83.3%, *IQR* = 73.3 – 83.3%) and NI (*Mdn* = 91.7%, *IQR* = 66.7 – 100.0%) groups.

Decision-making accuracy: The effect of player experience

When the decision-making accuracy data for the less experienced players were collapsed (i.e. *even player display* and *loose player display* combined), Kruskal Wallis testing revealed a main effect [χ^2 (2, N = 20) = 6.17, p = 0.05, V = 0.56], with post-hoc tests indicating greater decision-making accuracy for the LOOSE group (*Mdn* = 91.7%, *IQR* = 83.3 – 100.0%) compared with the TTF group (*Mdn* = 75.0%, *IQR* = 69.0 – 82.6%), while neither group was different to the NI group (*Mdn* = 79.2%, *IQR* = 64.6 – 85.4%). In contrast, when the data of the experienced players were collapsed for analysis, there was no main effect for decision-making accuracy [χ^2 (2, N = 20) = 2.85, p = 0.24, V = 0.33] among the three groups. These data indicate that the TTF instruction was more detrimental to the decision-making accuracy of lesser experienced participants, with instructional foci having no notable influence on the decision making of experienced participants.

Parametric statistics

Decision-making time

Even player display. A one-way ANOVA revealed no main effect for decision-making time [F (2, 17) = 1.31, p = 0.29, η_p^2 = 0.18] among the LOOSE (mean = 3.56 ± 0.35), TTF (Mean = 3.49 ± 1.34) and NI (mean = 4.23 ± 0.94) groups.

Loose player display. There was no main effect for decision-making time [F (2, 17) = .15, p = 0.86, η_p^2 = 0.26] among the LOOSE (mean = 4.04 ± 0.63), TTF (Mean = 3.92 ± 1.32) and NI (mean = 4.20 ± 0.75) groups.

Visual Search Behaviour

The subset of 20 players, whose visual search behaviour was measured, compared well with the entire participant cohort with respect to decision-making accuracy; hence, it was assumed that the visual search data collected was a true representation of the whole group (n = 46). Specifically, the same trends were found between the three sub-groups as when the entire cohort were analysed. The Kruskal-Wallis test showed a main effect for decision-making accuracy [χ^2 (2, N = 20) = 9.22, p = 0.01, V = 0.39] in the *even player display,* with post-hoc tests indicating greater accuracy for the LOOSE group (*Mdn* = 83.3%, *IQR* = 83.3 – 100%) and NI group (*Mdn* = 83.3%, *IQR* = 83.3 – 91.7%) compared with TTF group (*Mdn* = 66.7%, *IQR* = 66.7 – 79.2). Furthermore, similar to the analysis of the entire cohort of participants, no main effect for decision-making accuracy was found in the *loose player display* [χ^2 (2, N = 20) = 3.15, p = 0.21, V = 0.23] among the LOOSE (*Mdn* = 83.3%, *IQR* = 83.3 – 100.0%), TTF (*Mdn* = 73.3%, *IQR* = 66.7 – 82.5%) and NI (*Mdn* = 100%, *IQR* = 75.0 – 100.0%) groups.

An important initial step was to ensure that the different groups adhered to their instructional sets. Visual search data provided sufficient evidence to suggest that participants adhered to their specific instructional set. Specifically:

TTF. When the location of the TTF's group's final decision was compared to the location of the first fixation, 23.6% of first fixations matched the location of the final decision. When the second and third fixations were included, this measure increased to 47.2% and 62.5%, respectively. This suggests that the location of the final decision was attended to in the early fixations, in line with the instruction of "take the first option"Furthermore, when using the fixation location coding system based on the three areas of the display (i.e. left field, centre field, and right field), it was found that this group's final decision was to a player positioned in the same region as their first fixation in 66.7% of the trials. This is in good agreement with the findings of Raab and Johnson (2007) and suggests that the TTF group followed their specific instruction.

LOOSE. It was predicted that the instruction to "keep the ball away from the loose defender" would result in a greater number of fixations to the loose defender within their first fixation of seeing the environment. This was the case with 41% of first fixations for the LOOSE group allocated to the loose defender, which was more than any other location. The remaining 59% of first fixations were distributed across the other five locations (i.e. A1D1, A2D2, A3D3, A4D4, and open space). Comparatively, the TTF group fixated on the loose defender in 22.2% of first fixations and the NI group 20.5%.

The visual search data for the three instructional groups are presented in Table 1. No differences were found among the three groups in mean number of fixations, mean fixation duration and search rate, but differences were found between the two displays (i.e. *even player display* compared to the *loose player display)*. Multi-collinearity of the visual search variables were checked using Pearson's correlation (r). A strong negative correlation was found between mean fixation duration and mean number of fixations (r = -0.83).

*** Table 1 near here ***

Mean number of fixations. A mixed ANOVA found no main effect among the three groups [F (2, 17) = 0.01, p = 0.99, $\eta_p^2 < 0.01$], nor a group x display interaction [F (2, 17) =

2.96, $p = 0.08$, $\eta_p{}^2 = 0.26$]. A significant main effect for display was found [F (1, 17) = 174.54, $p < 0.01$, $\eta_p{}^2 = 0.91$], with post-hoc tests showing that the mean number of fixations was less in the *even player display* compared to the *loose player display*.

Mean fixation duration. There was no main effect among the three groups [F (2, 17) = 0.38, $p = 0.69$, $\eta_p{}^2 = 0.04$], nor a group x display interaction [F (2, 17) = 1.60, $p = 0.23$, $\eta_p{}^2 = 0.16$]. A main effect was found between the two displays [F (1, 17) = 48.44, $p < 0.01$, $\eta_p{}^2 = 0.74$], with post-hoc tests showing that mean fixation duration was significantly greater in the *even player display* compared to the *loose player display*.

Search rate. There was no main effect among the three groups [F (2, 17) = 0.06, $p = 0.91$, $\eta_p{}^2 = 0.01$], nor a group x display interaction [F (2, 17) = 3.13, $p = 0.07$, $\eta_p{}^2 = 0.27$]. A main effect was found between the two displays [F (1, 17) = 3.13, $p < 0.01$, $\eta_p{}^2 = 0.90$], with post-hoc tests showing that search rate was significantly less in the *even player display* compared to the *loose player display*.

Fixation Location: Even player display. There was no group x fixation location interaction [F (8, 68) = 1.81, $p = 0.09$, $\eta_p{}^2 = 0.18$]. No comparisons were made between the amount of time fixating on each location since the number of attacking and defensive players varied in each trial (see Fig. 2).

Fixation Location: Loose player display. A group x fixation location interaction was found [F (10, 85) = 2.28, $p = 0.02$, $\eta_p{}^2 = 0.22$], with post-hoc tests showing that the LOOSE group fixated on the loose defender more than the TTF group ($M = 0.39$, $s = 0.03$ vs. $M = 0.27$, $s = 0.03$, respectively). In contrast, the TTF group fixated on A2D2 more than the LOOSE group ($M = 0.49$, $s = 0.05$ vs. $M = 0.42$, $s = 0.04$, respectively), likely reflecting A2D2 being positioned centrally and providing a strong lead more than the other players in the video scenarios, thereby capturing the attention of the TTF group (see Fig. 2). No comparisons were made between the amount of time fixating on each location since the number of attacking and defensive players varied in each trial.

*** Figure 2 near here ***

Discussion

We examined the influence of two instructional foci on the decision-making accuracy of skilled performers when viewing video scenarios in Australian football. An important initial step was to ensure that the different groups adhered to their instructional sets. Given that research has demonstrated the importance of early fixations in decision-making in sport (Glockner, Heinen, Johnson, & Raab, 2012), the location of the first fixation was used as an indicator of whether this had occurred. This extends previous research which did not ascertain whether participants had followed instructions. Previous attentional-focus research has simply assumed that participants have followed instructions without any measure to support this assumption (e.g., Wulf & Su, 2007). Visual search data verified that the attention of each instructional group (i.e. LOOSE and TTF) was directed towards the loose defender and the first clear option, respectively. Moreover, a difference was found in the *loose player* display where the LOOSE group attended to the loose defender more than the TTF group and, conversely, the TTF group fixated on the player providing a strong central lead (A2D2) more than the LOOSE group.

The main aim of the experiment was to examine the influence that short-term instructional foci has on decision-making accuracy of skilled performers. In general, there was a lack of systematic difference among the three groups in decision-making accuracy and, thus, our hypothesis that groups receiving instructions would demonstrate superior decision-making accuracy was not supported. Specifically, there were no differences observed between either of the two instructional groups and the (control) group given no instructions. In fact, fixation location data suggested that the NI group adopted visual search strategies that did not differ from that of the TTF group – that is, their attention was drawn to the teammate presenting a strong lead in the centre of the display. This is not surprising given the perceptual-cognitive adaptations that are pre-eminent among skilled performers (Williams & Ford, 2008), and it is likely that such performers have developed patterns of behaviour (i.e. visual search strategies) to cope with complex scenarios in the field of play.

The only difference found in decision-making accuracy was between the LOOSE and TTF groups in the *even player display*. This result was unexpected given the nature of the LOOSE instruction in a condition where there was no loose defender. However, when each of the *even player display* scenarios were examined in greater detail, it was observed that the significant difference between the decision-making accuracy of the two groups was attributed to large differences in three of the six scenarios. These three trials all had one common feature – there was a strong lead drawing the decision selection of the TTF group, but it was not considered the correct decision by the coaching panel. When visual search patterns were analysed in these three scenarios, no differences were observed among the groups. We therefore speculate that, despite attending to the same locations as the LOOSE group, the TTF group did not make the correct decision due to adherence to their instruction. It appears possible that the TTF instruction lead to attentional capture, thereby hindering the participants' ability to differentiate between the first option (usually a strong lead) and the correct option which may have appeared later. Previous research in Australian football has demonstrated that attention is first directed to teammates who provide strong leads (Farrow & Mann, 2006); hence, the conversion of the TTF heuristic (Johnson & Raab, 2003; Raab & Johnson, 2007) to an instruction, as done in the present study, may have reduced the ability of the TTF group to pick-up critical information from other locations in the display. This suggestion resembles the inattentional blindness phenomenon, where performers fail to detect an unexpected object if attention is focussed on another location (Mack & Rock, 1998; Simons & Chabris, 1999).

The secondary aim of this study was to assess the effect that performer experience had on the influence of instructions. It was found that less experienced participants in the TTF instructional group were primarily responsible for the poorer decision-making performance of that group. These data for highly-skilled (i.e. playing in the elite national competition) lesser and more experienced performers extend previous findings where 'less experienced' performers were of novice standard only (Furley, et al., 2010). These data also suggest that less experienced players are more likely to adhere to a coaching instruction, while experienced players rely more on their 'know-how' to regulate their decision-making performance. These findings also demonstrate a potential problem with coaching directives, in that certain instructions (e.g. "take the first option") may create inattentional blindness in developing or less experienced players more so than in experienced performers. This finding is consistent with recent research that demonstrates that experienced performers are less likely to show inattentional blindness than performers with little experience in the domain (Furley, et al., 2010).

Whilst the present findings are limited by the small sample size, the results do have important implications for practitioners involved in facilitating perceptual-cognitive skill in team field sports. It is clear that influencing the decision-making accuracy of highly-skilled and experienced performers is very difficult with an acute instructional prompt, despite this practise being commonplace in applied settings. This factor is likely due to the relative strength of the experienced performers' existing pattern of behaviour and the short-term nature of the instructional intervention. Therefore, coaches should be aware that an extensive period of practice with constant reinforcement of the instruction is more likely required to influence the decision making of skilled and experienced performers. For lesser experienced performers, it appears that decision making is more easily influenced. There was some support to show that the instruction "take the first option" was detrimental to performance in certain scenarios, with less experienced performers most influenced, although further work is clearly required. Similarly, continued research is required to determine how the task complexity that is inherent in team field sports can be simplified with instruction and, importantly, the duration required to change the decision-making behaviour of skilled performers.

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Figure Captions.

Figure 1. The two coding systems used to assess fixation location – (a) the 10 locations (A1D1, A2D2, A3D3, A4D4, loose defender, nearest side space, furthest side space, goal square space, corridor space, and an unclassified area), and (b) the three general areas (left field, centre field, and right field). In actual video footage, attacking players wore red shirts and defenders wore yellow shirts.

Figure 2. Fixation characteristics while viewing video scenarios of Australian football. The proportion of total time fixating on specific locations in two types of video scenarios is shown in (A) displays with an even number of attackers and defenders, and (B) displays with an extra (loose) defender. Locations were divided into attacker/defender positions (e.g. A1D1 is the first attacker and defender from the left of the display), open space, and the loose defender (in 'B'). Players were divided into three groups: (i) LOOSE (■ n = 7) – instructed to "keep the ball away from the loose defender; (ii) TTF (■ n = 6) – instructed "take the first option"; and (iii) NI (☐ n = 7) given no instruction. These data underwent square-root transformation. Error bars represent standard deviation. *TTF group different from LOOSE group, and $^{\$}$LOOSE group was different from TTF group. Significance was set at $p \leq 0.05$.

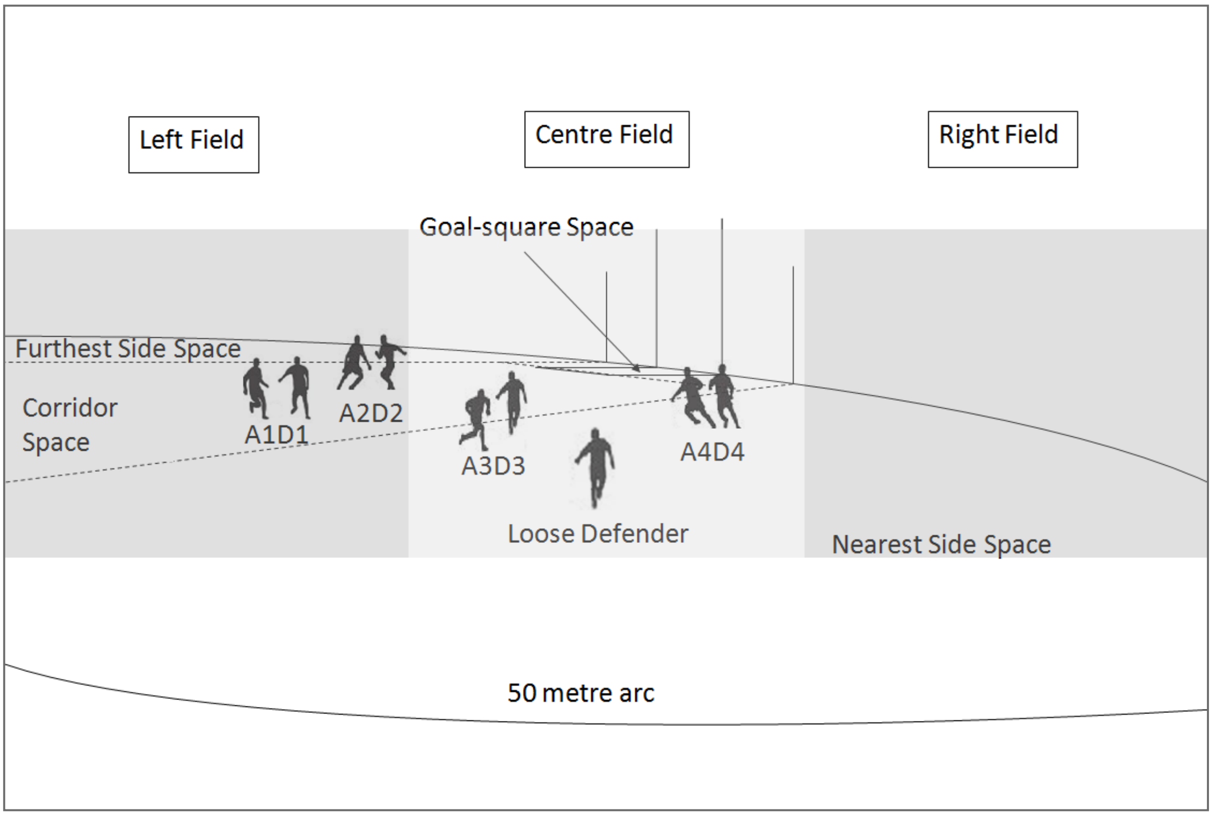
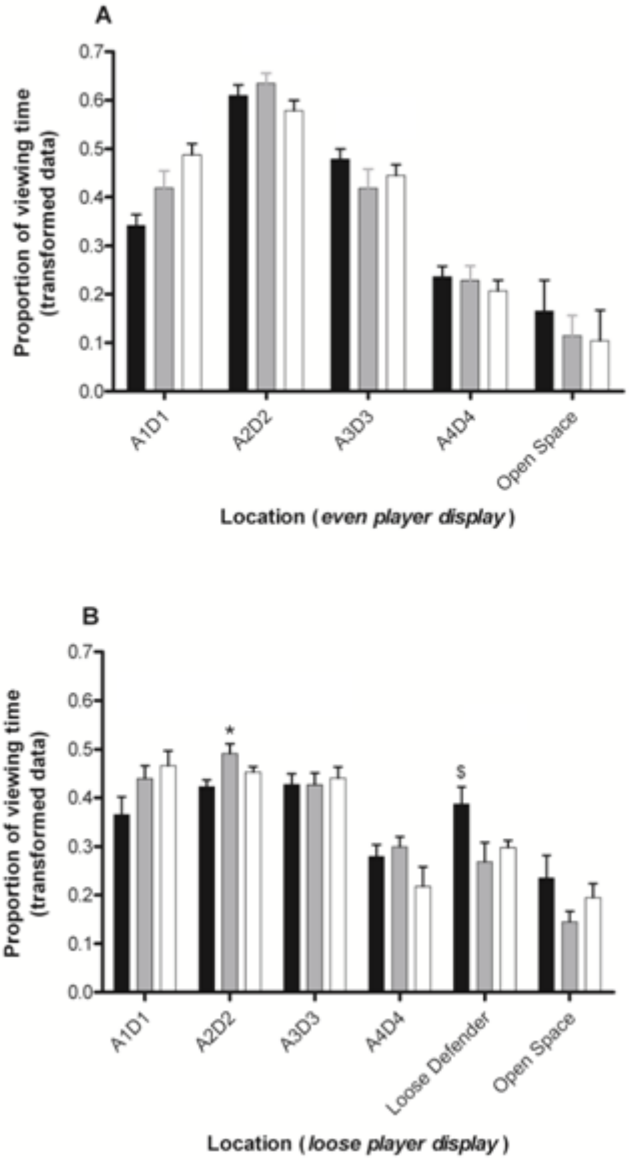

Left Field
Centre Field
Right Field
Goal-square Space
Furthest Side Space
Corridor
Space
A1D1
A2D2
A3D3
A4D4
Loose Defender
Nearest Side Space
50 metre arc

Figure 1.



A
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Proportion of viewing time (transformed data)
A1D1
A2D2
A3D3
A4D4
Open Space
Location (*even player display*)
B
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Proportion of viewing time (transformed data)
*
$
A1D1
A2D2
A3D3
A4D4
Loose Defender
Open Space
Location (*loose player display*)

Figure 2.

Table 1. Visual search behaviour characteristics of professional Australian football players while viewing video simulations of game-specific scenarios.

Visual search characteristics	**LOOSE (n = 7)**	**TTF (n = 6)**	**NI (n = 7)**	**Mean of the groups combined (n = 20)**
Even player display				
Mean number of fixation	5.8 (1.0)	6.0 (1.7)	5.6 (1.1)	5.8 (0.3) *
Mean fixation duration (ms)	576.5 (152.4)	562.1 (115.2)	661.2 (188.9)	600.0 (35.2) *
Search rate (fixations/s)	1.7 (0.3)	1.7 (0.3)	1.5 (0.4)	1.6 (0.1) *
Loose player display				
Mean number of fixation	7.8 (1.1)	7.5 (1.2)	7.9 (1.3)	7.7 (0.3)
Mean fixation duration (ms)	417.3 (77.1)	436.0 (68.8)	428.6 (110.9)	427.3 (0.3)
Search rate (fixations/s)	2.1 (0.3)	2.0 (0.3)	2.1 (0.5)	2.1 (0.1)

Data are represented as mean (s). *Significantly different ($p < 0.05$) from the respective value in the loose player display.