Detection of Task-Relevant Cues in Field Hockey

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Coaches and participants are well aware that effective performance in complex sport situations requires perceptual as well as physical skill. The relationship between skill level and perception of sport or game-relevant cues has been investigated in several settings (e.g., Allard, Graham, & Paarsalu, 1980; Chase & Simon, 1973; deGroot, 1965). Chase and Simon (1973) and deGroot (1965, 1966) have demonstrated that skilled chess players recall the positions of chess pieces on a briefly presented display better than do unskilled players only when displays present arrangements of the playing pieces that normally occur in the game of chess. When the displays present random patterns of playing pieces, skilled players recall the display no better than do unskilled players. Allard et al. (1980) found the critical interaction between skill level and structure of the presented information when subjects were asked to recall the positions of players in photographic slides of basketball games. It has been inferred from the interaction of skill level and game structure that experienced participants have developed effective perceptual strategies through their participation.

The apparent ability to use game structure as an aid to perception has not been evident in all investigations of perception in sport and games, however. Allard and Starkes (1980) compared the speed and accuracy of signal detection of volleyball players and nonplayers. Players were as accurate as and much more rapid than nonplayers at the task of detecting the presence of the volleyball in photographic slides of volleyball situations. However, the advantage of the experienced player was evident regardless of the degree of game structure present in the displayed slides. More recently, Saariluoma (1985) tested the role of experience in the detection of task-relevant cues by chess players. Players of all three skill levels were faster at detecting and classifying game positions than random positions. No interaction between experience and structure was noted.

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When the perceptual task has been the detection of game-relevant cues, it appears that game structure is used to aid in detection equally well by players of lesser and greater experience. All subjects in the detection experiments had some experience within the game or sport involved. It is possible that skill in the use of game structure as an aid to detection is acquired very early in exposure. Support for this explanation would accrue if subjects with no prior experience in a game were unable to take advantage of game structure while subjects with some degree of experience were so able.

We chose the sport of field hockey to further investigate the role of experience and game structure in the detection of game-relevant cues in complex sport situations for two reasons. First, it was possible to obtain subjects who were skilled athletes but who had no experience, either as participant or spectator, with the sport of field hockey. Thus a truer test of the role of sport-specific experience in the use of learned game structure in cue detection was possible. Second, due to the small size of the hockey ball, it was possible to show subjects slides that depicted situations in which game structure would predict the presence of the target object (the ball) but in which the ball was not visible. We reasoned that if more experienced players do use game structure to aid in rapid detection, the ambiguous slides should lead to higher detection error rates among the more experienced players than among the lesser or totally inexperienced players.

Methods

Subjects

Eighteen female athletes served as volunteer subjects for this study. Six subjects with competitive field hockey experience ($M = 6.3$ years) comprised the high experience group, 6 subjects with less experience ($M = 1.6$ years) comprised the low experience group, while the remaining 6 subjects were athletes who had no experience in field hockey. All subjects gave their written consent to participate in the study.

Materials

The stimuli consisted of 54 color slides of field hockey games. One set of slides presented scenes of structured game situations in which the ball was present (BG, $n = 11$); the second set included scenes of structured game situations in which the ball was predictably not present (NBG, $n = 10$); the third and fourth sets of slides presented nongame situations such as team huddles, or players on the sidelines or warming up. The slides in one of these sets included a hockey ball (BNG, $n = 11$) while slides in the other included no ball (NBNG, $n = 11$). The final set of slides included scenes of structured game situations in which the ball was within the scope of the scene but was hidden from camera view by a player or equipment (X, $n = 11$).

Procedures

Subjects were seated 3 m in front of a standard projection screen on which each stimulus slide was presented for 600 ms. The ITI was 10 s. The slides were randomly sequenced, and a single order was used for all subjects. Presentation
of each slide started a millisecond timer. The subject released a switch, stopping the timer when she was able to respond whether the ball was present in the slide. A delayed “yes” or “no” response was then given.

**Dependent Measures**

The accuracy of signal detection was measured as the percent of yes/no responses that were correct. Simple percent correct was selected as the dependent measure of accuracy, as the critical X slide condition included no signal present instances, thereby prohibiting the calculation of d' and beta. The speed of detection was reflected in the reaction time (RT) measured from slide exposure to switch release.

**Results**

The accuracy of game-relevant cue detection, measured as the percent of ball present/ball absent judgments that were correctly made, is plotted for each group as a function of slide structure in Figure 1. The main effect of playing experience was not significant, $F(2, 4) = 1.26, p > .05$.

The main effect of slide structure was significant, $F(2, 45) = 26.67, p < .01$ (Greenhouse-Geisser $p < .01$). The nongame slides allowed the highest percentage of correct detections (91.2%) for all subjects while the X slides led to the lowest percentage of correct detections (66.2%). Direct interpretation of the main effect of slide structure is difficult, however, as the interaction between slide structure and player experience was also significant, $F(4, 45) = 7.09, p < .01$.

![Figure 1](image)

Figure 1 — Percent correct detection as a function of playing experience and game structure.
In light of the significant interaction, the simple main effects of playing experience were examined within each category of slide. The only significant effect was within the X slides. For these slides, the no-experience group was most accurate (78%), the low experience group was slightly less accurate (72.5%), and the most experienced group was the least accurate (48.2%). This difference was significant. It appears, then, that the significant interaction was due primarily to the poor performance of the highly experienced players when viewing slides in which game structure indicated the presence of the ball, which was hidden from view.

**Speed of Detection**

The main effect of player experience was not significant, $F(2, 15) = 2.19$, $p > .05$. The main effect of game structure was significant, $F(4, 60) = 9.29$, $p < .001$. Post hoc analysis indicated that RTs for the NBG and X slides (both 1001 ms) were significantly longer than the RTs for the other three categories of slides. Also, the RT for the BNG slides (870 ms) was significantly shorter than for all other categories of slides. The interaction between game structure and experience was not significant.

**Discussion**

We selected the sport of field hockey for use in this study because it presented two unique characteristics. It was possible to employ subjects in the no-experience group who had neither participatory nor vicarious experience with the sport. Therefore they had had no opportunity to develop any sport-specific expectations or strategies. The second pertinent, somewhat unique, characteristic of field hockey is that the ball is small enough to be hidden from view in action scenes.

Given the first of these characteristics, we expected the detection accuracy data from the typical game and nongame situations to show a general advantage for the experienced players similar to that noted by others (Allard & Starkes, 1980; Saariluoma, 1985). Players were no more accurate than athletes who had never even observed the game, however. This finding, and the absence of any apparent interaction between game structure and experience for the typical situations, suggests that players do not use a strategy learned through participation as a basis for detecting game-relevant cues.

The introduction of situations in which game structure indicated the presence of the ball but where the ball itself was not visible led to quite a different inference about the strategies of subjects with different levels of game experience. The players with the most experience with field hockey performed most poorly in detection of the target object for the X slides. Subjects with no experience were most accurate in that situation. As the groups' mean RTs did not differ significantly, the errors by the experienced players cannot be attributed to a speed/accuracy trade-off. This finding suggests rather strongly that highly experienced players employed a detection strategy based on prediction from observed game structure. Thus, the results apparently present a contradiction about cue detection in sport.

Expert players and nonplayers were similar in the laboratory situation in that the motor response required was simple and demanded little attention (e.g.,
Ells, 1973). It is possible that the use of learned strategies was not necessary in this situation since the performer has sufficient attentional capacity to use an inefficient method of detection and execute the required response. Strategy differences among different skill levels became apparent, then, only when the structure presented misleading cues.

References


Manuscript submitted: May 30, 1986

Revision received: October 14, 1986