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The Effect of Screen Size on Video-Based Perceptual Decision-Making Tasks in Sport

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Abstract
This study tested the effect of screen size on the decision making performance of experienced and inexperienced basketball players during a video-based perceptual decision making task. Participants were 13 elite, 25 intermediate, and 34 novice participants who viewed 30 structured sequences of basketball games twice for between 4 to 6, once on a 43 cm (17 in.) computer monitor and once on a 1.8 m x 1.45 m (5 ft 10 in. x 4 ft 9 in.) video projection screen. Participants were required to indicate their decision basketball usage (i.e., pass, shoot, or dribble) after the visual display had been occluded for each clip. Results generally indicated that there was no difference in decision accuracy for screen size and that experienced players made more accurate decisions when compared with novices. The findings failed to support the notion that using a big screen provides a more ecologically valid testing-training environment and suggested that there is enough information in smaller visual displays to enable individuals to make accurate decisions. However, further research into the implementation of video-based perceptual training tasks using different screen sizes is recommended.

Key words: decision making, video-based, screen size

Introduction
Being able to anticipate future events and make effective decisions based on this anticipation is an important perceptual-cognitive activity in skilled sports performance (Williams, Davids, & Williams, 1999). In open skill team sports, such as soccer and basketball, the skill of anticipating may come from a combination of efficient visual search strategies, effective cue utilization, skill in pattern recognition, and knowledge of situational probabilities (Williams, Ward, Knowles, & Smeeton, 2002). Because of the importance of anticipation and decision making to skilled performance, research focusing on anticipation and perceptual decision making in sport has increased rapidly in recent years. Much of this research has adopted the expert performance approach (Ericsson & Smith, 1991) where the performance of experts and non experts is compared.
on sport-related anticipation and perceptual decision making tasks. Many of the studies on perceptual-cognitive tasks in sport have found that experts perform better on perceptual-cognitive tasks than non experts (e.g., Abernethy, 1989; Chase & Simon, 1973; Mascarenhas, Collins, & Mortimer, 2005; Tenenbaum, Levy-Kolker, Sade, Lieberman, & Lidor, 1996; Williams, Davids, Burwitz, & Williams, 1994).

The design of sport-related perceptual decision making tasks—especially those related to open skills, which are representative of actual performance—is challenging (Williams & Ericsson, 2005). Because of this, video-based tasks have frequently been used to measure perceptual-cognitive performance. These studies have often employed a temporal occlusion paradigm in which the appropriate display is filmed and then selectively edited so that the film is paused at particular points momentarily before or after the action is completed (Williams, Davids, & Williams, 1999). When the footage is presented to the participants, they are asked to make a decision as to what they would do next, predict what the opponent would do next, or predict the result of the action observe; the accuracy of their response is recorded. Typically, the filming position is from a participant's customary, or first person, perspective in the action—this has been the case for most individual skill studies, such as in squash (Abernethy, 1989), tennis (Farrow, Chivers, Hardingham, & Sachse, 1998; Farrow & Abernethy, 2002), and cricket (Houlston & Lowes, 1993). In a team open-skill sport, this type of filming is difficult as it is hard to capture the movements of both team members and opposition unless the plays are structured and simulated specifically for the test (Gorman, 2004). Instead, a camera filming a large section of the playing area is often used, as was the case in studies of basketball (Starkes & Lindley, 1994), soccer (Williams & Davids, 1998), and officiating rugby (Mascarenhas, Collins, & Mortimer, 2005).

With advances in technology, visual images are now more commonly presented in large screen format (Williams, Ward, Knowles, & Smeeton, 2002). A review of the literature suggests that earlier studies utilized smaller screen formats. For example, screen sizes have ranged from 20–21 in. (50.8 cm–53.34 cm) for activities such as tennis (Tenenebaum et al., 1996) and cricket (Houlston & Lowes, 1993), and 25 in. (63.5 cm) for American football (Christina, Barresi, & Shaffner, 1990). More recent studies have utilized larger screens or displays with most ranging from approximately 1.2 m x 1.8 m (4 ft x 5ft 10 in.) to 3 m x 3.5 m (9 ft 10 in. x 11 ft 5 in.) in a range of sports, such as basketball (Al-Abood, Bennett, Hernandez, Ashford, & Davids, 2002; Gorman, 2004), cricket (Renshaw & Fairweather, 2000), hockey (Williams, Ward, & Chapman, 2003), and soccer (Horn, Williams, & Scott, 2002; Williams et al., 2003; Williams & Davids, 1998). Interestingly, perceptual training studies have sometimes used both large and small screens. For example, Gorman (2004) pre- and posttested participants using a basketball decision making test on a 1.83 m by 1.43 m (6 ft by 4 ft 8 in.) large screen, but the perceptual training group had been trained by watching video on a 34 cm (13 in.) monitor. There has not been one standard screen size used throughout the literature.

One study that has investigated the influence of screen size on visual search strategies was conducted by Al–Abood and colleagues (2002). They investigated the effect that verbal instructions and image size had on visual search strategies in basketball players...
taking a free throw shot. Participants had their eye movements tracked whilst viewing the same six demonstrations on the 1.5 m x 1.5 m (4 ft 11 in. x 4 ft 11 in.) large and the 29 cm x 23 cm (11 in. x 9 in.) small screen. They found that verbal instructions, coupled with perceptual training, improved performance of the basketball foul shot. In terms of visual search, they found that participants performed less fixations but for a longer period of time on the large screen than on the small screen. They suggested that this may be attributable to the small screen size. That is, participants using the small screen could not adequately pick up visual information via the peripheral retina, therefore, requiring a search pattern of more fixations of shorter duration. Further, regarding the differences in the amount of fixations per screen, it was discovered that participants made more mean fixations on the upper body when watching the big screen than the small screen. When viewing the lower half of the body, participants made less fixations, but of longer duration, on the large screen. Al–Abood and colleagues (2002) proposed that the larger image provided the participants with a better opportunity for perceiving relevant information about the various aspects of shooting a foul shot, therein leading to more fixations on the upper body.

Williams and Ericsson (2005) reported that many questions have yet to be answered in the design of representative task simulations attempting to capture anticipation and perceptual–cognitive skill in sport. One question they raised is, when using video footage, whether the image size should be body-scaled using large screen displays or whether performance can be adequately captured with smaller screen displays. That is, the effect of image size reduction on performance is not clear (William, Davids, & Williams, 1999). The use of larger screens in recent research appears to be based on the assumption that the larger screen provides a more realistic environment with life-size images on the screen (Williams & Davids, 1998).

From both a cognitive information processing and an ecological perspective, having more realistic perceptual information could provide a more valid measure of perceptual skill. A cognitive or information processing view would suggest that the performer must search the visual display for relevant sources of environmental information and ignore less relevant cues; that is, using this information with internally represented movement to make a decision (Norman, 1968, 1969; Williams, Davids, & Williams, 1999). Perception of the relevant environmental information is crucial in this view because, if it is not attended to or is unable to be picked up from a display, information is unlikely to be used in making a decision about action. The use of a large visual display might aid in visual search performance as opposed to using the smaller visual display, which may make visual search more difficult. It is also possible that the larger screen allows participants to pick up more spatial or relational information, a process that could be used from a cognitive viewpoint to make a decision about action. In the ecological account of direct perception (Gibson, 1979), the perception of affordances is only possible if the participant actively searches for opportunities for action. The theory of direct perception involves the interaction of physical and optical variables to create affordances or opportunities to act in response to the perceived variables. Physical variables refer to the properties of surfaces and objects in the environment, whilst optical variables come in many forms: These include direction of motion of an object, distance to an object, and time until contact (Williams et al., 1999).
This leads the participant to perform an action that is determined by the environment, task constraints, and the participant's own strengths and weaknesses. Because affordances are directly perceived from the display, it is possible that the larger and smaller screens present information that is qualitatively different; this could influence the affordances perceived. It may be that researchers have expected that the affordances, or opportunities to act, when viewing a large screen are more representative of the affordances encountered in a real life situation. Both these theoretical accounts provide some basis for using larger screens in exploring decision making and perceptual–cognitive skills in sport; however, researchers appear to have adopted the use of larger screens without exploring whether the larger screens actually do provide a more realistic environment. It is important that the validity of this assumption be empirically tested.

Although some researchers have assumed larger screens provide a more realistic environment—that is, with images being presented life sized on the screen (Williams & Davids, 1998)—in team sports the critical information is the pattern of play rather than a particular cue. In addition, having more realistic perceptual information could be expected to provide a more valid measure of perceptual skill from both a cognitive information processing and an ecological perspective, but that may not always be the case. A study by Williams, Hodges, North, and Barton (2006) has provided evidence that skilled performers perceive and process displays in a team sport as a function of relational information. Therefore, a possibility is that, as screen size is altered, the relational information remains constant, and thus, expert performance is accurately captured in context regardless of screen size. Interestingly, Tan, Gergle, Scupelli, and Pausch (2006) reported in a nonsporting study that there was no significant difference on a reading task performed on projected wall displays versus standard desktop monitors; however, participants had better performance on the larger screen on a spatial orientation task, suggesting that spatial information may be better on the larger screen.

The purpose of this study was to examine the effect of screen size on the decision making performance of participants in a video-based perceptual test (a sequence of 30 basketball clips) and to determine whether these effects vary according to the experience and performance level of participants. It was hypothesised that: (a) decisions made when viewing a large screen would be more accurate than decisions made when viewing a small screen; (b) these differences would be apparent for each of three different types of decisions (i.e., pass, shoot, and dribble); (c) participants who are currently playing basketball, have played basketball at a higher level, have more basketball experience, or who usually play a team sport will make more accurate decisions than those not currently playing basketball, played basketball at a lower level, have less basketball experience, or who usually participate in individual type sports; and (d) the nature of the interaction between screen size and participant experience (i.e., currently playing basketball, played basketball at higher level, and more basketball experience) will be such that experienced participants will increase their decision accuracy from the small screen to the large screen. However, it is proposed that, since novices are unable to effectively use the information available to them, there will be little improvement evident from the small screen to the large screen presentation.
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METHOD

PARTICIPANTS

Participants were 72 adults (n = 38 females, n = 34 males) ranging in age between 18 and 29 years (M = 20.8, SD = 2.2) from undergraduate university human movement and physical education classes and individuals from recreational, semiprofessional, and professional basketball teams. Participants were recruited due to interest expressed in response to a poster on a university noticeboard, via word of mouth, or through known basketball players who were invited to be participants in the study. Participants were asked to indicate the primary sport in which they participated: 50 participants were primarily playing in team sports (e.g., basketball, netball, Australian Rules football, and cricket), 20 played in individual sports, and 2 individuals did not participate in sports at all. Participants were asked to indicate if they had played basketball, the number of years they played, and the highest level of competition in which they played. There were 55 participants who were currently playing basketball ranging from 1–3 years (n = 21), 4–6 years (n = 14), and 7 or more years (n = 20). Participants also indicated the highest level of basketball played, which consisted of 29 social/recreational, 25 junior/senior local, 13 state league or national/international, and 5 who had not played at all.

DESIGN AND MEASURES

This experimental study incorporated a mixed design that included one repeated measures factor (i.e., screen size) in conjunction with a number of between groups factors, including three basketball factors (i.e., currently playing, highest level played, and years played) and one general sport factor (i.e., type of main sport played). Scores were the number of correct decisions (i.e., "best option") made for the 30 test trials under the two test conditions.

Participants completed a video-based perceptual decision making test. The test involved the participants watching 30 offensive basketball plays with the duration of each of the 30 clips ranging between 4 and 6 s. Prior to the test beginning, the participants viewed 5 practice clips. At the end of each clip, the video was occluded and the participants were asked to make a decision as to what to do with the ball, pass, shoot, or dribble it as if they were the player with the ball at the time of occlusion.

Footage for each clip was recorded from two men's games in the South East Australian Basketball League and one men's game in the Big V Championship League. The matches had not been televised, so participants had no prior information from the clips. The footage contained offensive patterns of play from all six teams and was captured in widescreen format using a Canon digital video camcorder (PAL MV850i) from a fixed and elevated position (3 m) located 5 m from the half-court line. The widescreen format allowed for all players to be seen without the camera moving. Each clip was edited so that it began at a point in the game sequence where there was a natural break, such as a player receiving the ball or the ball being turned over to the other team. The test footage was then edited using Pinnacle Studio Plus Version 9 with sequences occluded.
.05-.30 s. prior to the ball handler releasing the ball to execute a movement. Sequences were selected on the basis that, at the time of occlusion, the player had not commenced their movement, leaving the possibility for at least two of the three options (i.e., pass, dribble, shoot) to be selected as a decision. The selected sequences were then shown to three accredited basketball coaches (one Level 3 and two Level 2 Basketball Australia accredited coaches), who ranked pass, shoot, or dribble for each clip in order from best option to worst option. All three coaches had to agree on the best option, with two agreeing on the worst option, for the clip to be included. Using these criteria, a total of 30 clips were selected for use. Thus, the final test contained 30 clips with 5 practice clips and a 6-s. response period between each clip. The mean clip duration was 5.10-s. (SD = .75). Participants indicated their decision by writing the chosen response on a prepared response sheet. The frequency of each outcome (i.e., pass, shoot, and dribble) was ranked as the best option and all options were equally distributed. The 10 clips in which pass was the best option had a mean duration of 4.94-s. (SD = .70), the 10 clips in which shoot was the best option had a mean duration of 5.25-s. (SD = .75), and the 10 clips in which dribble was the best option had a mean duration of 5.13-s. (SD = .85). The same 30 clips were used during testing for two presentation conditions and included different trial sequences. In the small screen condition, participants watched the clips presented via a 17-in. (43 cm) flat screen computer monitor (27 cm high x 33.5 cm wide). Participants sat approximately 1 m from the computer screen in an upright position. The vertical visual angle, subtended from the top to the bottom of the screen, was approximately 15°. In the large screen condition, clips were projected using a Sony 3LCD (XGA VPL-Cx30) digital projector onto a screen that was 1.8 m high x 1.45 m wide (5 ft 10 in. x 4 ft 9 in.). Participants were seated 5 m (16 ft 4 in.) from the screen. The vertical visual angle subtended from the top to the bottom of the screen was approximately 19°47'.

PROCEDURE

Participants were briefed on the general purpose of the study and the test procedures were explained. Participants were instructed to view 30 clips under two different presentation conditions—small screen and large screen—and that each clip was 4–6s. in length; they were also notified that the clips were of offensive plays. At the end of each clip, the participants had to decide which of the three options they would have executed if they were the player with the ball at the time of occlusion. It was emphasised to the participants that they were not trying to guess what the ball handler on the screen was about to do, but what they would do with the ball in that situation. Participants had 6 s. between each test clip to record their 35 responses (5 practice and 30 test) for each condition. After the 30 test clips, the participants had a short break before they completed the same task on the other screen size. The order of testing was counterbalanced such that half of the participants performed the testing on the small screen first and half performed on the large screen first. Testing was completed in a single session approximately 30 min in duration.
Ethics approval for the study was provided by the University of Ballarat and all participants provided informed consent prior to testing.

Data Analysis

The dependent variable was decision making accuracy, indicated as the number of best option nominations. Descriptive information about overall decision making accuracy—percentage of best option responses made by participants under the two screen size conditions—was computed for the three types of trials (i.e., pass, dribble, shoot) as well as for all trials. Separate mixed analyses of variance (ANOVAs) were used to test for differences in decision accuracy (i.e., total number of correct responses on all trials, with scores ranging from 0–30) according to the screen size factor [Screen] as well as each of the basketball factors—that is, currently playing basketball [Playing], highest level played [Level], and number of years played [Years]—and general sport factor describing the main type of sport played [Type]. Post-hoc tests were performed with Tukey’s HSD where appropriate. Results for the main effects and marginal means of three basketball factors were used to assess validity of the decision making test. Validity of the test as a measure of decision making accuracy would be demonstrated by its ability to discriminate levels of basketball experience and expertise. We used partial eta-squared ($\eta^2$) to indicate the strength of effects for all analyses and Cohen’s $d$ to determine the magnitude of differences among means where follow up comparisons were performed. Significance was accepted as $p < .05$ and all testing was performed using SPSS V14.0.2.

Results

Decision accuracy was evaluated by determining the number of best option decisions for the 30 trials as well as for each of the three subsets of trials (i.e., pass, dribble, and shoot) according to the size of the presentation screen. The results summarized in Figure 1 indicate similar decision accuracy for each of the three types of play and for all trials under the two screen size conditions.

Mean decision accuracy (i.e., number of best option decisions on all trials) was computed for screen size and for each of the three basketball and one general sport factors. These results are shown in Table 1 and reveal that—while decision accuracy was best for participants who were currently playing basketball, had more basketball experience, or had played at higher levels, as well as for those whose main sport was a team sport—these trends did not appear to vary according to screen size.

Follow-up analyses (ANOVA) performed for each of these factors generally confirmed these observations. There was a significant main effect for Playing, $F(1, 70) = 9.4, p < .01, \eta^2 = .12$; those currently playing basketball ($M = 17.4, SD = 3.4$) made more correct decisions than those not currently playing ($M = 14.5, SD = 3.0, d = .90$). The main effect for Screen and Playing x Screen interaction were both not significant, $F = 0.8, 0.8$ and $\eta^2 = .01, .01$ respectively. There was a significant main effect for Level, $F(2,64) = 8.6, p < .001, \eta^2 = .21$; both local ($M = 18.4, SD = 2.4$) and state–national level ($M = 18.2, SD = 3.7$) made more correct decisions than social–recreational level.
Figure 1. Mean decision accuracy (i.e., percentage of best options) for pass, dribble, shoot ($n = 10$ for each), and all trials ($n = 30$) for small screen and large screen presentation formats.

Players ($M = 15.0$, $SD = 3.6$, $ds = 1.09$ and $1.05$ respectively). The main effect for Screen and Level x Screen interaction were both not significant, $F = 3.7, 2.3$; $\eta^2 = .06, .07$ respectively. Analysis with the Years factor indicated that, although decision accuracy increased with years played—that is, $1–3$ years ($M = 16.5$, $SD = 4.0$), $4–6$ years ($M = 18.0$, $SD = 2.2$), and $\geq 7$ years ($M = 18.2$, $SD = 3.4$)—this main effect failed to reach significance, $F(2, 52) = 1.5, p > .05, \eta^2 = .05$. The main effect for Screen and Level x Screen interaction were both not significant, $Fs = 2.7, 1.0$; $\eta^2 = .05, .04$ respectively. Together, the results for the main effects of the three basketball factors indicate support for the validity of the test task; that is, the test was able to discriminate on two of the measures (i.e., Playing and Level), and results of the third measure (i.e., Years) were as would be expected but not statistically significant. Analysis of the other sport factor revealed that the main effect for Type was not significant, $F(1, 68) = 2.4, p > .05, \eta^2 = .03$; however, there was a significant main effect for Screen, $F(1, 68) = 5.6, p < .05, \eta^2 = .08$. Participants made more correct decisions on the small screen ($M = 17.1$, $SD = 3.8$) than for the large screen ($M = 16.3$, $SD = 4.2$, $d = .20$). The Type x Screen interaction was not significant, $F(1, 68) = 3.4, p > .05; \eta^2 = .01$.

Figure 1. Mean decision accuracy (i.e., percentage of best options) for pass, dribble, shoot ($n = 10$ for each), and all trials ($n = 30$) for small screen and large screen presentation formats.
Table 1. Mean Decision Accuracy Under Small Screen and Large Screen Presentation Formats According to Basketball and General Sport Factors.

<table>
<thead>
<tr>
<th></th>
<th>Small screen</th>
<th>Large screen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>Overall</td>
<td>72</td>
<td>17.0</td>
</tr>
<tr>
<td>Currently play basketball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>55</td>
<td>17.8</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>14.5</td>
</tr>
<tr>
<td>Years played basketball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–3</td>
<td>21</td>
<td>17.2</td>
</tr>
<tr>
<td>4–6</td>
<td>14</td>
<td>17.9</td>
</tr>
<tr>
<td>≥7</td>
<td>20</td>
<td>18.6</td>
</tr>
<tr>
<td>Highest level played basketball*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social-recreational</td>
<td>29</td>
<td>15.7</td>
</tr>
<tr>
<td>Local competition</td>
<td>25</td>
<td>18.2</td>
</tr>
<tr>
<td>State-national competition</td>
<td>13</td>
<td>19.2</td>
</tr>
<tr>
<td>Main sport type*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>20</td>
<td>16.7</td>
</tr>
<tr>
<td>Team</td>
<td>50</td>
<td>17.2</td>
</tr>
</tbody>
</table>

Note: Mean decision accuracy is the number of "best option" decisions for 30 trials. Five participants indicated none/not played as their highest level and two participants indicated no major type of sport.

**DISCUSSION**

This study investigated the effect of screen size on decision making accuracy during a video-based perceptual basketball test. It had been suggested that the use of a large screen during research into the various aspects of decision making in sport affords a more ecologically valid environment due to the visual display presenting near life-like images (Williams et al., 1999). Therefore, participants in this study were tested using a large screen, which is the current preferred research design, and a small screen of similar size to that used in earlier research. The findings failed to support the hypothesis that decision making accuracy would be better for the large screen presentation; rather, they indicated no reliable differences in decision accuracy according to the size of the screen being viewed. Although the results did not indicate any reliable differences for screen size, the null finding is important because it highlights that there does not appear to be an advantage in using a large screen over a small screen in decision making testing.

Furthermore, in regards to the main research question, the present study compared the decision accuracy for both screen sizes according to current involvement with basketball, previous basketball experience, and expertise (i.e., highest level played) as well as
the main type of sport played. Overall decision accuracy was quite low (56.8%), possibly due to the inclusion of participants who were inexperienced at basketball in the sample. Participants who reported currently playing basketball or who had played at a higher level of competition had better decision accuracy than those not currently playing basketball, which is consistent with previous research demonstrating superior decision making by those familiar with the skill/activity (e.g., Abernethy, 1989; Chase & Simon, 1973; Mascarenhas, Collins, & Mortimer, 2005; Tenenbaum, Levy-Kolker, Sade, Liebermann, & Lidor, 1996; Williams, Davids, Burwitz, & Williams, 1994). Other results failed to show significant effects for amount of previous basketball experience or type of main sport played, although for each of these factors, trends consistent with previous research were observed. Significantly, decision accuracy on the two different sized screens did not vary according to each of these factors. Thus, the hypothesis, which indicated that decision accuracy of experienced participants would increase from small to large screen while performance would be invariant for less experienced participants, was not supported. Importantly, findings for the three basketball factors did confirm that decision accuracy was statistically superior for those who played basketball relative to those who did not; this was similar for higher level players relative to the more novice players for both the small and large screen conditions as well. Similar but nonsignificant trends were also observed for the amount of basketball experience factor. Together these findings suggest that the decision making test was a valid test of decision making performance.

Results indicated that the big screen simulation did not produce better decision making performance than the small screen simulation. As discussed earlier, the design of sport-related perceptual decision making tasks that are representative of actual performance is challenging (Williams & Ericsson, 2005). Video-based tasks have frequently been used to simulate and measure perceptual–cognitive performance in sport; however, the issue of whether large screen displays are more representative than smaller screen displays has not been addressed previously. Both the cognitive information processing views and ecological views of perception would suggest that having more realistic perceptual information would be expected to provide a more valid measure of perceptual skill. It appears that both the large and small screen provided similar perceptual experiences. We did not measure visual search of participants, so it is possible that participants were using different visual search behaviors in each condition; however, given that decisions made in both conditions were similar, it would appear that participants were perceiving similar environmental information or affordances for action. Williams, Hodges, North, and Barton (2006) reported that skilled performers perceive and process displays in a team sport as a function of relational information. Altering screen size may not have altered the relational information; therefore, decision making performance was accurately captured regardless of screen size.

A number of limitations need to be considered when interpreting the present findings. First, the number of high-ability athlete participants was small but still similar to numbers reported in previous studies. Adequacy of numbers was also indicated by replication of the previous findings in terms of differences in decision accuracy for expert and novice athletes. Second, participants in this study were required to make their own
decisions based on the information presented to them. Even though participants were provided clear instructions about the requirements of the task, it is possible that participants may have tried to guess what the player on the screen was about to do. Third, contextual and environmental constraints—such as game clock, score, 24 s. clock, team members, and coaches—were not present in the study, all of which are constraints when making a decision during a real game (McPherson, 1993, 1999; Paull & Glencross, 1997). It should be noted that, in many of the previous studies, such constraints have not been included. Further, since the aim of the present study was to investigate the effect of screen size on decision accuracy, inclusion of such constraints were not necessary. Fourth, the clip length varied between 4 and 6 s. Although this should not influence our findings in relation to differences between the large and small screen—that is, because the same clips were watched under both conditions—North and Williams (2008) have reported that even a variation of 2 s. in clip length can have an impact on skilled performers' perceptual performance.

Even after allowing for these factors, the findings of the current study suggest that, during a video-based perceptual test, decision accuracy does not differ according to viewing based on a small or large screen. Further investigation of this issue is warranted to determine conclusively how screen size influences decision making performance on a video-based test. In addition, other variables could be explored in the design of future studies, including point of view (e.g., the current study used a broadcast third person view), investigation of other perceptual-cognitive skills, and other sports. In terms of point of view, a different video technique could be used, such as with simulated plays filmed from the view of the participant, to assess the effect of screen size on the decision making. In relation to perceptual-cognitive skills, Al–Abood and colleagues (2002) investigated the visual search strategies in basketball players on a large and a small screen and found different visual search patterns. They suggested that the larger screen provided better opportunity to perceive relevant information because participants could not adequately pick up visual information via the peripheral retina. Because the current study utilized a team sport in which overall patterns of play (Williams, Hodges, North, & Barton, 2006) may be more important to decision making than specific environmental cues (e.g., opponent's body kinematics), it is recommended that future studies explore screen size issues within individual sports. In an individual sport, such as tennis or badminton, there may be a perceptual advantage of the larger screen over the small screen because specific environmental cues are more difficult to search on the small screen.

Exploration of such issues logically leads to the area of perceptual training and the issue of its effectiveness—that is, investigation of whether the training effects are similar for video-based training programs using a large or a small screen. If there is no difference between the screens for testing and training purposes, training videos can be developed for team and individual sports and viewed within the athlete's own home at any time, making training more accessible. Furthermore, and perhaps the most important area for research, is the area of transfer from a video-based perceptual task, as used in the current study, to a game situation. Perhaps screen size has an influence on the amount of transfer from video-based training to real world tasks.
Overall the findings of this study indicated that the large screen did not appear to provide a simulation that resulted in better decision making performance than the small screen. This suggests that, in video-based perceptual testing and training, there may be no need to utilize large screen formats to simulate the visual display in sport. This could assist in making training more accessible for training purposes.

REFERENCES


