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Anticipation and Situation Assessment Skills in Soccer Under Varying Degrees of

Informational Constraint

Itay Basevitch

Sport Studies, Manhattanville College, NY, USA

Gershon Tenenbaum

B. Ivcher School of Psychology, Interdisciplinary Center, Herzliya, Israel

Edson Filho

School of Psychology, University of Central Lancashire, Preston, UK

Selen Razon

Department of Kinesiology, West Chester University, PA, USA

Nataniel Boiangin

Sport and Exercise Sciences, Barry University, FL, USA

Paul Ward

The MITRE Corporation, Washington D.C., USA*

30   **Abstract**

31   We tested the notion that expertise effects would be more noticeable when access to the

32   situational information would be reduced by occluding (i.e., non-cued) or freezing (i.e., cued) the

33   environment under temporal constraints. Using an adaptation of tasks developed by Ward et al.

34   (2013), participants viewed video clips of attacking soccer plays frozen or occluded at three

35   temporal points, then generated and prioritized situational options and anticipated the outcome.

36   High-skill players anticipated outcomes more accurately, generated less task-irrelevant options

37   and were better at prioritizing task-relevant options, than their low-skill counterparts.

38   Anticipation scores were significantly and positively correlated with option prioritization and

39   task-relevant options generated but not with total options generated. Counter to our prediction,

40   larger skill-based option prioritization differences were observed when the play was frozen than

41   occluded. These results indicate that processing environmental information depends on temporal

42   and contextual conditions.

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44   Keywords: option generation, anticipation, decision-making, team sports

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54   **Anticipation and Situation Assessment Skills in Soccer Under Varying Degrees of**

55   **Informational Constraint**

56   The ability to "read the game" is crucial in team sports. Expert players can anticipate upcoming

57   moves (Gabbett, Rubinoff, Thorburn & Farrow, 2007; Ward & Williams, 2003; Williams &

58   Davids, 1995), assess game situations (Belling, Suss, & Ward, 2015; Ward, Ericsson, &

59   Williams, 2013), and make decisions accurately and efficiently (Vaeyens, Lenoir, Williams,

60   Mazyn & Philippaerts, 2007). Such perceptual-cognitive skills are amongst the better predictors

61   of skill level in sport (Mann, Williams, Ward & Janelle, 2007; Ward & Williams, 2003).

62   However, limited scientific effort has been directed at identifying the underlying mechanisms

63   accounting for superior anticipation in team sports. Even fewer scholars have examined the

64   cognitive processes involved in assessing patterns of play (e.g., generating and prioritizing

65   situational options) in team settings (Raab & Johnson, 2007; Ward, et al., 2013).

66   Several studies have examined skill-based differences in anticipation using a temporal

67   occlusion method in team sports (e.g., Belling et al., 2015; Ward et al., 2013). These studies

68   demonstrated that skill-based differences in the ability to anticipate the outcome of a pattern of

69   play are more apparent when access to situational information is constrained (e.g., occluded

70   earlier in the play sequence). Although researchers have examined extensively the effect of

71   temporally constraining access to contextual information on anticipation (e.g., Jones & Miles,

72   1978), few, if any, researchers have examined the effect of temporally constraining access to

73   contextual information on the situational assessment process. This is surprising, because the

74   temporal occlusion method has been used extensively for studying anticipation. The results of

75   these studies indicated consistent skill-based differences in anticipation performance at specific

76   time-points of occlusion. Similarly, situation assessment is a process that changes over time as

77   the play develops. Thus, research is warranted that examines the underlying mechanisms of

78   advanced situation assessment skills under varying degrees of informational constraint induced

79   by temporal occlusion (henceforth, temporal constraint). The purpose of this study was,

80   therefore, to examine the relative differences in performance of high and low-skill male soccer

81   players on domain-specific anticipation and situation assessment tests under varying degrees of

82   temporal constraint.

83   **Anticipation**

84   Anticipation skills have been studied extensively in individual and team sport settings. A

85   meta-analysis indicated that expert, elite, and high-level performers have superior skill at

86   anticipating the outcome of a play earlier and with greater accuracy than novices (e.g., see Mann

87   et al., 2007). Such skills provide a crucial advantage, especially in fast-paced sports where timing

88   is of utmost importance, and the available time to respond is limited. Impressively, in time-

89   pressured domains such as most team sports, this is often done intuitively - in the blink of an eye

90   (for recent reviews, see Hoffman et al., 2014; Suss & Ward, 2015). However, few scholars have

91   investigated the cognitive strategies that permit successful anticipation in team settings (for

92   exceptions see Belling et al., 2015; Ward et al., 2013). Where supporting cognitive skills and/or

93   processes have been explored, most have examined memory skills such as recall and recognition

94   (e.g., North, Ward, Williams, & Ericsson, 2011; Williams & Davids, 1995). Although these

95   memory skills might be important for successful performance, some of the findings suggest that

96   they do not fully capture the underlying mechanisms supporting skilled performance or skilled

97   anticipation (see North, et al., 2011).

98   Several studies have examined domain-specific anticipation skills in team sport settings

99   (Belling et al., 2015; North, et al., 2011; Ward & Williams, 2003). Ward and Williams (2003)

100   examined skill and age-based differences on a series of perceptual-cognitive tasks. Specifically,

101   following a series of video clips of a developing soccer play that was stopped 120ms prior to ball

102   contact, soccer players were asked to predict the upcoming actions. Elite players exhibited

103   superior anticipation ability than their sub-elite counterparts. In a more recent study that

104   examined the effect of reducing the available time to respond on decision-making, skilled soccer

105   players were able to predict outcomes more accurately than less skilled players, irrespective of

106   the amount of time available (Belling et al., 2015).

Situational Assessment

108   Situational assessment refers to a performer's ability to generate (rather than select from

109   explicitly presented) plausible options and prioritize those options in an integrated manner, based

110   on expected future events and potential impact or likely threat to oneself or one's team (Ward, et

111   al., 2013). Recently, researchers investigated the mechanisms responsible for superior decision-

112   making (including situational assessment), and tested predictions from different theoretical

113   perspectives. Johnson and Raab (2003) suggested that, in these kinds of complex and dynamic

114   sport situations where individuals are required to decide about how to respond, experts make use

115   of a simple, fast and frugal heuristic called Take-the First (TTF). According to these authors,

116   TTF predicts that the first option (i.e., a personal course of action) generated by skilled decision

117   makers is better than those generated subsequently. From this perspective, generating more

118   options, beyond the first, is generally considered an inefficient decision-making process that

119   would likely result in poorer decision quality because decision makers end up choosing from a

120   larger pool of lower quality options. The TTF heuristic is consistent with naturalistic

121   observations of decision-making in the real world and the tenets of recognition-primed decision-

122   making (RPD, see Klein, 1989). According to Klein, Wolf, Mitello and Zsambok, (1995)

123   "people can recognize a situation as typical, thereby calling forth typical reactions without

124   having to sift through large sets of alternatives" (p. 63). This apparently simple, albeit highly

125   skilled behavior, is often referred to as a process of intuition.

126   In a study of handball players, Johnson and Raab (2003) demonstrated that players

127   generated, on average, just over two options per trial, and the number of options generated was

128   inversely related to the quality of the final chosen option. In a related study using a similar

129   method, Raab and Johnson (2007) examined skill-based differences (i.e., experts, near-experts,

130   and non-experts) in the option generation process among handball players. Although no skill-

131   based differences in the number of options generated were observed (i.e., relatively few options,

132   as in the previous study), the first option generated by the experts and their final chosen option

133   was of a higher quality than near-experts and non-experts (Raab & Johnson, 2007).

134   Researchers in a range of complex domains, such as chess (Chabris & Hearst, 2003),

135   soccer (Belling et al., 2015; Ward et al., 2013), law enforcement (Ward, Suss, Eccles, Williams,

136   & Harris, 2013) and nursing (Ward, Torof, Whyte, Eccles & Harris, 2010) have observed

137   findings that are generally consistent with the prescriptions but inconsistent with some of the

138   predictions of TTF. That is, experts frequently generate better options first and tend to generate

139   only very few options (especially when time pressure is present). However, generating more

140   task-relevant situational options (when they are available in the environment) is often positively

141   related to success and skill-level (e.g., Belling et al., 2015; Ward et al., 2013). According to

142   contemporary (e.g., Ericsson & Kintsch, 1995) as well as recent (e.g., Hoffman et al., 2014;

143   Ward, Gore, Hutton, Conway, & Hoffman, 2018; Ward, Schraagen, Gore, & Roth, 2019)

144   conceptions of expertise, skilled performance in these types of domains is supported by the

145   ability to efficiently index and encode information in a manner that allows one to engage in

146   anticipatory thinking, predict future retrieval demands, and access task-relevant information as

147   and when needed. The ability to engage in a more complex and analytical process of building a

148   dynamic mental model, i.e., the moment-to-moment development of detailed cognitive

149   representations that accurately represents the changing demands of the situational dynamics, has

150   been noted as a hallmark of expert decision-making in numerous complex domains (e.g.,

151   Hoffman et al., 2014; Suss & Ward, 2015).

152   To test these notions, Ward et al. (2013) examined the relationship between the

153   situational assessment process and anticipation in soccer. As per TTF, they predicted that more

154   skilled participants would generate few options and better ones first. However, they predicted a

155   positive relationship between the number of task-relevant options generated and the quality of

156   decision-making (i.e., anticipation accuracy) and a negative correlation between task-irrelevant

157   options and accuracy. Like the handball studies, a video simulation was used, in which action

158   clips were shown to soccer players. However, in this study, players were asked to generate and

159   prioritize the plausible options, or courses of action, that their opponent might take next, rather

160   than generate the option(s) the participant themselves might take (the perspective and task used

161   by Raab and Johnson, 2007). Based on an *a priori* task analysis, Ward et al. coded each possible

162   option as task-relevant or -irrelevant. As predicted, the number of options generated was

163   relatively small (< 3), and they observed a positive relationship between the number of task-

164   relevant options and the accuracy of anticipatory decision (and a negative one with task-

165   irrelevant options). No skill-based differences were observed in the total number of options

166   generated; experts generated more relevant and fewer irrelevant options than novices.

167   Two major differences are noteworthy between the methods used by Raab and Johnson

168   (2007) and Ward et al. (2013). Raab and Johnson (2007) permitted participants to generate

169 options while observing the final frame of action frozen on screen for varying time periods.

170 Ward et al. asked participants to either: (a) respond only after occlusion, then subsequently asked

171 participants to repeat the task using a freeze frame approach similar to Raab and Johnson (Exp

172 2), or alternatively, (b) respond in an occluded mode on some trials and freeze frame on others

173 (Exp 3).

174 Importantly, in both studies, only one temporal point of occlusion (or freeze frame) was

175 used to examine situational assessment. Since the options available to a participant, and that a

176 player generates and subsequently prioritizes vary as the context changes over time, it is possible

177 that the two mechanisms tested in each of the prior studies may both support performance, albeit

178 be context-dependent. The utility of both mechanisms has been shown to vary in other complex

179 and dynamic domains based on changes in context and task demands (e.g., prediction versus

180 decision- making) (Suss, Belling, & Ward, 2014; Suss & Ward, 2012). Interestingly, to the best

181 of our knowledge, no studies have examined situation assessment under temporal constraint.

182 **The Current Study**

183 In the current study we adapted the methods used by Ward et al. (2013, Exp 2 & 3) to

184 include the temporal occlusion method. Anticipation and situational assessment skills (i.e.,

185 option generation and prioritization) of male, high and low-skill soccer players were measured at

186 three temporal occlusion points: 400ms or 200ms prior to a potential turning point in the

187 opposing team's play, or at that point of play (i.e., henceforth, 0ms). Rather than make contrasts

188 across occlusion conditions, our primary focus was on whether skill-based differences in

189 anticipation and situation assessment could be observed at each condition, and whether these

190 differences were compounded by display type. Hence, we conducted three separate analyses, one

191 for each occlusion point, which allowed us to answer specific hypotheses (see below).

192   Based on the available anticipation data, we expected high-skill participants to make

193   better anticipatory decisions than low-skill participants across display conditions and in each

194   analysis (i.e., at each temporal point). Based on findings from Ward et al., (2013) we predicted

195   that high-skill participants will perform better on the situational assessment task than low-skill

196   participants (i.e., generate more task-relevant options, less task-irrelevant options, and better

197   option prioritization of the relevant options) across both display conditions. It was less clear

198   whether this finding would be observed in each analysis (i.e., at different time points) as to the

199   best of our knowledge, this is the first study that examined option generation using several

200   temporal points.

201   More specifically and based on the findings from Ward et al. (2013), we predicted that

202   under the non-cued condition the amount of relevant options will decrease, the amount of

203   irrelevant options will increase, and prioritization of options will be inferior relative to the cued-

204   condition. We made slightly different predictions for anticipation than situation assessment. For

205   the anticipation data, we expected to reveal a main effect only for skill, whereas for situational

206   assessment we expected main effects for both skill and display. Furthermore, based on the

207   findings from Ward et al. (2013) we predicted that high-skill participants will anticipate and

208   assess the situation better than low-skill players across display conditions.

209   We also predicted, based on Ward et al., (2013), that anticipation would be positively

210   correlated with the number of task-relevant options generated, negatively correlated to the

211   number of task-irrelevant options generated, and positively correlated with the ability to

212   prioritize options regardless of skill and display conditions at each of the three points of

213   occlusion.

214   Hypotheses:

215   1) High-skill participants will perform better on the anticipation task compared to low-

216   skill participants across display conditions and temporal points.

217   2) High-skill participants will perform better on the situational assessment task than

218   low-skill participants across the display conditions.

219   3) Situational assessment scores will decrease in the non-cued condition compared to the

220   cued-condition across skill level and temporal points.

221   4) There will be a positive correlation between anticipation scores and (a) number of

222   task-relevant options generated and (b) option prioritization and a negative correlation

223   with the number of task-irrelevant options generated, across skill and display

224   conditions at each of the three points of occlusion.

225   **Method**

226 **Participants**

227   An a priori power analysis using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007)

228 was performed to determine the number of participants needed for the study. Effect size was set

229 at $d = .40$, $\alpha = .05$, and $1\text{-}\beta = .80$. The effect size used in the power analysis was estimated based

230 on previous studies that utilized similar methods to examine anticipation and option generation

231 differences between skill level groups (see Raab, & Johnson, 2007; Tenenbaum, Sar-El & Bar-

232 Eli, 2000; Ward et al., 2013). Accordingly, to satisfy these conditions the minimum sample size

233 required was $n = 34$. In total, 40 soccer players participated in the study. Participants were

234 recruited from several universities located in the Southeastern region of the United States.

235 Participants in the high-skill category met all the following inclusion criteria: (1) played soccer at

236 or above collegiate level, (2) played organized soccer for at least 7 years, (3) played soccer for a

237 total of 10 years or more. Participants in the low-skill category met all the following inclusion

238   criteria: (1) never played soccer above high-school level, (2) played organized soccer for no

239   more than 3 years, (3) played soccer for no more than 5 years in total (see Table 1 for descriptive

240   statistics by group). The sample consisted of 19 high-skill ($M_{age} = 21.00$, $SD_{age} = 1.73$), and 21

241   low-skill players ($M_{age} = 22.14$, $SD_{age} = 3.49$).

242   **Film and scenario design**

243   The test film used in this study was identical to that used in Ward et al. (2013, Exp 2 &

244   3). The test film was comprised of video stimuli filmed during live, 11-player versus 11-player

245   professional and semi-professional soccer matches in the UK. The camera was positioned above

246   and behind one of the goals with attacking play progressing toward the camera and, hence filmed

247   from a defensive perspective. A similar camera angle has been used in previous studies (see

248   Belling et al., 2015; Johnson & Raab, 2003; Williams & Davids, 1995), and known-groups

249   validity demonstrated. In total, 10 unique sequences of attacking soccer play were used in the

250   test film, each lasting 10s, and ending prior to a turning point when the player with the ball either

251   (a) passed the ball to another player, (b) took a shot on goal, or (c) retained possession while

252   running with the ball. The end of the test film was edited to form cued/non-cued conditions that

253   ended at different points in time (see below: *Task Conditions*)

254   **Perceptual-cognitive tasks**

255   After presentation of each video stimulus, participants were required to complete two

256   simultaneous tasks: anticipation and situational assessment (see Ward et al., 2013).

257   **Anticipation task.** Each participant was asked to predict what would happen next by

258   indicating (a) the action that would be taken by the opposing player with the ball (i.e., pass to

259   player X, shoot at goal, or retain possession/dribble), (b) the direction of the play, and (c) if

260   determined to be a pass, the destination / recipient of the pass (see Ward et al., 2013).

261   **Situational assessment task.** Each participant was asked to generate all plausible options

262   (i.e., threats - from a defensive perspective) that the player with the ball might take, and that

263   would warrant some consideration (i.e., as many options as they think are plausible). Participants

264   were also asked to prioritize each of their highlighted options by ranking them in an order

265   reflecting the greatest threat posed to the defense (e.g., rank 1 = highest threat; 2 = second

266   highest threat, etc.; see Ward et al., 2013).

267   **Instrumentation**

268   **Demographic information.** A brief questionnaire was used to gather information on

269   participants' age, number of years played in organized and recreational soccer, and the age when

270   the participant first started to play soccer. This information was collected to ensure that

271   participants met the criteria of the high- and low-skill level groups.

272   **Anticipation performance**. Three anticipation variables were recorded: action, direction,

273   and destination (Ward et al., 2013). One point was assigned to each correct response. For each

274   trial, the maximum total anticipation score (i.e., action + direction + destination) was 3, and for

275   each condition of 10 trials, the maximum score was 30.

276   **Situational assessment performance.** The current study adopted the coaches' ranking

277   that was used in Ward et al. (2013). Specifically, three expert soccer coaches from an English

278   Premier League Football club served as "expert judges" by identifying and prioritizing the

279   relevant task options for each trial. The coaches were able to view, analyze, and review the film

280   several times, to ensure they were provided with enough time and information to identify the

281   relevant options. The coaches' inter-rater reliability for options ranked was 90.4%. However,

282   only options of total agreement among coaches were included. These ratings were subsequently

283   verified by the expert data presented in Ward et al. (2013).

284   Two situational assessment variables were analyzed: amount of options generated (task-

285   relevant and -irrelevant), and option prioritization. Option prioritization was calculated using a

286   weighted point system (Ward et al., 2013). A 5-points score was assigned for identifying the

287   highest priority, 4 points score for the second highest priority, and so on. Additionally, when an

288   option was relevant, but not prioritized in the correct order (i.e., lower or higher than the

289   coaches' ranking), the absolute difference between the two was deducted from the number of

290   points allocated to the specific ranking. To standardize the scores among the trials, the total

291   number of points for each trial was divided by the maximum number of points available. The

292   final option prioritization value for each trial was between 0 and 1 (e.g., a score of 1 indicating a

293   perfect match between the participant's and coaches' prioritization).

294   One rater scored the variables for all the participants, while another rater scored 20% of

295   the participants (randomly selected). The two raters were given the same instructions and scored

296   all the variables independently. Raters were not provided with any details regarding the group

297   (e.g., skill level) and condition (e.g., display, temporal) to assure unbiased ratings (i.e., blind

298   scoring). Inter-rater agreement was calculated for 20% of the variables that both raters scored.

299   Percent agreement was 87.4% and inter-rater reliability using the Kappa statistic was .81, which

300   is considered a strong agreement level (McHugh, 2012). In addition, all the option generation

301   measures in the study were found to be reliable (Cronbach's alpha: task-relevant options - $\alpha =$

302   .90, irrelevant options - $\alpha = .94$, option prioritization - $\alpha = .88$)

303   **Answer sheet.** The participants were provided with a replica drawing of the pitch on a

304   standard size paper as per Ward et al. (2013). The answer sheets included information from the

305   final frame of each specific action clip (i.e., goal posts, pitch markings / boundary lines and

306   position of the ball) but did not include any player information (offensive or defensive players).

307   Participants used a pencil to mark their answers on a sheet, using "X" for offensive players, "O"

308   for defensive players, arrows for direction of play, the letter "A" to mark the anticipated action,

309   and numbers (e.g., 1-5) to indicate their ranking of threat posed by each option (where rank 1 =

310   highest threat).

311   **Task Conditions**

312   **Temporal conditions.** Three temporal points were used in which the video clip

313   terminated at a specific time prior to the turning point (i.e., 400ms, 200ms, 0ms). Participants

314   watched the same clip three times (i.e., repeated conditions for the three temporal points). The

315   temporal times chosen were based on previous research using similar temporal-occlusion

316   methods that have examined anticipation skills (e.g., Ward & Williams, 2003).

317   **Display conditions.** Two display conditions were used, cued and non-cued (Ward et al.,

318   2013). Participants watched the same clip twice (i.e., repeated conditions for the two cued

319   conditions). In the cued condition, the last frame of the action clip was frozen and remained on

320   the screen for 35s until the next clip started. Therefore, situational information was available

321   throughout the task. The non-cued condition included a blank frame (that was identical to the

322   response sheet) that appeared immediately after the last frame of the action clip and continued to

323   be displayed on the screen until the next clip started for 35s. In the non-cued condition,

324   participants completed the task without any detailed situational information and were required to

325   rely on their situational representation containing their encoding of the preceding pattern of play.

326   If participants responded in shorter time than the 35s allotted, they waited until the 35s passed

327   prior to starting the next trial. In addition, participants were verbally cued to look up prior to the

328   next trial to ensure they answer all trials on time. Participants viewed the conditions in a

329   counterbalanced order and viewed the trials in both display conditions and in the three temporal

330   conditions. Hence, in total there were six task conditions (i.e., 2 display x 3 temporal) per unique

331   sequence of play and each participant watched a total of 60 clips (i.e., 6 task conditions X 10

332   unique sequences). Participants did not receive any feedback throughout and after completion of

333   the testing procedure.

334   **Procedure**

335   The study was conducted in a quiet classroom using a 2.7m x 3.5m projection

336   screen and a projector to display the video stimuli. Participants were asked to read and sign a

337   consent form and provide demographic information prior to commencing the study. They were

338   then provided with instructions and given two practice trials (i.e., one cued and one non-cued) to

339   become familiar with the task (Ward et al., 2013). The familiarization video clips were not part

340   of the 10-video clips pool; however, they were similar in difficulty level and followed the same

341   process as the ones used in the trial video clips. The researcher then checked the answer sheet to

342   ensure that the participants understood the task, and that the answer sheet was filled out

343   correctly. Prior to each test trial, as per Ward et al., (2013) a pointer - a red box on a white screen

344   used to mark the initial position of the ball - was presented to participants to direct their attention

345   to the part of the screen were action would commence. Immediately afterwards, the video

346   stimulus commenced followed by anticipation and situational assessment task completion. After

347   the last video frame of action, participants had 35s to complete the respective answer sheet. Two

348   different stimulus presentation orders (randomly assigned) for display and temporal conditions

349   were used to counteract any order or familiarization effect across the 60 trials[1]. The time to

350   complete the entire task was approximately 60min. Following test completion, participants were

351   provided time to ask questions, and were debriefed about the study.

352   **Analyses**

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[1] The results of the two stimulation presentations were statistically compared to ensure there were no order effects and familiarization of trials.

353   To test our specific hypotheses about skill level and display type at each occlusion point,

354   we conducted three separate repeated-measures ANOVAs (i.e., one for each temporal point) for

355   each of the dependent variables, anticipation and situational assessment. Display condition (cued,

356   non-cued) was the within-participant factor, and Skill-level (high, low) was the between-

357   participant factor in each analysis. In the analysis of number of options generated, task-relevant

358   and irrelevant options were an additional within-participant factor (i.e., type of options

359   generated). Effect size (ES) coefficients, partial eta squared and Cohen's d (pooled SD for

360   independent group analyses and baseline SD for dependent group analyses as appropriate;

361   Becker, 2000) were used to estimate the effect magnitudes where applicable. To analyze the

362   relationship between anticipation and the situational assessment variables Pearson product-

363   moment correlations (i.e., r) were computed (for each temporal point).

364   **Results**

Anticipation Accuracy

366   To test anticipation differences between skill-levels across display conditions, we

367   conducted three separate repeated measure ANOVAs for each temporal point (i.e., 400ms,

368   200ms, and 0ms before the turning point) (see Figure 1). Results indicated that when the stimuli

369   were occluded at 400ms prior to the critical incident, the only significant difference was between

370   display conditions, *Wilk's* $\lambda = .88$, $F(1, 38) = 5.12$, $p = 0.03$, $\eta_p^2 = .12$. Participants were more

371   accurate in predicting the outcome in the cued condition ($M = 15.89$, $SE = .56$) than in the non-

372   cued condition ($M = 14.53$, $SE = .48$, $d = .39$). Skill-level differences were not significant, $F(1,$

373   $38) = 1.99$, $p = 0.17$, $\eta_p^2 = .05$, neither was the Skill x Display interaction, *Wilk's* $\lambda = 1.00$, $F(1,$

374   $38) = .08$, $p = 0.78$, $\eta_p^2 < .01$. Follow up analysis of simple effects for each display condition

375   indicated non-significant skill level differences in both the cued ($p = .13$) and non-cued display

376   conditions ($p = .36$).

377   At 200ms before the turning point, significant differences were only found between

378   display conditions, *Wilk's* $\lambda = .78$, $F (1, 38) = 10.54$, $p < 0.01$, $\eta_p{}^2 = .22$. Participants anticipated

379   the outcome more accurately in the cued condition ($M = 16.53$, $SE = .56$) than in the non-cued

380   condition ($M = 14.66$, $SE = .59$, $d = 53$). Non-significant skill-level, $F (1, 38) = 1.91$, $p = 0.18$,

381   $\eta_p{}^2 = .05$ and Skill x Display interaction effects emerged, *Wilk's* $\lambda = 1.00$, $F (1, 38) = .01$, $p =$

382   0.97, $\eta_p{}^2 < .01$. Follow up analysis of simple effects for each display condition indicated non-

383   significant skill level differences in both the cued ($p = .23$) and non-cued display conditions ($p =$

384   $.25$). At the turning point (0ms), there were significant differences between skill-levels, $F (1, 38)$

385   $= 10.63$, $p < 0.01$, $\eta_p{}^2 = .22$. High-skill participants ($M = 17.84$, $SE = .82$) anticipated the

386   outcome more accurately than low-skill participants ($M = 14.17$, $SE = .78$) and the effect was

387   large ($d = 1.06$). However, non-significant display conditions, *Wilk's* $\lambda = .98$, $F (1, 38) = .76$, $p =$

388   0.39, $\eta_p{}^2 = .02$, and Skill x Display interaction, *Wilk's* $\lambda = .98$, $F (1, 38) = .93$, $p = 0.34$, $\eta_p{}^2 = .02$

389   emerged.. Follow up analysis of simple effects for each display condition indicated significant

390   skill level effects in both the cued ($p < .01$) and non-cued display conditions ($p = .02$). In both

391   display conditions, high-skill participants scored higher in anticipation compared to low-skill

392   participants.

393   **Situational Assessment: Option Generation**

394   Results for the option generation data indicated that at 400ms prior to the turning point

395   there were significant main effects for skill, $F (1, 38) = 18.04$, $p < 0.01$, $\eta_p{}^2 = .32$, and display,

396   *Wilk's* $\lambda = .62$, $F (1, 38) = 23.04$, $p < 0.01$, $\eta_p{}^2 = .38$. Low-skill participants generated more

397   options in general ($M = 17.91$, $SE = .67$) compared to high-skill participants ($M = 13.80$, $SE =$

398   .70, $d = 1.04$). Furthermore, participants generated more options under the cued ($M = 16.78$, $SE =$

399   .52) than under the non-cued condition ($M = 14.93$, $SE = .52$, $d = .57$). Both effects (skill and

400   display) were large. The Skill x Type interaction was also significant, *Wilk's* $\lambda = .33$, $F (1, 38) =$

401   77.80, $p < 0.01$, $\eta_p^2 = .67$. High-skill participants generated more task-relevant ($M = 16.47$, $SE =$

402   .61) than -irrelevant options ($M = 11.13$, $SE = 1.02$, $d = 2.06$), while low-skill participants

403   generated more task-irrelevant options ($M = 20.88$, $SE = .97$) than -relevant ones ($M = 14.93$, SE

404     $= .58$, $d = 2.29$) (see Figure 2). Follow-up analysis of simple effects for each option type

405   indicated a non-significant skill level effect for number of task-relevant options generated ($p =$

406   .08). However, significant skill-level effects were noticed for task-irrelevant options ($p < .01$, $d =$

407   2.25); high-skill participant generated less task-irrelevant options than low-skill participants.

408   None of the other interactions was significant (Fs < 3.5).

409   At 200ms before the turning point there were significant main effects for skill-level, $F (1,$

410   38) = 20.16, $p < 0.01$, $\eta_p^2 = .35$, display, *Wilk's* $\lambda = .41$, $F (1, 38) = 55.11$, $p < 0.01$, $\eta_p^2 = .59$,

411   and a significant skill x type of options generated interaction, *Wilk's* $\lambda = .51$, $F (1, 38) = 36.89$, p

412   < 0.01, $\eta_p^2 = .49$. Low-skill participants generated more options in general ($M = 18.44$, $SE = .71$)

413   than high-skill participants ($M = 13.84$, $SE = .74$, $d = 1.46$), and both high and low skill

414   participants generated more options in the cued ($M = 17.47$, $SE = .59$) than in the non-cued

415   condition ($M = 14.82$, $SE = .49$, $d = .72$). However, high-skill participants generated more task-

416   relevant options ($M = 15.82$, $SE = .68$) than -irrelevant ones ($M = 11.87$, $SE = 1.15$, $d = 1.37$ and

417   low-skill participants generated more -irrelevant ($M = 21.33$, $SE = 1.09$) than -relevant options

418   ($M = 15.55$, $SE = .64$, $d = 2.02$). Follow-up analysis of simple effects for each option type,

419   resulted in a non-significant skill level effect for number of task-relevant options generated ($p =$

420   .78). However, a significant skill-level effect emerged for task-irrelevant options ($p < .01$, $d =$

421   1.94); high-skill participant generated less -irrelevant options than low-skill participants. All the

422   other interactions were not significant (Fs < 1).

423   Similar results were found at the turning point (0ms). The skill-level, F (1, 38) = 21.39, p

424   < 0.01, η_p^2 = .36, display, *Wilk's λ* = .71, F (1, 38) = 15.8, p < 0.01, η_p^2 = .29, and Skill x Type,

425   *Wilk's λ* = .57, F (1, 38) = 28.52, p < 0.01, η_p^2 = .43, effects were all significant. Low-skill

426   participants generated more options in general (M = 17.85, SE = .67) than high-skill participants

427   (M = 13.36, SE = .70, d = 1.50), more options were generated in the cued (M = 16.24, SE = .50)

428   than in the non-cued condition (M = 14.96, SE = .53, d = 41). As in the previous two conditions,

429   high-skill participants generated more task-relevant (M = 15.68, SE = .59) than -irrelevant

430   options (M = 11.03, SE = 1.09, d = 1.86), while low-skill participants generated more task-

431   irrelevant (M = 19.41, SE = 1.04) than -relevant options (M = 16.29, SE = .57, d = 1.22).

432   Follow-up analysis of simple effects for each option type resulted in non-significant skill level

433   effects for number of task-relevant options generated (p = .47). However, significant skill-level

434   effect was evident for -irrelevant options (p < .01, d = 1.72); high-skill participant generated less

435   -irrelevant options than low-skill participants. The other interactions were not significant (Fs <

436   3.5).

437   **Situational Assessment: Option Prioritization**

438   Results indicated that in the analysis at 400ms prior to the turning point, there were main

439   effects for skill, F (1, 38) = 12.78, p < 0.01, η_p^2 = .25, and display conditions, *Wilk's λ* = .62, F

440   (1, 38) = 23.22, p < 0.01, η_p^2 = .38. High-skill participants (M = 4.80, SE = .16) were better at

441   prioritizing the options than low-skill participants (M = 4.01, SE = .15, d = 1.17). Furthermore,

442   participants prioritized options better in the cued condition (M = 4.74, SE = .12) than in the non-

443   cued one (M = 4.07, SE = .14, d = .89). The Skill x Display interaction was not significant,

444   *Wilk's* λ = .98, *F* (1, 38) = .77, *p* = 0.39, η_p^2 = .02. Follow-up analysis of simple effects for each

445   display condition, indicated significant skill level effects in both the cued (*p* = .02) and non-cued

446   display conditions (*p* < .01). In both display conditions, high-skill participants had higher

447   prioritization scores compared to low-skill participants.

448   At 200ms before the turning point, a significant Skill x Display interaction was observed,

449   *Wilk's* λ = .89, *F* (1, 38) = 4.61, *p* = 0.04, η_p^2 = .11. Low-skill participants prioritized the options

450   similarly under the cued (*M* = 4.45, *SE* = .20) and non-cued conditions (*M* = 4.52, *SE* = .27, *d* =

451   08). In contrast, high-skill participants prioritized the options better in the cued (*M* = 5.21, *SE* =

452   .21) than in the non-cued condition (*M* = 4.54, *SE* = .28, *d* = 75) (see Figure 3). There were no

453   significant differences between skill-levels, *F* (1, 38) = 1.51, *p* = 0.20, η_p^2 = .04, and display

454   conditions, *Wilk's* λ= .93, *F* (1, 38) = 3.08, *p* = 0.09, η_p^2 = .08. Follow-up analysis of simple

455   effects for each display condition, indicated no significant skill level effects for the non-cued

456   condition (*p* = .93). However, significant skill-level effect was found for the cued-condition (*p* =

457   .01); high-skill participant prioritized options better than low-skill participants.

458   At the turning point (0ms), there was a significant main effect for display, *Wilk's* λ = .81,

459   *F* (1, 38) = 8.71, *p* < 0.01, η_p^2 = .19, and a significant Skill x Display interaction effect, *Wilk's* λ

460   = .86, *F* (1, 38) = 6.36, *p* = 0.02, η_p^2 = .14. Low-skill participants prioritized the options similarly

461   under the cued (*M* = 4.40, *SE* = .17) and non-cued conditions (*M* = 4.33, *SE* = .24, *d* = 09), while

462   high-skill participants prioritized the options better in the cued (*M* = 5.16, *SE* = .18) than in the

463   non-cued condition (*M* = 4.28, *SE* = .25 *d* = 1.15) (see Figure 3). The main skill effect was not

464   significant, *F* (1, 38) = .17, *p* = 0.17, η_p^2 = .05. Follow up analysis of simple effects for each

465   display condition indicated no significant skill level effect for the non-cued condition (*p* = .87).

466   However, significant skill-level effect was noted for the cued-condition ($p < .01$); high-skill

467   participant prioritized options better than low-skill participants.

468   **Relationship between Anticipation and Situational Assessment Variables**

469   The correlation analysis indicated that, as predicted, at 400ms before the turning point,

470   anticipation was significantly and positively correlated with option prioritization, $r = .46$, $p < .01$,

471   and the number of task-relevant options generated, $r = .33$, $p < .01$. However, anticipation was

472   not significantly correlated with the number of -irrelevant, $r = -.13$, $p = .23$, and total options

473   generated, $r = .04$, $p = .70$ (see Table 5).

474   Likewise, and as predicted, at 200ms before the turning point, anticipation was

475   significantly and positively correlated with option prioritization, $r = .63$, $p < .01$, and the number

476   of task-relevant options generated, $r = .44$, $p < .01$. The correlations with the amount of -

477   irrelevant options, $r = -.07$, $p = .54$, and total options generated were not significant, $r = .13$, $p =$

478   .23.

479   As predicted, at the turning point (0ms) there was a positive and significant correlation

480   between anticipation and option prioritization, $r = .49$, $p < .01$, and the number of relevant

481   options generated, $r = .29$, $p < .01$. There was also a significant negative correlation with the

482   number of task-irrelevant options generated, $r = -.25$, $p < .02$. The relationship between

483   anticipation and total amount of options generated was not significant, $r = -.07$, $p = .56$.

484   **Discussion**

485   In this study we examined anticipation and situation assessment skills of high-skill and

486   low-skill male soccer players in two display conditions (i.e., cued and non-cued) at three

487   temporal points.

488 **Anticipation Skills**

489   We predicted that high-skill participants would be able to anticipate opponents' actions

490   more accurately than low-skill participants across display conditions and temporal points. The

491   findings indicated that at the turning point, these predictions were supported. High-skill soccer

492   players anticipated the opponents' actions significantly more accurately than low-skill players,

493   supporting previous research indicating that higher skilled level players are better able to make

494   domain-specific, task-related decisions (Gabbet et al., 2007; Mann et al., 2007). Furthermore,

495   participants anticipated the actions similarly under the cued and non-cued conditions and thus

496   Skill by Display interaction was not evident, as expected. These results replicate the findings

497   reported by Ward et al.'s (2013; Exp 3), where the anticipation data revealed significant main

498   effects for skill-level but no display or interaction effects.

499   Contrary to our predictions, at 200ms and 400ms before the turning point, high-skill

500   players did not anticipate the opponents' action significantly better than low-skill players in

501   general and at each display condition. Although we refrained from comparing temporal points as

502   it was not the aim of the study, previous findings indicated that at earlier temporal points, higher

503   level players anticipated more accurately upcoming moves than lower level players (Ward et al.,

504   2003). The rationale for larger skill-level differences at earlier temporal points is based on the

505   notion that higher skill players can extract information using fewer environmental cues from

506   their advanced domain-specific knowledge base and using more efficient search strategies

507   (Ericsson & Roring, 2008; Mann et al., 2007; Panchuk & Vickers 2006; Williams & Burwitz,

508   1993).

509   In the current study, we chose the temporal points to align with previous studies that used

510   the temporal occlusion method mainly in 1v1 situations in team and individual sports. However,

511   other studies used different temporal points, such as Ward et al.'s (2013) Exp 1, which used the

512   temporal points 120s prior to an action, 0 ms and 120 ms post action. Previous findings revealed

513   that occlusion periods have both temporal and contextual characteristics that affect anticipation

514   skill (Suss & Ward, 2015). Thus, it is plausible that lack of sufficient information in the observed

515   scenarios prevented high-skill players to anticipate the action accurately at the earlier temporal

516   points. Furthermore, it could be that the high-skill players had not yet acquired the skill to extract

517   information from the environment when information is limited, or alternatively that the high and

518   low skill players were more similar in experiences compared to previous studies. It is important

519   to note that high-skill participants displayed superior anticipation skills than low-skill

520   participants descriptively at all three temporal points. More targeted research must incorporate

521   additional temporal and contextual points and compare athletes at varying skill levels to gain a

522   better understanding of the underlying mechanisms and cues that mediate superior anticipation

523   performance in team sports.

524   Furthermore, and contrary to our expectations, at the 200ms and 400ms turning points,

525   there were anticipation differences attributed to the display conditions. Display conditions

526   affected players of both skill-levels similarly. Specifically, anticipatory decisions declined when

527   the environmental information was unavailable (i.e., non-cued display condition). Results are

528   similar to Ward et al.'s (2103) Exp 2 in which there was a significant main effect for display

529   condition, but no Skill by Display interaction was noted. However, in Ward et al.'s (2013) Exp 3,

530   the display condition emerged to be non-significant. The reason for the inconsistency is not clear.

531   In line with previous research findings, both skill-level players performed better at the cued

532   condition when information was available for a longer time, and the players could extract more

533   information from the environment compared to the non-cued condition (Mann et al., 2007).

534 **Situational Assessment Skills: Option Generation**

535   Consistent with previous research findings (and with the TTF prescriptions), relatively

536 few total options were generated per trial ($M = 3.15$) with high-skill players generating fewer

537 options ($M = 2.92$) than low-skill players ($M = 3.38$) (Raab & Johnson, 2007; Ward et al. 2013).

538 As predicted, additional analyses on the relevance of options revealed that high-skill players

539 generated more task-relevant options than -irrelevant ones, while low-skill players generated

540 more task-irrelevant options than -relevant ones, which replicated Ward et al.'s (2013) research

541 findings. Furthermore, although no significant differences were observed in the number of task-

542 relevant options generated between skill-levels, high-skill participants generated less task-

543 irrelevant options compared to low-skill participants. These results were consistent at both cued

544 and non-cued display conditions and at all three temporal points. The results extend Ward et al.'s

545 (2013) findings and previous research in the domain by indicating that option generation

546 differences attributed to skill level exits at various temporal constraints in the situation

547 assessment process. Similar to anticipation, situation assessment is a process that consists of the

548 ability to attend and process dynamic and changing environmental information over time. Future

549 research must examine other temporal points (e.g., 100ms after the action) to expand on the

550 option generation process. The findings further indicate that a crucial process in option

551 generation is the ability to distinguish among options and focus on task-relevant options; a

552 characteristic of more experienced players (Ward et al., 2013). Furthermore, the results indicate

553 that it is crucial to consider the type of options generated rather than the total amount of options

554 as indicated by Raab and Johnson (2007) when evaluating and training option generation skills.

555 In addition, the results support the notion that higher-level players maintain a more

556 comprehensive representation of the domain-specific situation coupled with an ability to analyze

557   the situation more efficiently; consequently, leading to more successful anticipation and decision

558   making (Ericsson & Kintsch, 1995; Hoffman et al., 2014; Suss & Ward, 2015). The findings

559   suggest that high-level players more than low-level players possess a better "information

560   reduction" strategy, and that reducing the attended noise (i.e., irrelevant options) means they are

561   better able to pay more attention to the same number of relevant options (Haider & Frensch,

562   1995). Lower level players on the other hand must sift through the noise to make use of the same

563   number of relevant options.

564   As expected and supporting Ward et al.'s (2013) findings, participants generated more

565   options in the cued condition than in the non-cued condition, regardless of skill-level and across

566   temporal points. Of note, there were no differences in relevant and irrelevant options, only in

567   total options, between display conditions. These results indicate that when more time is available

568   to extract information from environmental cues, players tend to analyze more options in general

569   and not necessarily more relevant options.

570   **Situational Assessment Skills: Option Prioritization**

571   Analyses of the option prioritization scores revealed that high-skill players were better

572   able to indicate which options were more threatening than low-skill players at 400ms before the

573   turning point, replicating Ward et al.'s (2013) findings. Thus, although the number of relevant

574   options generated were similar across skill-levels, high-skill players were able to prioritize the

575   relevant options better than low-skill players. These findings indicate that the analytic ability to

576   prioritize options plays a major role in the perceptual-cognitive process (Ward et al., 2013). A

577   main display effect was also observed at the 400ms temporal point. Players were able to

578   prioritize options better in the cued condition than in the non-cued condition. These results are

579   in-line with findings from Ward et al. (2013) and support the notion that when available,

580   environmental information is important in the decision-making process for all skill levels.

581   At 200ms and 0ms before the turning point, option prioritization scores revealed a

582   significant Skill by Display conditions interaction effect. Contrary to our predictions, a larger

583   difference attributed to skill level was observed under the cued condition than the non-cued

584   condition. The task and environmental constraints under this condition resembles on field

585   situations more than the non-cued condition. However, this finding necessitates more evidence

586   under stronger representative and ecological environments. The current study extends Ward et

587   al.'s (2013) findings (and previous research in this domain) by exploring option prioritization

588   differences at several temporal constraints. The results of the current study indicate that temporal

589   constrains play a crucial role in option prioritization. Specifically, at earlier temporal points (i.e.,

590   -400ms) differences are not dependent on the display conditions, while at temporal points closer

591   to the point of decision and action, the display conditions maintain a significant role in option

592   prioritization of skilled players; they rely on visual information to prioritize options efficiently

593   and when not available, their option prioritization ability decreases to a similar level of low skill

594   players. Importantly, low skill players were not affected by the display conditions at these

595   temporal points.

596   The option prioritization results contradict the predictions of the TTF heuristic stating

597   that the first option generated should be the best option (Raab & Johnson, 2007). According to

598   the proponents of the TTF heuristic high-skill players choose the best option first regardless of

599   display conditions (i.e., cued and non-cued). In the current study the information available prior

600   to generating the options was similar and thus should result in similar prioritization scores.

601   Additionally, the findings revealed that the option generation process is analytic in nature, and

602   not serial and intuitive. Generating options is dependent on environmental factors and constrains

603   (e.g., time, information, score), as changes in the amount of generated options varied among the

604   display conditions (Chabris & Hearst, 2003).

605   **Relationship between Anticipation and Situational Assessment Variables**

606   As predicted, a positive and significant correlation emerged between anticipation and the

607   amount of relevant options generated and option prioritizations scores across all three temporal

608   points. Furthermore, the amount of total options generated was not significantly correlated with

609   anticipation at all three temporal points. Moreover, a negative and significant relationship

610   between anticipation and the amount of irrelevant options generated at the turning point emerged

611   (0ms). The correlations support the claims that the ability to generate and analyze plausible

612   options is the key determinant of successful decision-making (Ward et al., 2013). Additionally,

613   the findings indicate that the total amount of options is not related to the quality of decision-

614   making and does not align with the predictions of the TTF heuristic that there should be a

615   negative relation between the amount of options generated and decision-making (Raab and

616   Johnson, 2007). An interesting finding, that replicates and extends the results from the Ward et

617   al. (2013) study, is that option prioritization had the strongest correlation with anticipation across

618   *the temporal points* compared to the option generation variables. This indicates that the analytic

619   ability to process options is an imperative process in successfully anticipating upcoming events.

620   Furthermore, the study extends previous research by indicating that the relationship between

621   task-irrelevant options and anticipation was significant only at the turning point (i.e., just before

622   the action). Thus, these findings indicate that it is necessary to reduce the number of irrelevant

623   options (i.e., reducing the noise) when approaching the point of action in the decision-making

624   process. The findings also support the notion that researchers must examine the decision making

625   process across temporal points.

626   **Conclusion, Limitations, and Future Research**

627   The current study is one of the first to examine anticipation and situational assessment

628   skills in a dynamic *team* sport setting under varying informational constraint induced by

629   temporal occlusion. The conceptual framework and methodology used in the study was guided

630   by Ward et al.'s (2013) study, and examined two opposing perspectives (i.e., analytical and

631   intuitive; see Ericsson & Kintsch, 1995 and Johnson & Raab, 2003, respectively). In addition,

632   the current study extended Ward et al.'s (2013) study (and previous studies) by exploring the

633   situation assessment process across temporal constrains. Findings indicated that in general, high-

634   skill players possessed more enhanced "game reading" skills than low-skill players and that

635   display and temporal constraints determine anticipation and situation assessment processes.

636   Findings further indicated that anticipation and situational assessment were affected

637   differently by display conditions depending on the temporal point. High-skill participants

638   anticipated significantly better only at the turning point, and display conditions affected players

639   of different skill-level similarly across temporal points. However, while results for the option

640   generation task were similar across temporal points, high-skill players generated more relevant

641   than irrelevant options, low-skill players generated more irrelevant options than relevant ones,

642   and importantly, high-skill players generated less task-irrelevant option than low-skill players.

643   Like anticipation, players of both skill-level were affected similarly by the display conditions

644   across temporal points. Option prioritization results indicated a significant main effect for skill-

645   level only at the 400ms temporal point. Interestingly, at the 200ms and 0ms temporal point there

646   was a significant Display by Skill-level interaction, with larger ESs between skill levels at the

647   cued condition. Thus, this indicates that the processes of extracting information at various

648   temporal points and contextual situations differ among players which vary in perceptual-

649   cognitive skills.

650   The relationship between anticipation and situational assessment support and extend

651   Ward et al.'s (2013) findings and contradict the TTF heuristic predictions. The amount of options

652   generated was not related to anticipation as expected by proponents of the TTF heuristic.

653   However, the amount of relevant options generated and more importantly the ability to analyze

654   those options and prioritize them was significantly and positively related to anticipation

655   accuracy.

656   To capture the anticipatory and decision-making processes, more ecologically valid

657   research methods must be employed. Specifically, methods incorporating time constraints, full

658   body responses, and inclusion of additional environmental information such as sounds and fans,

659   are required to fully capture the decision-making process, and the development of expertise

660   (Belling et al., 2015; Ward et al., 2013). Brain imaging studies may further advance the

661   understanding of space-time neural correlates underpinning skilled anticipation in sports

662   (Nakata, Yoshie, Miura, & Kudo, 2010).

663   Finally, we propose that the analytical and intuitive processes complement each other; at

664   the earlier stages of the developing play there is more uncertainty, the pattern is less structured,

665   and more time is available compared to the latter developmental stages. Thus, skilled players

666   may need more time under these conditions to analyze the situation, generate more options, and

667   analytically prioritize the options (Wared et al., 2013). Conversely, just before the point of play,

668   time is limited, and the situation is more structured and certain. Under this condition, less time is

669   available to analyze the situation, resulting in a fast, serial, and automatic recognition-based

670   process by the skilled players (Raab & Johnson, 2007). Consequently, a synthesis of both

671   processes (i.e., analytical and intuitive) must be further explored.

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783

784 **Table Captions**

785 Table 1

786 *Descriptive statistics (i.e., M and SD) for experience playing soccer by skill level.*

787

Skill	Organized Soccer	General Soccer	Age Started
Low (*n* = 21)	1.00(1.14)	2.21(1.74)	8.74(4.96)
High (*n* =19)	13.79(4.33)	16.11(2.85)	4.79(2.45)

788

789

790 Table 2

791 *Correlations between anticipation and situational assessment at all three temporal points*

792

Situational Assessment	Anticipation (0ms)	Anticipation (200ms)	Anticipation (400ms)
Option prioritization	.49**	.63**	.46**
Task-relevant options	.29**	.44**	.33**
Task-irrelevant options	-.25*	-.07	-.13
Total options	-.07	.13	.04

793 *p < .05. **p < .01

794

795 **Figure Captions**

796 *Figure 1*. Anticipation scores (*M* and *SD*) by skill, display, and temporal conditions.

797 *Figure 2*. Task-relevant and task-irrelevant options generated (*M* and *SD*) by skill, display, and

798 temporal conditions.

799 *Figure 3*. Option prioritization scores (*M* and *SD*) by skill, display, and temporal conditions.