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

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Abstract

We tested the notion that expertise effects would be more noticeable when access to the situational information would be reduced by occluding (i.e., non-cued) or freezing (i.e., cued) the environment under temporal constraints. Using an adaptation of tasks developed by Ward et al. (2013), participants viewed video clips of attacking soccer plays frozen or occluded at three temporal points, then generated and prioritized situational options and anticipated the outcome. High-skill players anticipated outcomes more accurately, generated less task-irrelevant options and were better at prioritizing task-relevant options, than their low-skill counterparts. Anticipation scores were significantly and positively correlated with option prioritization and task-relevant options generated but not with total options generated. Counter to our prediction, larger skill-based option prioritization differences were observed when the play was frozen than occluded. These results indicate that processing environmental information depends on temporal and contextual conditions.

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

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).

107 **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 Zsombok, (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 $1 - \beta = .80$. 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 ($M_{\text{age}} = 21.00$, $SD_{\text{age}} = 1.73$), and 21
241 low-skill players ($M_{\text{age}} = 22.14$, $SD_{\text{age}} = 3.49$).

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 where 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 trials¹. 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**

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

365 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 ($F_s < 3.5$).

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 ($F_s < 1$).

423 Similar results were found at the turning point (0ms). The skill-level, $F(1, 38) = 21.39, p$
424 $< 0.01, \eta_p^2 = .36$, display, *Wilk's* $\lambda = .71, F(1, 38) = 15.8, p < 0.01, \eta_p^2 = .29$, and Skill x Type,
425 *Wilk's* $\lambda = .57, F(1, 38) = 28.52, p < 0.01, \eta_p^2 = .43$, 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 ($F_s <$
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, $F(1, 38) = 12.78, p < 0.01, \eta_p^2 = .25$, and display conditions, *Wilk's* $\lambda = .62, F$
440 $(1, 38) = 23.22, p < 0.01, \eta_p^2 = .38$. 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* $\lambda = .98$, $F(1, 38) = .77$, $p = 0.39$, $\eta_p^2 = .02$. 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* $\lambda = .89$, $F(1, 38) = 4.61$, $p = 0.04$, $\eta_p^2 = .11$. 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, $F(1, 38) = 1.51$, $p = 0.20$, $\eta_p^2 = .04$, and display
454 conditions, *Wilk's* $\lambda = .93$, $F(1, 38) = 3.08$, $p = 0.09$, $\eta_p^2 = .08$. 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* $\lambda = .81$,
459 $F(1, 38) = 8.71$, $p < 0.01$, $\eta_p^2 = .19$, and a significant Skill x Display interaction effect, *Wilk's* λ
460 $= .86$, $F(1, 38) = 6.36$, $p = 0.02$, $\eta_p^2 = .14$. 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, $F(1, 38) = .17$, $p = 0.17$, $\eta_p^2 = .05$. 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 exists 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 (Ward 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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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 (<i>n</i> = 21)	1.00(1.14)	2.21(1.74)	8.74(4.96)
High (<i>n</i> =19)	13.79(4.33)	16.11(2.85)	4.79(2.45)

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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

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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.