1 Running Head: TRANSFER FROM ESPORT TO TRADITIONAL SPORT

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3   "Esport expertise benefits perceptual-cognitive skill in (traditional) sport"

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Abstract

The ability to recognise patterns in developing sequences of play is a characteristic of experts that consistently distinguishes them from less-skilled performers. In addition to *in situ* training, researchers and practitioners seek alternative, simulated practice activities that may assist in the development of such perceptual-cognitive skills, whilst limiting physical load. In this study, we investigated whether pattern recognition skills of esport experts transferred to traditional sport. Expert esport (FIFA) players, skilled soccer players and a control group of novices in both FIFA and soccer completed two pattern recognition tasks, one that involved viewing and identifying previously seen footage of structured sequences from competitive FIFA 19 matches and another displaying sequences from soccer matches. Both skilled groups recognised previously viewed sequences significantly more accurately than the control group irrespective of viewing condition. Moreover, although expert FIFA players were more accurate than skilled soccer players in the FIFA 19 condition, no difference was observed between the two groups in the soccer condition. Positive transfer of pattern recognition skill was therefore stronger from FIFA to soccer than in the other direction. The findings suggest that engagement in esport may aid the development of perceptual-cognitive skills required for expert performance in traditional sport.

Keywords: Perception; memory; transfer; soccer; esports

Introduction

In dynamic and temporally constrained tasks such as soccer, aviation, and esports, the ability to anticipate future events is a distinguishing characteristic of expert performers (Triolet et al., 2013). One perceptual-cognitive skill underpinning this advantage is the ability to perceive and recognise patterns within displays (North & Williams, 2019). Retrospective data from expert performers indicates that extensive practice over many years is necessary to develop such perceptual-cognitive skills (see Ericsson, Krampe, & Tesch-Romer, 1993; Roca, Williams, & Ford, 2012). As a result, researchers and practitioners have sought to identify methods and interventions that may support the development of these skills (Hoffman et al., 2014). While *in situ* practice activities are important (Ford, Ward, Hodges, & Williams, 2009; Hendry & Hodges, 2018), there are nevertheless concerns over injury risk and burnout (Baker, Cobley, & Stephen-Thomas, 2009). Increasingly, efforts are being made to develop virtual environments that provide engaging and varied opportunities for domain-specific practice whilst minimizing injury risk (Stone, Strafford, North, Toner, & Davids, 2019). An alternative, but currently more accessible and affordable, activity that may contribute to the development of perceptual-cognitive skills is competitive electronic sports (esports; Boot, 2015). Although it is intuitively appealing to suggest that engagement in esports may facilitate transfer of perceptual-cognitive skills to the traditional sports they simulate (e.g., EA Sports FIFA and soccer), research investigating this notion is scarce.

Pattern perception has been shown to distinguish skilled from lesser-skilled performers in multiple domains (e.g., basketball: Allard, Graham, & Paarsalu, 1980; map reading: Gilhooly, Wood, Kinnear, & Green, 1988; medical diagnosis: Sowden, Davies, & Roling, 2000). At a practical level, the ability to perceive emerging sequences early in their development affords expert performers additional time and enables them to demonstrate their anticipation advantage (North & Williams, 2019). This domain-specific expertise is thought

80   to arise through extended engagement in domain-specific practice that results in the

81   development of specialised cognitive knowledge structures which support processes of

82   encoding, storage, and retrieval that ultimately enable quicker and more accurate judgments

83   (see Ericsson & Kintsch, 1995). An early study by Allard and Starkes (1992) investigated

84   pattern perception in expert basketball and ice hockey players when viewing sequences from

85   both sports, revealing that basketball players recalled sequences more accurately when

86   viewing basketball stimuli, while ice hockey players were more accurate on ice hockey trials,

87   highlighting the domain-specific nature of pattern perception.

88   Despite the proposed domain-specificity of perceptual-cognitive expertise and the

89   sport expertise × recognition task interaction reported by Allard and Starkes (1992), the

90   authors nevertheless noted that recall accuracy of both groups in the non-domain-specific task

91   was significantly above chance, suggesting that experts were able to perceive and encode

92   meaning from such displays. If perceptual-cognitive skills did transfer between domains,

93   there may be scope to develop such skills away from one's primary sport, potentially in a less

94   physically demanding way, thus reducing the risk of injury and burnout (Stone et al., 2019).

95   Positive transfer of perceptual-cognitive skills is most likely to be observed between tasks

96   that share similar characteristics (see Causer & Ford, 2014; Roca & Williams, 2017; Rosalie,

97   & Müller, 2014). For example, Smeeton, Ward, and Williams (2004) investigated the transfer

98   of perceptual-cognitive skill between sports that were thought to share similar perceptual

99   features and processing strategies (soccer and field hockey) and another sport thought to be

100   dissimilar on these factors (volleyball). Using a recognition task, the researchers reported that

101   soccer and field hockey players each recognised previously seen soccer and field hockey

102   sequences more quickly than volleyball players, demonstrating positive transfer between

103   structurally similar sports. Similarly, Abernethy, Baker, and Côté (2005) used a pattern recall

104   task to demonstrate that expertise in one sport enabled positive transfer to related sports.

105 Experts demonstrated superior levels of recall accuracy for domain-specific sequences but

106 nevertheless recalled patterns from other similar sports more effectively than non-experts.

107 Collectively, the findings suggest that perceptual-cognitive skills may transfer between

108 similar domains

109   In their Identical Elements theory, Thorndike and Woodworth (1901) suggested that

110 transfer of learning is dependent on the number of similar elements between the tasks, these

111 elements being perceptual, motor or strategic in nature. For example, soccer and field hockey

112 may share similar perceptual and strategic elements due to the number of players involved,

113 the pitch size and the formations employed. In contrast, Lee's (1988) Transfer-Appropriate

114 Processing theory suggests that transfer occurs when tasks share similar perceptual and

115 cognitive processing demands. For example, comparable visual search strategies in sports

116 like soccer and field hockey are likely to facilitate the type of encoding and retrieval

117 processes that lead to positive transfer (Helsen & Starkes, 1999; Smeeton et al., 2004;

118 Williams, Swarbrick, Grant, & Weigelt, 1999). Therefore, time spent engaging in secondary

119 activities that involve similar perceptual and strategic elements and/or processing demands

120 could facilitate the development of perceptual-cognitive skills in an athlete's primary sport.

121   Esports involve individuals or teams competing in video games either in person or

122 online, for trophies, ranking points or prize money (Ruvalcaba, Shulze, Kim, Berzenski, &

123 Otten, 2018). Like traditional sport, expert esports performance requires highly developed

124 perceptual-cognitive skills that, depending on the game, underpin quick and effective

125 anticipation and decision making under time constraints (Latham, Patston, & Tippett, 2013;

126 Pedraza-Ramirez, Musculus, Raab, & Laborde, 2020). Once merely a popular pastime, the

127 prevalence of professional esports has increased drastically in recent years (Pluss et al.,

128 2020). While early video games were limited in their realism (Boot, 2015), current versions

129 are increasingly realistic, both in gameplay and graphics, creating a highly engaging

130   environment (Towne, Ericsson, & Sumner, 2014). Esports therefore provide an ideal domain

131   within which to study expertise (Pluss et al., 2019) and may also be suitable to supplement

132   the development of perceptual-cognitive skills in other domains, without adding extra

133   physical demand. Engagement with video simulations of real-world actions has been shown

134   to aid the development of perceptual-cognitive skills that are transferrable to *in situ*

135   performance (Broadbent, Causer, Ford, & Williams, 2015; Müller & Abernethy, 2014;

136   Smeeton, Williams, Ward, & Hodges, 2005). However, creation of test stimuli for such

137   methods is time consuming and can lack variation, therefore participation in esports that

138   simulate an athlete's sport may provide a readily available, cost-effective alternative.

139   The aim of the current study was to investigate whether pattern recognition skills can

140   be transferred between esport (FIFA) and traditional sport (soccer). We compared the

141   performance of expert FIFA players, skilled soccer players and a control group of novices on

142   two pattern recognition tasks, one in which sequences from competitive FIFA 19 matches

143   were presented and another presenting sequences from competitive soccer matches. As expert

144   performers have been shown to transfer perceptual skills between similar tasks (Lee, 1988;

145   Smeeton et al., 2004; Thorndike & Woodworth, 1901), we hypothesized that the two skilled

146   groups would recognize sequences more accurately than the control group regardless of the

147   viewing condition, thus demonstrating positive transfer. However, based on previous research

148   highlighting the expert advantage in pattern perception on domain-specific tasks (Abernethy

149   et al., 2005), we hypothesized that the two skilled groups would nevertheless outperform one

150   another when responding to footage from their own domain.

151   **Method**

152   **Participants**

153 Sample size was calculated using G*Power 3.1 (Faul, Erdfeldner, Lang, & Buchner,

154 2007). A total of 42 participants were calculated as being sufficient to detect a medium effect

155 size ($f = .25$) with power set at 0.80 for the within-between interaction. In total, 58

156 participants completed the experiment, 22 of whom were expert FIFA players ($M_{age} = 22.8$,

157 standard deviation [SD] = 3.5), 17 were skilled soccer players ($M_{age} = 21.2$, $SD = 6.1$), and 19

158 participants who had limited experience in both soccer and FIFA acted as a control group

159 ($M_{age} = 25.7$, $SD = 10.2$). Expert FIFA players reported having achieved a FIFA 19 (EA

160 Sports, 2019) ranking of Elite 2 or higher (rankings are on a twelve-tier system with Elite 2

161 being the second highest tier outside the top 100 World rankings). At the time of the study,

162 they reported playing a mean of 26.8 ($SD = 12.0$) hours' FIFA 19 per week. Skilled soccer

163 players played semi-professionally and competitively in the 8th tier of English soccer or

164 above. They reported currently playing a mean of 3.4 ($SD = 4.6$) hours' soccer per week.

165 Expert FIFA players who reported playing soccer regularly were excluded from the study, as

166 were skilled soccer players who reported regular engagement in FIFA video games. The

167 control group played both soccer and FIFA irregularly and did not take part in either activity

168 competitively. Written informed consent was provided by each participant with ethical

169 approval granted from each of the institutions at which data collection took place.

170 **Test Stimuli**

171 Four sets of test stimuli were created; two for use as viewing and recognition phases

172 in the FIFA 19 condition and two for use in the soccer condition. Each set of stimuli

173 consisted of 30 trials, edited to be five seconds in duration. In both conditions, sequences

174 were originally selected for use if they included a key pass, e.g., a through ball or a cross. For

175 the FIFA 19 condition, test stimuli were generated from live streams of competitive FIFA 19

176 events (EA Sports FIFA 19 Ultimate Team, 2019). Originally, 96 sequences of play were

177 generated and edited to remove recognizable superficial features such as the score line, face

178   camera shots and energy bars. For the soccer condition, 92 sequences of play were originally

179   generated from internationally broadcast footage. To avoid presenting footage that had

180   previously been viewed by participants, none of the selected footage was of matches played

181   by English teams. As in the FIFA 19 condition, score lines were removed from this condition.

182   All footage was of a side-on, birds-eye view perspective (see Figure 1).

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185   Figure 1. Example FIFA 19 (top) and soccer (bottom) test stimuli

186   A professional FIFA player with a higher ranking than any of the participants rated

187   the level of structure in each of the FIFA 19 clips on a Likert scale of 0 to 10 (based on the

188   extent to which the sequences represented what would occur in a competitive setting; 0 being

189   not at all structured, 10 being highly structured). Similarly, a semi-professional soccer player

190   rated the level of structure in the selected soccer sequences. This process of ensuring

191 structure within sequences has been used by other researchers studying expert pattern

192 perception (Gorman, Abernethy, & Farrow, 2012; North, Williams, Hodges, Ward, &

193 Ericsson, 2009). In both tasks, the 45 sequences receiving the highest structure rating were

194 used as experimental test stimuli. From this base of 45 sequences, 30 were randomly selected

195 for presentation in the viewing phase. The remaining 15 sequences formed the 'new' trials to

196 be presented in the recognition phase. These were presented along with 15 randomly selected

197 trials from the viewing phase that acted as 'previously seen' trials. The 'new' and 'previously

198 seen' trials were randomly ordered within the recognition phases.

199 **Apparatus and set-up**

200 Test stimuli were edited using Davinci Resolve 15 software (Blackmagic Design,

201 Fremont, CA, USA). Participants viewed footage on a standard laptop or desktop computer.

202 The laptop/computer on which footage was viewed was not consistent between participants

203 but the screen was always of personal computer size. Participants sat approximately 40 cm

204 from the screen, yielding a viewing angle of approximately 45 degrees on a standard 15.6"

205 screen, similar to previous research (North et al., 2009; North, Hope, & Williams, 2016).

206 **Procedure**

207 Data collection was carried out in one of two ways; either in person with the

208 researcher or remotely, via telephone. In those instances of remote participation, participants

209 viewed footage via uploaded videos from Google Drive (Mountain View, CA, USA). First,

210 participants were told that they would be presented with a series of sequences of play from

211 competitive FIFA 19 or soccer matches and that they were required to view the footage. Half

212 of the participants in each group viewed the soccer test stimuli first with the other half

213 viewing the FIFA 19 test stimuli first. Having completed the initial viewing phase,

214 participants completed a playing history questionnaire to ascertain their level of experience

215   and engagement in the activity corresponding to the viewing condition. The questionnaire

216   was completed during a break of approximately 15 minutes. Next, participants were informed

217   that they would view a further series of sequences, but that on this occasion some of the

218   sequences had already been shown in the initial viewing phase, whereas others had not.

219   Participants were asked to highlight those previously seen as "old" and those that had not yet

220   been seen as "new". An inter-trial interval of 5 seconds was employed throughout. Participant

221   responses were either written or typed depending on whether data was collected in person or

222   remotely, respectively. Upon completion of the first recognition phase, participants took a

223   short break prior to completing the same procedure in the other viewing condition.

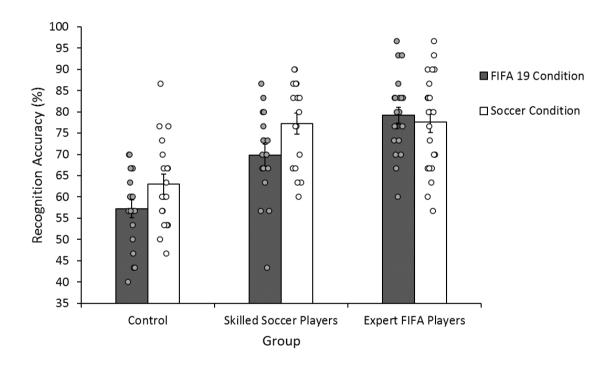224   **Data Analysis**

225   First, recognition accuracy scores were converted to percentages (%). The data were

226   then screened for outliers using box plots and were subsequently tested for normality. No

227   outliers were detected and the Shapiro-Wilk test showed the data met the parametric

228   assumption of normality. Moreover, significant skewness or kurtosis was not observed in any

229   of the variables for any of the groups. Next, a 3 (Group [Control, Skilled Soccer Players,

230   Expert FIFA Players]) × 2 (Viewing Condition [Soccer, FIFA 19]) mixed Analysis of

231   Variance (ANOVA) with repeated measures on the latter factor was conducted to determine

232   whether domain-specific expertise affected ability to recognise patterns of play across

233   conditions. Percentage recognition accuracy (%) acted as the dependent variable. In the case

234   of main effects or interactions, Bonferroni-corrected pairwise comparisons were employed to

235   control for family-wise error. Partial eta squared (η_p^2) and Cohen's d are used to report effect

236   sizes. 95% confidence intervals are reported on d and the alpha level was set at .05.

237   **Results**

238   Mean (and standard error) recognition accuracy scores are presented in Figure 2.

239   ANOVA revealed a main effect of Group, $F(2,55) = 24.27$, $p < .01$, $\eta_p^2 = 0.47$. Compared to

240   the control group ($M = 60.09$ %, $SD = 10.12$), recognition accuracy was higher for both the

241   expert FIFA players ($M = 78.41$ %, $SD = 10.10$, $p < .01$, $d = 1.81$, 95 % confidence interval

242   [CI] = [1.29, 2.33]) and the skilled soccer players ($M = 73.53$ %, $SD = 11.04$ $p < .01$, $d =$

243   1.27, 95 % CI = [0.76, 1.78]). A main effect of Viewing Condition was also observed, F

244    $(1,55) = 7.26$, $p = .01$, $\eta_p^2 = 0.12$. Recognition accuracy was higher in the soccer ($M = 72.70$

245   %, $SD = 12.57$) than the FIFA 19 condition ($M = 69.25$ %, $SD = 13.25$).

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248   Figure 2. Mean (SE) recognition accuracy (%) across groups and viewing conditions.

249   A Group × Viewing Condition interaction was observed, $F(2,55) = 4.05$, $p = .02$, η_p^2

250    $= 0.13$. In the soccer condition, the control group ($M = 62.98$ %, $SD = 10.42$) were

251   significantly less accurate than both the skilled soccer players ($M = 77.26$ %, $SD = 10.22$, $p <$

252   .01, $d = 1.38$, 95 % CI = [0.64, 2.11]) and expert FIFA players ($M = 77.58$ %, $SD = 11.37$, p

253    $< .01$, $d = 1.33$, 95 % CI = [0.65, 2.01]), with no difference observed between the two latter

254   groups ($p = .93$, $d = 0.03$, CI = [-0.60, 0.66]). In contrast, in the FIFA 19 condition, while the

255 control group ($M = 57.19$ %, $SD = 9.18$) was again significantly less accurate than the skilled

256 soccer players ($M = 69.80$ %, $SD = 10.83$, $p < .01$, $d = 1.26$, 95 % CI = [0.54, 1.97]), the

257 soccer players were, in turn, significantly less accurate than the expert FIFA players ($M =$

258 79.24 %, $SD = 8.84$, $p = .01$, $d = 0.97$, 95 % CI = [0.29, 1.63]). The expert FIFA players were

259 also significantly more accurate than the control group ($p < .01$, $d = 2.45$, CI = [1.62, 3.26]).

260   **Discussion**

261   To determine whether perceptual-cognitive skill transfers between esports and the

262 traditional sports they simulate, we compared performance of expert FIFA players, skilled

263 traditional sports (soccer) players and novices (control) on two pattern recognition tasks in

264 which sequences from competitive FIFA 19 or soccer matches were presented. Consistent

265 with research demonstrating positive transfer between similar tasks (Abernethy et al., 2005;

266 Lee, 1988; Thorndike & Woodworth, 1901; Smeeton et al., 2004), we expected the skilled

267 participants to outperform the control group regardless of the viewing condition. Moreover,

268 based on previous research demonstrating expertise effects on domain-specific pattern

269 perception tasks (Abernethy et al., 2005), we expected the skilled participants to be more

270 accurate than the other groups when viewing sequences from their domain of expertise.

271   In line with our first hypothesis, both skilled groups recognised structured sequences

272 of play more effectively than the control group regardless of whether they were viewing

273 footage from competitive FIFA 19 or soccer matches. Skilled participants not only made

274 more accurate recognition judgments than participants in the control group when viewing

275 sequences from their own domain of expertise (e.g., soccer players viewing soccer sequences,

276 North et al., 2009; North, Ward, Ericsson, & Williams, 2011) but they were able to maintain

277 this advantage in the non-domain specific viewing condition, highlighting positive transfer of

278 pattern recognition skill between tasks. While previous research has demonstrated positive

279 transfer of perceptual-cognitive skills between sports (Moore & Müller, 2014; Rosalie &

280 Müller, 2014; Smeeton et al., 2004), this is the first study to our knowledge to demonstrate

281 positive transfer between esport and traditional sport.

282   The similarity between the two tasks is likely to be a driving factor behind the

283 observed transfer. Given that FIFA 19 aims to simulate soccer through a video game medium,

284 by design the two tasks share common elements, e.g., the number of players, formations and

285 underlying strategies (Thorndike & Woodworth, 1901). The degree of positive transfer

286 between the two tasks is therefore not surprising. It is equally unsurprising that differences in

287 superficial features between the viewing conditions (i.e., computer graphics vs real players)

288 did not prevent positive transfer from being observed. Pattern recognition is underpinned by

289 the effective processing of dynamic relational information between features, as demonstrated

290 by the maintenance of an expert advantage when surface level features are removed from

291 visual displays using point-lights (North et al., 2009; Williams, Hodges, North, & Barton,

292 2006; Williams, North, & Hope, 2012). In the current study, both groups of experts were able

293 to effectively encode and retrieve task-relevant information from memory when required for

294 both tasks, despite superficial differences between display conditions.

295   Partially in line with our second hypothesis, while the expert FIFA players were more

296 accurate than skilled soccer players when viewing the FIFA 19 footage, the two groups

297 achieved comparable accuracy on the soccer task. The positive transfer of perceptual-

298 cognitive skill from FIFA to soccer was therefore stronger than in the other direction. These

299 findings contrast with those of Abernethy et al. (2005) which showed that although pattern

300 recall skills transferred positively between similar sports, the degree of transfer did not result

301 in as high performance levels as those of domain experts. While the sports used by Abernethy

302 et al. (2005) were similar in that they were all team-based invasion sports (basketball, field

303 hockey and netball), factors such as player numbers, pitch size and strategy all differed

304 between the sports. As a video game based simulation of soccer, FIFA 19 is likely to be

305 highly similar to soccer both in terms of the perceptual and strategic elements involved

306 (Thorndike & Woodworth, 1901), and the cognitive processes underpinning effective pattern

307 recognition on the task (Lee, 1988).

308   Although researchers have previously demonstrated that engagement with video

309 games may be associated with enhanced perceptual and cognitive abilities (Bediou et al.,

310 2018; Green & Bavelier, 2003; Wu & Spence, 2013), these are the first findings, to our

311 knowledge, that demonstrate positive transfer of perceptual-cognitive skill from esport to

312 traditional sport. In non-sporting contexts, it has previously been shown that enhanced

313 perceptual and cognitive processing is associated with engagement in video games that share

314 common demands to the transfer task. For example, engagement in first-person shooter

315 games that require fast and accurate decisions in dynamic, time constrained environments has

316 resulted in more efficient visual search strategies on laboratory based tasks that share these

317 demands (Green & Bavelier, 2007; Hubert-Wallander, Green, Sugarman, & Bavelier, 2011).

318 The findings presented here suggest that engagement in esports which simulate traditional

319 sports may lead to the development of perceptual-cognitive skills that underpin expert

320 performance in the sport. Of course, it is possible that rather than positive transfer of pattern

321 recognition skills, the superior performance of skilled participants was due to enhanced

322 generic visual recognition. However, as our findings align with a large body of research

323 demonstrating the domain-specific nature of effective pattern perception (Gorman et al.,

324 2012; North et al., 2011; North, Hope, & Williams, 2017), we consider this possibility

325 unlikely.

326   The Group × Viewing Condition interaction revealed that transfer of pattern

327 recognition skill was stronger from FIFA to soccer than in the other direction. We suggest

328 two possible explanations for this. First, while viewing perspective was maintained as

329   consistently as possible between the two tasks for the purpose of control, the aerial side-on

330   viewing perspective was more representative of the performance environment normally

331   experienced by FIFA players than soccer players. Tasks that are less representative of the

332   performance environment, e.g., via the viewing perspective or response employed, have been

333   shown to yield smaller expertise effects (see Farrow & Abernethy, 2003; Mann, Abernethy,

334   & Farrow, 2010). It follows that the visual search and cognitive processing strategies of

335   soccer players in the soccer viewing condition may have been different, and in turn less

336   effective, than those normally employed from a pitch level first-person viewing perspective

337   (Mann, Farrow, Shuttleworth, & Hopwood, 2009). We therefore recommend that future

338   research replicate the current findings while manipulating the viewing perspective employed.

339   A second potential explanation, and in turn an associated limitation of the study, is that the

340   FIFA players were competing at a higher level and spent more time engaging in their domain

341   than the soccer players. The FIFA players were therefore likely to have attained a higher level

342   of expertise than the soccer players, thus facilitating more effective transfer of perceptual-

343   cognitive skill. In line with this suggestion, researchers have previously observed that the

344   degree of transfer of perceptual-cognitive skill between domains is moderated by expertise

345   level of performers (Abernethy et al., 2005; Rosalie & Müller, 2014).

346   From an applied perspective, of particular interest is the positive transfer from esport

347   to traditional sport because the high level of physical activity associated with traditional

348   sports like soccer carries with it an inherent risk of injury and burnout (Baker et al., 2009).

349   Our findings, therefore, show promise for the use of esports to develop perceptual-cognitive

350   skills in traditional sports and may provide a substitute for physical training when players are

351   injured or resting. It is important to note that our findings do not suggest engagement in

352   esport to be more beneficial than participating in traditional sport itself, nor do our findings

353   demonstrate that engagement in esport actually leads to enhanced performance in traditional

sport. Rather, we suggest that engaging in simulated activities may provide a challenging,

varied practice environment that yields continued motivation over time (Gray, 2019), while

contributing to the development of perceptual-cognitive expertise. We thereby recommend

that future research employs interventions to investigate the effect of engagement in esport on

perceptual-cognitive skill development and indeed, the ability to transfer skills to traditional

sport and enhance performance. First, like research which has previously investigated the link

between video games and general perceptual and cognitive abilities, intervention based

studies would provide evidence as to whether there is a causal link between engagement in

esport and perceptual-cognitive skill in traditional sport (Blacker, Curby, Klobusicky, &

Chein, 2014; Toril, Reales, & Ballesteros, 2014). Second, research is needed to investigate

whether the degree of transfer displayed in this study is still observed in more ecologically

valid tasks, such as in-situ (on field) tests of anticipation and decision making. Finally,

research that employs engagement in esport as a training intervention to determine its effect

on traditional sports performance (i.e., on field performance) is required. Such systematic

investigation would provide valuable information for practitioners exploring the possibility of

using esport as a training tool for traditional sport.

In this paper we have reported novel findings that show positive transfer of

perceptual-cognitive skill between esport (FIFA) and traditional sport (soccer). Moreover, we

have demonstrated positive transfer to be more pronounced from FIFA to soccer than in the

other direction. Findings suggest there may be scope to use video game based simulations to

develop perceptual-cognitive skills for traditional sport, thus alleviating risk of overtraining

through increased physical load. We have recommended several avenues of further

investigation to examine these ideas. Thus, the current findings highlight the ability of expert

performers to transfer perceptual-cognitive skill between similar domains and the potential of

esports to act as a training tool for these skills in traditional sports.

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544 The authors report no conflicts of interest. The authors declare that they are not able to make

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