A large scale test of the gaming-enhancement hypothesis

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A growing research literature suggests that regular electronic game play and game-based training programs may confer practically significant benefits to cognitive functioning. Most evidence supporting this idea, the *gaming-enhancement hypothesis*, has been collected in small-scale studies of university students and older adults. This research investigated the hypothesis in a general way with a large sample of 1,847 school-aged children. Our aim was to examine the relations between young people's gaming experiences and an objective test of reasoning performance. Using a Bayesian hypothesis testing approach, evidence for the gaming-enhancement and null hypotheses were compared. Results showed no substantive evidence supporting the idea that having preference for or regularly playing commercially available games was positively associated with reasoning ability. Evidence ranged from equivocal to very strong in support for the null hypothesis over what was predicted. The discussion focuses on the value of Bayesian hypothesis testing for investigating electronic gaming effects and the importance of open science practices and pre-registered designs to improve the quality of future work.

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47   **Abstract**
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50   programs may confer practically significant benefits to cognitive functioning. Most evidence

51   supporting this idea, the *gaming-enhancement hypothesis*, has been collected in small-scale

52   studies of university students and older adults. This research investigated the hypothesis in a

53   general way with a large sample of 1,847 school-aged children. Our aim was to examine the

54   relations between young people's gaming experiences and an objective test of reasoning

55   performance. Using a Bayesian hypothesis testing approach, evidence for the gaming-

56   enhancement and null hypotheses were compared. Results showed no substantive evidence

57   supporting the idea that having preference for or regularly playing commercially available games

58   was positively associated with reasoning ability. Evidence ranged from equivocal to very strong

59   in support for the null hypothesis over what was predicted. The discussion focuses on the value

60   of Bayesian hypothesis testing for investigating electronic gaming effects and the importance of

61   open science practices and pre-registered designs to improve the quality of future work.

62 **A large scale test of the gaming-enhancement hypothesis**

63 *Background*

64 Electronic games are now a ubiquitous form of entertainment and it is popularly believed

65 that the time spent playing games might have positive benefits that extend outside of gaming

66 contexts (Lenhart et al., 2008; McGonigal, 2012). This general idea, the *gaming-enhancement*

67 *hypothesis*, posits that electronic gaming contexts influence a range of perceptual and cognitive

68 abilities because they present complex, dynamic, and demanding challenges. A recent

69 representative study of British adults and young people suggests this idea is widely held; Nine in

70 ten think brain-training games provide an effective way to improve focus, memory, and

71 concentration, and as many as two thirds have tried using these games to improve their own

72 cognitive abilities (Wellcome Trust Ipsos MORI, 2014). This view is increasingly profitable and

73 controversial (Nuechterlein et al., 2016). Given the intense public and private interest and

74 investment in games as a way of improving cognition and reasoning, is noteworthy that the

75 scientific literature investigating the gaming-enhancement hypothesis, though promising, is still

76 at an early stage.

77 A growing body of research suggests that common varieties of electronic gaming

78 experience might enhance general cognitive skills and abilities. These studies show that those

79 who opt to, or are assigned to, play a range of commercially available games show measurable

80 differences in terms of their visual and spatial abilities (Quaiser-Pohl, Geiser & Lehmann, 2006;

81 Green & Bavelier, 2006), executive functioning, information processing (Maillot, Perrot &

82 Hartley, 2012), and performance at specialist skills such as laparoscopic surgery performance

83 (Rosser et al., 2007). In particular, action games (Green & Bavelier, 2006), strategy games

84 (Basak et al., 2008), and multiplayer online games (Whitlock, McLaughlin & Allaire, 2012),

85   have been identified as having enhancing effects because they provide complex multi-tasking

86   environments that require players to integrate a range of sensory inputs. Researchers argue these

87   environments lead players to implement adaptive strategies to meet the varied demands of these

88   virtual contexts (Bavelier et al., 2012).

89   There is good reason to think that predispositions to engage specific kinds of games may

90   relate to cognitive performance and reasoning more broadly. For example, in studying skill

91   acquisition among strategy game players, researchers have reported evidence that differences in

92   brain volume are correlated with speed and performance in gaming contexts (Basak et al., 2011).

93   Exploration and learning in online gaming contexts closely mirror their offline analogues. Those

94   with pre-existing strengths tend to thrive at online gaming challenges initially, but those with low

95   levels of starting ability quickly close the performance gap (Stafford & Dewar, 2013). It is

96   possible that such inclinations guide players to games that suit them. Findings from experimental

97   and quasi-experimental studies suggest both preference and experience matter in terms of small

98   to moderate effects across a wide range of cognitive performance indicators (Powers et al.,

99   2013).

100   Unfortunately, many of these studies have pronounced shortcomings that temper the

101   broad promise of the gaming-enhancement hypothesis (van Ravenzwaaij et al., 2014). For

102   example, most of the evidence supporting this view has been derived from small-scale surveys,

103   intervention studies in university settings, or from samples of older adults. A recent review of

104   this literature indicates a small yet consistent link between gaming and general reasoning ability

105   (Cohen's $d = 0.24$), but the average sample size of studies examining the gaming-enhancement

106   hypothesis is only 32 participants (Powers et al., 2013). Perhaps as a consequence of such small

107   samples, the effects sizes reportedly linking games to cognitive abilities vary widely as a

108   function of the methods used and the research groups investigating them. For example, studies

109   published in top-tier journals, while typically using very small samples, report substantially

110   larger effects compared to the rest of the literature (e.g., Cohen's $d = 0.85$; Powers et al., 2013).

111   Moreover, despite the fact that games are played by the overwhelming majority of young people

112   (Lenhart et al., 2015), fewer than one in ten studies of the gaming enhancement study have

113   included participants under the age of 18. Childhood and adolescence see profound development

114   in cognitive abilities, and though negative effects of games are fiercely debated (Mills, 2014;

115   Bell, Bishop & Przybylski, 2015), there is very little evidence concerning their possible positive

116   effects in this cohort. Further, nearly all studies examining gaming effects do so by studying

117   individual games or game types in isolation. So although there is reason to think that action

118   (Green & Bavelier, 2006), strategy (Basak et al., 2011), and online game play (Whitlock,

119   McLaughlin & Allaire, 2012) could have positive effects, it is not possible to know if attitudes,

120   preferences, or engagement with games in general, or specific subtypes in particular, are driving

121   the effects reported. Finally, there are a number of larger-scale intervention studies that show

122   evidence that does not support or directly contradicts the gaming-enhancement hypothesis

123   (Chisholm et al., 2010; Kennedy et al., 2011). Given the nature of the existing evidence, research

124   that systematically addresses these gaps in our knowledge is needed.

125   *Present Research*

126   The aim of the present research was to evaluate the extent to which everyday electronic

127   game engagement by young people relates to their general reasoning abilities. In particular, we

128   were interested to test how personal preferences for specific types of games related to reasoning

129   ability. In line with previous research, we hypothesized that those who gravitate towards action,

130   online, and strategy games would show higher levels of cognitive performance on a test of

131 deductive reasoning ability (Basak et al., 2011). Our second goal was to test whether regular

132 active engagement with action, online, and strategy games was linked to cognitive ability. In line

133 with highly cited work in the area, we hypothesized that those playing these challenging games

134 for more than five hours each week (Green & Bavelier, 2006) would show higher levels of

135 reasoning ability.

136 **Method**

137
138 *Data Source*

139 The present study utilized data collected in the first year of the Effects of Digital Gaming

140 on Children and Teenagers in Singapore (EDGCTS) project. This dataset has been used in

141 numerous previous publications focusing on the effects of gaming on motivation, dysregulated

142 behavior, and interpersonal aggression in young people (Wan & Chiou, 2006; Gentile et al.,

143 2009; Wang, Liu & Khoo, 2009; Chen et al., 2009; Choo et al., 2010; Gentile et al., 2011; Wang

144 et al., 2011; Li, Liau & Khoo, 2011; Chng et al., 2014; Prot et al., 2014; Gentile et al., 2014;

145 Busching et al., 2015; Eichenbaum & Kattner, 2015; Chng et al., 2015; Liau et al., 2015b; Choo

146 et al., 2015; Liau et al., 2015a). A subsample of data from the EDGCTS project was used for the

147 present study because it included self-reports of game play and an objective test of participants'

148 reasoning abilities. Neither of these variables has been the focus of previously published studies,

149 and a complete list of publications based on the EDGCTS dataset can be found on the Open

150 Science Framework (osf.io/je786).

151 *Participants, Ethics, and Data*

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153 Ethical clearance for data collection was granted through the Institutional Review Board

154 of Nanyang Technological University in Singapore. Because of the combined length of the

155 EDGCTS testing protocol, data collection was conducted over a four-day period to reduce

156   participant burden and minimize sequence effects. The research was deemed low risk and

157   consent was obtained from parents through liaison teachers. Participants were informed that

158   involvement in the project was voluntary and that they could withdraw at any time. Ethical

159   review for this secondary data analysis was conducted by the research ethics committee at the

160   University of Oxford (SSH/OII/C1A-16-063).

161   In the first wave of the EDGCTS, quantitative data were collected from a total of 3,034

162   respondents. Gender information was present for 3,012 participants (99.3% of all cases), age data

163   were available for 2,813 participants (92.7%), 2,135 participants provided the name of at least

164   one electronic game they played (70.4%), and a total of 2,647 participants completed the

165   reasoning test (87.2%). In sum, a total of 1,847 participants (60.9% of all cases), provided valid

166   data and were included in subsequent analyses. These 1,847 participants ranged in age from 8 to

167   16 years ($M = 10.97$, $SD = 1.99$); 430 of these identified as female and 1,417 identified as male.

168   The self-report materials, datasets, source code, and analysis code used in this study are available

169   from the Open Science Framework (osf.io/je786).

170   *Outcome Variable*

171   *Reasoning Ability*. Participants' deductive reasoning ability was assessed using the 60-

172   item Raven's Standard Progressive Matrices Plus (RPM) task (Raven, Raven & Court, 1993).

173   The RPM, a widely used non-verbal test of reasoning ability, measures deductive intelligence by

174   prompting takers to identify the key missing visual element that completes patterns shown in a

175   series of increasingly complex 2x2, 2x3, 3x3, 4x4, and 6x6, matrices. This assessment was used

176   because it has been well validated across a range of demographic and cross-cultural cohorts

177   (Raven, 2000). Because our participants were school-aged children, they completed the version

178   of this multiple-choice test designed for group administration in educational settings for students

179 between the ages of 8 and 16 years. Participants got a median of 29 of 60 matrices ($SD = 4.44$)

180 correct, and age-adjusted reasoning scores were created for each participant in line with best-

181 practices (Savage-McGlynn, 2012). To this end, participants were segregated by age and their

182 raw performance scores were transformed into z-scores such that their performance was

183 standardized with respect to other children their age.

184 *Explanatory Variables*

185   Participants' electronic gaming was assessed through a series of questions asking about

186 the games they frequently played. Participants were requested to provide the names of up to three

187 games they played as well as an estimate of the amount of time they spend playing each. A total

188 of 446 (24.1%) participants named a single game, 485 (26.3%) participants named two games,

189 and 916 (49.6%) named three games. The titles of named games were content coded to mark if

190 they belonged to one of the three game categories of interest: action games (e.g. Call of Duty,

191 Halo), multiplayer online games (e.g. Maple Story, World of Warcraft), or strategy games (e.g.

192 SimCity, StarCraft).

193   *Game Preference*. Preference scores were created for each participant using the game

194 names provided through self-report. If one or more of a participant's named games belonged to

195 the action, online, or strategy types, they were marked as expressing a preference for this kind of

196 game (coded 1); if not, they were counted as not having a preference for this game type (coded

197 0). This meant three preference scores, one for each game type, were computed for each

198 participant.

199   *Regular Play*. Data from game preference scores and participants' self-reported play

200 behavior were used to determine if participants were regular players of specific game types.

201 Scores were created for participants by combing information about the kinds of games they

okgo

202 expressed preferences for and their self-reported amounts of weekly play. Amounts of weekly

203 play were computed summing participant estimates of weekday engagement, multiplied by five,

204 and estimates of weekend day engagement multiplied by two. Codes for game types were then

205 used to create one game engagement score for each type of game. In line with the approach

206 prescribed in previous research (Green & Bavelier, 2006), participants were considered regular

207 active players of a game type if they invested five or more hours in a given game type in a week

208 (coded 1), and were coded 0 if they did not spend any time playing this game type in a typical

209 week. Table 1 presents summary statistics for participant game preferences and proportions of

210 active players of each game type.

Results

212 *Preliminary Analyses*

213   Zero-order bivariate correlations between observed variables are presented in Table 2.

214 Because 36 correlations were conducted, we adjusted our *p* value threshold for rejecting the null

215 hypothesis from 0.05 to 0.0014 (Holm, 1979). Analyses indicated that older participants were

216 more likely to report higher levels of engagement with games as compared to younger ones (rs =

217 .130 to .278). Similarly, female participants were less likely to engage action and strategy games

218 (rs = -.128 to -.217). Gender was not significantly related to online game play nor was it related

219 to age-adjusted reasoning ability (all *p*s > 0.0014). Because gender was not associated with our

220 target outcome, which was centered on age, neither age nor gender were considered as covariates

221 in hypothesis testing.

222 *Game Preference and Reasoning Ability*

223   In line with meta-analytic evidence a series of one-sided Bayesian independent samples t-

224 tests were used to quantify evidence for the game-enhancement hypothesis (Rouder et al., 2012;

225   Powers et al., 2013; Morey, Romeijn & Rouder, 2016), that specified preference for action,

226   online, and strategy games would be related to more deductive reasoning ability. Table 3

227   presents a summary of these results and observed means using a Cauchy prior of 0.24, effect size

228   for quasi-experiments on measures of reasoning and intelligence, and a second prior effect size

229   for the enhancement hypothesis as reported in top-tier journals (Cohen's d of 0.85; Powers et al.,

230   2013). Results provided very strong support for the null hypothesis over the alternative for action

231   games ($BF_{10} = 0.06$; $M_0 = 0.02$, $SD_0 = 1.00$, $M_1 = -0.12$, $SD_1 = 0.97$) and equivocal support for

232   alternative hypothesis for those who preferred strategy games ($BF_{10} = 1.45$; $M_0 = -0.02$, $SD_0 =$

233   1.02, $M_1 = 0.08$, $SD_1 = 0.93$), or online multiplayer games ($BF_{10} = 2.815$; $M_0 = -0.05$, $SD_0 = 1.04$,

234   $M_1 = 0.05$, $SD_1 = 0.95$). In examining the robustness of these Bayes factors it is clear that

235   evidence for effects larger than the average in the literature are also not supported. Results

236   derived using the larger effect sizes reported in top-tier journals for the enhancement effect, $d =$

237   0.85, appeared less likely as evidence was 1.25 and 57.01 times more likely to have been

238   observed under the null hypothesis than under the gaming-enhancement hypothesis (see Table

239   3). Figure 1, panels A, B, and C, present relative evidence for the gaming-enhancement

240   hypothesis for effect sizes ranging from a 0.0 to 1.5. Taken together with the focused hypothesis

241   tests, these results indicated participants' preferences for these specific types of games were not

242   reliably linked to their deductive reasoning ability in these data.

243   *Regular Game Play and Reasoning Ability*

244   To examine the relations between regular action, strategy, or online game play and

245   reasoning ability, three additional Bayesian hypothesis tests were conducted following the

246   procedure used for game preferences. These models evaluated the relative evidence for the null

247   hypothesis as well as the gaming-enhancement hypothesis that postulates that playing these

248   games for more than five hours each week would be associated with players' reasoning abilities.

249   Results provided moderate support for the null over the alternative hypothesis for action games

250   ($BF_{10} = 0.12$; $M_0 = 0.02$, $SD_0 = 1.00$, $M_1 = -0.07$, $SD_1 = 0.99$), equivocal evidence for strategy

251   games ($BF_{10} = 1.120$; $M_0 = -0.023$, $SD_0 = 1.02$, $M_1 = 0.08$, $SD_1 = 0.90$), and equivocal to

252   moderate evidence for the null over the alternative hypothesis for multiplayer online games

253   ($BF_{10} = 0.34$; $M_0 = -0.04$, $SD_0 = 1.04$, $M_1 = 0.01$, $SD_1 = 0.97$). Robustness checks using effect

254   size for the gaming enhancement hypothesis as reported in top-tier journals ($d = 0.85$; Powers et

255   al., 2013) indicated evidence against the this hypothesis. Data were between 2.45 and 29.15

256   times more likely to be observed under the null hypothesis. Figure 1, panels D, E, and F, present

257   relative evidence for the gaming enhancement hypothesis for effect sizes ranging from of 0.0 to

258   1.5. Taken together with the previous results, these findings suggest it is unlikely that regular

259   active play of these games is systematically related to higher levels of general reasoning abilities.

260   **Discussion**
261
262   *Overview*

263   The promise that electronic games might positively influence human cognition is one that

264   generates intense public, corporate, and scientific interest. The present research drew on a large

265   sample of school-aged children and considered both their electronic gaming and cognitive

266   performance to test of the gaming-enhancement hypothesis. Of central interest was the nature of

267   the potential relations between children's self-reported preferences and gaming habits, and

268   performance on a widely used test of deductive reasoning ability. Contrary to our expectations,

269   the results did not provide substantial evidence in support of the hypothesis that the complex and

270   interactive experiences provided by commercially available games generalize to functioning

271   outside of gaming contexts. In most cases, the evidence was in favor of the null hypothesis over

272   this account.

273   We hypothesized that those who express preferences for action, strategy, and multiplayer

274   online games, modes of play would show modestly higher levels of cognitive performance as

275   seen in previous smaller-scale studies (Basak et al., 2011). In contrast to what was expected, we

276   found equivocal to very strong evidence favoring the null hypothesis over this prediction.

277   Second, we hypothesized that regular engagement with games – playing five or more hours a

278   week of action, strategy, and multiplayer online games – would be linked with better reasoning

279   ability. Results from our analyses did not support this prediction. Evidence for regular strategy

280   game players were equivocal, but ranged from moderately to strongly in favor of the null for

281   these types of games. Taken together, our findings disconfirmed the gaming-enhancement

282   hypothesis, especially in terms of the larger effects reported in top-tier journals.

283   Our approach carries a number of strengths that should inform future studies of gaming

284   effects. First, evidence from this study relied on data provided by more than 1,800 young people,

285   a sample over 50 times larger than the average for studies examining gaming and cognition

286   (Powers et al., 2013). If research is to sort out the cognitive dynamics of play, larger and more

287   robust sampling is needed. Second, the Bayesian hypothesis testing approach we adopted used

288   open source software (JASP; Love et al., 2016), and allowed our study to quantify evidence for

289   the both the null hypothesis as well as a plausible alternative based on the existing literature.

290   Although the analysis plan for this study was not registered before the data were known, the

291   framework provides valuable empirical data that researchers can use as the basis, or prior, to

292   inform their own pre-registered designs. Finally, if indeed scholars are increasingly skeptical of

293   corporate attempts to sell games based on their purported upsides (e.g. Allaire et al., 2014), this

294   vigor should be extended to all scientific inquiry in this area, for example by making the

295   materials, data, source and analysis code openly available. Future research making both positive

296   and negative claims regarding the effects of gaming on young people should do likewise.

297   *Limitations and Future Directions*

298   The present study presents a number of limitations that suggest promising avenues for

299   future work. First, because the data under study were cross-sectional they capture an easy to

300   interpret pattern of results that represent a snapshot in time. The data structure did so at the

301   expense of being able to draw causal inferences, and a complementary approach would examine

302   long-term salutary effects on cognition, ideally as a function of experimental manipulations of

303   game exposure. Second, data regarding participants' game preferences and regular play were

304   collected through self-report. Research indicates that some participants, and young people in

305   particular, provide exaggerated data when it comes to taboo activities such as sexual habits and

306   drug use (Robinson-Cimpian, 2014). It is possible that the average levels of engagement reported

307   by our participants disguised interesting patterns of engagement which merit inquiry. For

308   example, infrequent periods of high engagement (e.g. binge-playing), might have its own special

309   relations with reasoning abilities. If so, an experience-sampling based approach would be needed

310   to assess both between- and within-person variability with respect to the relation between

311   gaming and reasoning ability. Finally, the present study only used a single assessment of general

312   cognitive abilities, the Ravens Progressive Matrices task (Raven, 2000). There are many other

313   facets to intelligence and executive control that might be more sensitive to influence by regular

314   electronic gaming. Measures of naïve reasoning (Masson, Bub & Lalonde, 2011), short and long-

315   term memory (Melby-Lervåg & Hulme, 2013), audio processing (Liu & Holt, 2011) might be

316   more liable to be influenced by gaming. If the gaming-enhancement hypothesis is not broadly

317   accurate, it may find empirical support under conditions where these alternative aspects of

318   intelligence and reasoning abilities are under study.

319   *Closing Remarks*

320   The promise that popular games can enhance cognitive skills is an alluring one. Our

321   findings suggest there is no relation between interest in, or regular play of, electronic games and

322   general reasoning ability. As such, we advise that future research examining the potential

323   influences of gaming contexts on players should pre-register their analysis plans or follow the

324   registered reports process (e.g., Chambers, 2013; Elson, Przybylski & Krämer, 2015). Such steps

325   would go a long way to reduce researcher degrees of freedom which might, along with

326   publication bias, affect conclusions drawn about the effects of gaming and cognitive

327   enhancement (Feynman, 1974; Gelman & Loken, 2013; Nissen et al., 2016). While the research

328   presented here might be further informed by additional work conducted to these standards, our

329   findings above offer an early exploration of the gaming-enhancement hypothesis which is well-

330   powered and guided by open-science.

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484

485   Table 1
486   *Participant Game Preferences and Engagement*

	Game Preference			Regular Play		
	Action	Strategy	Online	Action	Strategy	Online
Males	21.7%	25.1%	45.1%	13.0%	17.2%	33.7%
Females	2.3%	11.4%	52.8%	1.9%	7.4%	41.8%
Total	17.2%	21.9%	47.2%	10.4%	14.9%	34.1%

487

488 Table 2
489 *Observed Zero-Order Correlations*
490

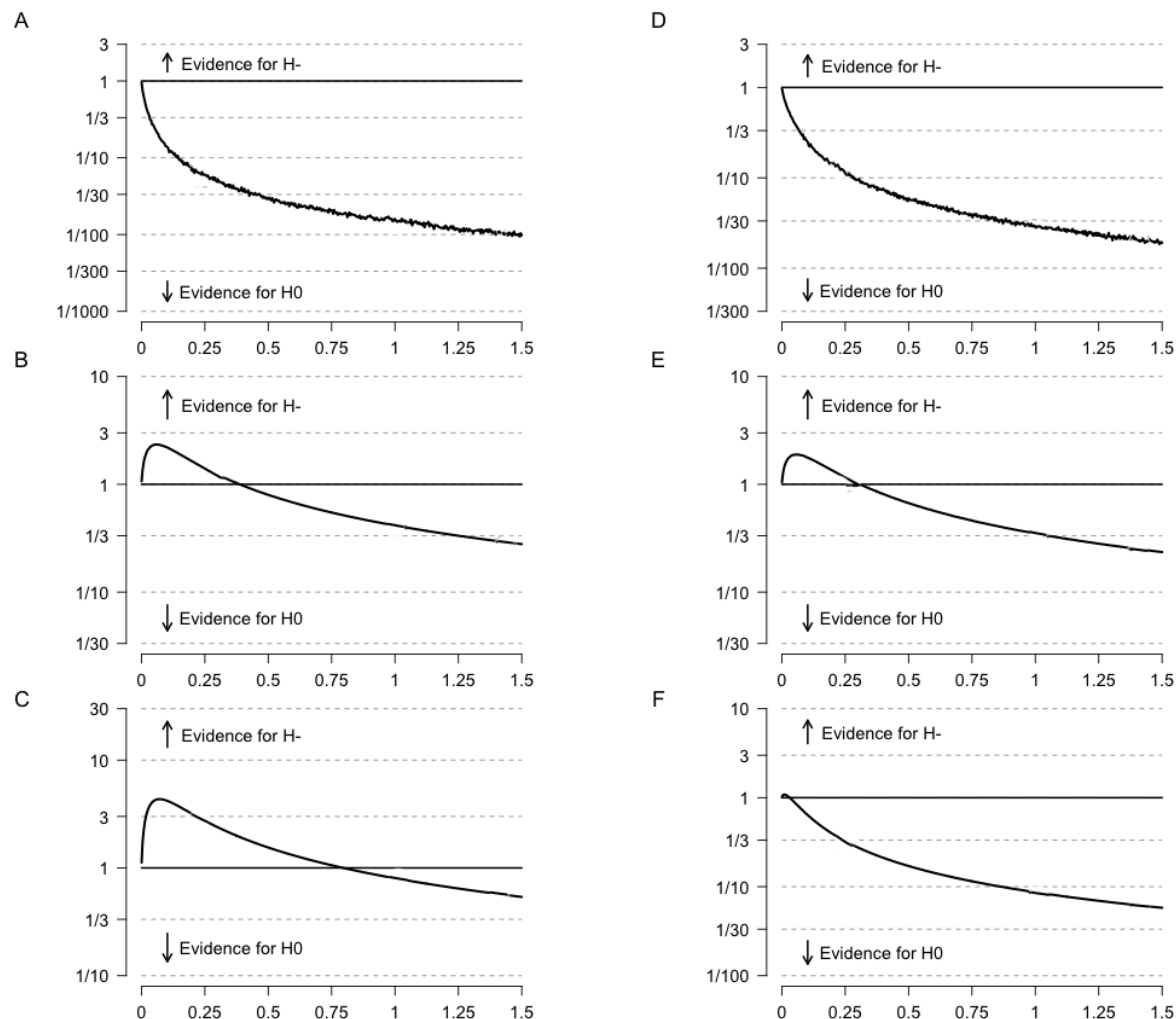
		2.	3.	4.	5.	6.	7.	8.	9.
1. Age	Pearson's r	-0.070	0.132*	0.175*	0.130*	0.125*	0.215*	0.198*	-0.000
2. Female	Pearson's r	—	-0.217*	-0.140*	0.062	-0.167*	-0.126*	0.040	-0.029
3. Action Game Preference	Pearson's r		—	0.078*	-0.123*	0.943*	0.067	-0.111*	-0.053
4. Strategy Game Preference	Pearson's r			—	-0.061	0.052	0.959*	-0.060	0.041
5. Online Game Preference	Pearson's r				—	-0.093*	-0.046	0.946*	0.051
6. Regular Action Game Play	Pearson's r					—	0.090*	-0.055	-0.028
7. Regular Strategy Game Play	Pearson's r						—	-0.019	0.038
8. Regular Online Game Play	Pearson's r							—	0.020
9. Deductive Reasoning Ability	Pearson's r								—

491
492 Note. *Denotes p value below Bonferroni-Holm adjusted value of 0.0014.

493   Table 3.
494   *Evidence from Bayesian Hypothesis Testing*
495

	Participants who did not express preference or play game type			Participants who did express preference or play game type			Average Enhancement Effect[1]		Enhancement Effect in Top Tier Journals[2]	
	Count	Mean	SD	Count	Mean	SD	BF_{01}	BF_{10}	BF_{01}	BF_{10}
Action Game Preference	1530	0.02	1.00	317	-0.12	0.97	16.38	0.06	57.01	0.02
Strategy Game Preference	1442	-0.02	1.02	405	0.08	0.93	0.69	1.45	2.06	0.48
Online Game Preference	975	-0.05	1.04	872	0.05	0.95	0.36	2.82	1.07	0.94
Regular Action Game Play	1551	0.02	1.00	192	-0.07	0.99	8.61	0.12	29.15	0.03
Regular Strategy Game Play	1462	-0.02	1.02	276	0.08	0.90	0.84	1.20	2.45	0.41
Regular Online Game Play	1019	-0.04	1.02	630	0.01	0.97	2.97	0.03	9.84	0.10

496
497   Note. BF_{01} denotes evidence favoring the Null hypothesis. BF_{10} denotes evidence favoring the alternative
498   hypothesis. 1. Average effect size for quasi-experiments on measures of reasoning and intelligence ($d = 0.24$;
499   Powers et al., 2013). 2. Average effect size for quasi-experiments on measures of general cognitive abilities
500   published in top-tier journals ($d = 0.85$; Powers et al., 2013).

501   Figure 1.
502   *Bayes factors for the comparison of electronic gaming to reasoning*
503   *ability as a function of the scale parameter of the Cauchy prior for effect*
504   *sizes ranging from 0.0 to 1.5 under the alternative hypothesis.*

505
506
507   Note. Equal variances are assumed. Panels A through C represent game
508   preference, and D through F represent regular game play. A. Action
509   games. B. Strategy games. C. Online games. D. Action games. Strategy
510   games. F. Online Games.