

An examination of imagery ability and imagery use in skilled golfers

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Abstract

Objectives: The use of imagery to improve golf performance is well established and recognised as a key psychological technique in developing and maintaining excellence. However, the relationship between a golfer's imagery ability and their imagery use is still poorly understood. The current study examined differences in participants vividness of movement imagery and imagery use and the extent their vividness of movement imagery predicted functions of imagery use.

Methods: One hundred and one male skilled golfers ($M_{age} = 27.80$, $SD = 11.03$) with CONGU recognised handicaps ranging from plus 4 to 5 ($M_{handicap} = 1.32$, $SD = 2.74$) completed both the Vividness of Movement Imagery Questionnaire-2 (Roberts et al. 2008) and Sports Imagery Questionnaire (Hall et al. 1998).

Results: The results demonstrated no significant differences between Internal and External visual imagery, however, Kinaesthetic imagery scores were significantly higher than External visual imagery scores. Significant differences in imagery use were recorded with participants reporting higher Cognitive specific imagery use scores compared to other functions of imagery use. Regression analyses indicted that golf handicap accounted for 12% in the variance of Cognitive specific imagery use with an additional 12% accounted for by Internal visual imagery and 7% Kinaesthetic imagery. For Cognitive general imagery use golf handicap accounted for 4% of the variance with Internal visual imagery adding a further 5% to the model.

Conclusion: Our findings highlight that vividness of movement imagery; specifically, Internal and Kinaesthetic imagery ability are significant predictors of skilled golfers Cognitive specific and Cognitive general imagery use.

24 **Keywords:** imagery, ability, use, skilled, golfers

25 **Introduction**

26 *I never hit a shot, even in practice, without having a very sharp, in-focus picture of it in my head. It's like*
27 *a color movie.* (Jack Nicklaus, 1974 p.79)

28 The above description from golf's greatest major winner highlights the importance
29 Jack Nicklaus placed on the systematic use of specific clear and controlled visual images
30 prior to executing a golf shot. Considerable empirical evidence now supports utilising
31 volitional symbolic sensory experiences (Hardy & Jones, 1994) as an effective psychological
32 technique to enhance aspects of golf performance (e.g., McCaffrey & Orlick, 1989; Bernier
33 & Fournier, 2010; Marshall & Wright, 2016). More specifically, research has established that
34 putting (e.g., Woolfolk, Parish, & Murphy, 1985; Thomas & Fogarty, 1997; Marshall &
35 Wright, 2016), pitch shots (Brouziyne & Molinaro, 2005), full swing shots (Swainston et al.,
36 2012), and bunker shot performance (Smith, Wright, & Cantwell, 2008) improve when
37 imagery is the covert rehearsal technique of choice. Indeed, the aforementioned evidence
38 supports why top touring professionals report using imagery as a key mental factor in
39 developing and maintaining excellence (Mccaffrey & Orlick, 1989).

40 One facet of mental imagery research that has garnered considerable interest is what
41 purpose imagery serves. The accurate mapping of function (i.e., purpose of the image) to
42 outcome (i.e., images primary effect) has been specified an important determinant in how
43 imagery successfully contributes to an athlete's target behaviours (e.g., Martin, Moritz, &
44 Hall, 1999; Smith et al., 2008). Pavio's (1985) analytic framework suggests that imagery can
45 serve both cognitive and motivational functions at either a specific or general level. Building
46 on Pavio's model Hall and colleagues (1998) developed the Sport Imagery Questionnaire
47 (SIQ) to measure the frequency athletes adopt five functions of imagery use. These include,

48 cognitive general (CG) imagery which relates to images of strategies and game scenarios.
49 Cognitive specific (CS) images are used when athletes are imaging the unfolding of a specific
50 movement sequence. When athletes imagine goals and outcomes they would like to achieve,
51 they are adopting motivational specific (MS) images. Motivational general-arousal (MG-A)
52 images enable athletes to simulate the emotions and arousal levels experienced during
53 competition and practice. Whereas, motivational-general mastery (MG-M) imagery is used to
54 rehearse one's ability to triumph during challenging circumstances. Although there has been
55 debate regarding the extent the SIQ can account for whether athletes use the same image for
56 various reasons (Cumming & Williams, 2013; Fournier, Deremaux, & Bernier, 2008;
57 Murphy, Nordin, & Cumming, 2008), it continues to be successfully applied across a number
58 of sports (e.g., Simpson, Munroe-Chandler, & Paradis, 2020) and has been adapted to
59 investigate specific athletic populations (see Gregg & Hall, 2005; Parker & Lovell, 2009;
60 Simonsmeier & Buecker, 2017).

61 Specific to golf, Gregg and Hall (2006) identified that golfers frequently employ MG-
62 M imagery followed by CS and CG imagery, but were less likely to use MG-A and MS
63 images. Bernier and Fournier (2010), adopting an interview-based investigation, examined
64 the functional and characteristic aspects of imagery use in a sample of expert golfers (i.e.,
65 amateur golfers with handicaps between -2 and 6). Their results highlighted that expert
66 golfers used imagery to “learn the perfect technique, prepare strategic and tactical aspects of
67 their game, manage psychological states, and evaluate shot making capabilities”.
68 Furthermore, Gregg and Hall reported that some golfers experienced changes in the vividness
69 of mental images due to shot difficulty and their current level of confidence. Bernier and
70 Fournier's study also reported that golfers preferred adopting an internal visual imagery
71 perspective (i.e., seeing the image through one's own eyes) compared to an external visual

72 imagery perspective (i.e., seeing the image as if watching a video recording of oneself).
73 Indeed, both these investigations highlight that golfers adopt imagery to serve a variety of
74 functions facilitated by a capability to image using different perspectives with imagery
75 vividness variable dependent on specific conditions, thus leading some researchers to contend
76 imagery ability (an individual's capability to create and control vivid images) should be
77 conceptualised as a constellation of skills rather than a fixed trait (Marshall & Wright, 2016).
78 While the effectiveness of imagery is influenced by the image's vividness (i.e., clarity and
79 sharpness of the image) (see Baddeley & Andrade, 2000).

80 There is growing support that a positive relationship exists between imagery ability
81 and imagery use (see Slimani, Chamari, Boudhiba & Chéour (2016). For example, Gregg,
82 Hall, and Nederhof (2005) reported that track athletes with higher visual and kinaesthetic
83 imagery ability recorded increased CS imagery use. In a similar, yet extended investigation,
84 Gregg and colleagues (2011) using hierarchical regression found that visual, kinaesthetic, and
85 motivational imagery ability significantly predicted all five functions of imagery use.
86 Simonsmeier and Buecker (2017) investigating the interrelationship between imagery use,
87 imagery ability, and gymnastic performance in sample of gymnasts between 7 and 16 years
88 found a small to medium positive association between the subscales of the measures used to
89 record participants imagery use and imagery ability. These aforementioned studies contribute
90 to an emerging consensus that imagery is more effective for athletes who possess better
91 imagery ability skills (Nordin & Cumming, 2008), and why imagery ability is considered by
92 scholars to be an important characteristic that contributes to the effectiveness of imagery
93 interventions (e.g., Collet, Guillot, Lebon, MacIntyre, & Moran, 2011; Cumming &
94 Williams, 2013; Martin, Moritz, & Hall, 1999).

95 The relationship between imagery ability and imagery use has been measured using
96 the Movement Imagery Questionnaire (Hall, Pongrac, & Buckloz, 1985) and Movement
97 Imagery Questionnaire-Revised (Hall & Martin, 1997). Typically, these assessment tools
98 present participants with the description of a variety of movements followed by instructions
99 to physically perform the movement. In turn each movement is then imaged adopting visual
100 and kinaesthetic imagery with participants rating themselves on a Likert scale relative to the
101 difficulty by which they experience seeing and feeling the image. More recently Simonsmeier
102 and Buecker (2016) adopted Williams and Cumming's (2011) Sport Imagery Ability
103 Questionnaire which consists of five imagery ability subscales (i.e., skill, strategy, goal,
104 affect and mastery). Participants are asked to rate themselves on a 7-point Likert scale
105 relative to the ease by which they can image specific sporting scenarios. One draw back to
106 the above measures are that they fail to distinguish between which visual imagery
107 perspectives participants are imaging from. This appears to be an important omission as
108 internal and external visual perspectives have been shown to aid skill acquisition in different
109 ways relative to the type of task being performed (see White & Hardy, 1998).

110 An imagery ability measure that delineates between different visual imagery
111 perspectives is the Vividness of Movement Imagery Questionnaire-2 (Roberts, Callow,
112 Hardy, Markland, & Bringer, 2008). Although, similar to the MIQ and MIQ-R in that both
113 visual and kinaesthetic modalities are measured, the VMIQ-2 provides the additional
114 assessment of visual imagery perspectives which are deemed to be a key consideration in
115 imagery ability research (Callow & Roberts, 2010). For example, White and Hardy (1995)
116 demonstrated that improvements in the speed of task performance were related to an internal
117 visual perspective while enhanced movement precision associated with an external visual
118 perspective. More recently Dana and Gozalzadeh (2017) reported improvements in tennis

119 serve performance in participants adopting an internal visual imagery perspective. Adding
120 additional support to previous empirical evidence that stipulates closed skills may benefit
121 more from an internal visual imagery perspective (McLean & Richardson, 1994), with
122 external imagery adopted more frequently by participants performing open skills (Spittle &
123 Morris, 1999a, 2001). Furthermore, empirical investigations have presented a case for
124 integrating the kinaesthetic imagery modality (imagery that recreates the feel and forces of
125 moments) with either of the visual imagery perspectives. For example, Callow and colleagues
126 (2017) using a driving simulator task reported beneficial performance effects for participants
127 combining internal visual imagery with kinaesthetic imagery over those adopting internal
128 visual imagery. In consideration of Bernier and Fournier's (2010) observation that elite
129 golfers experience variations in the vividness of their images and report a preference for
130 using an internal perspective, it appears beneficial to employ the VMIQ-2 as it is an
131 introspective self-report measure that can provide additional quantification of these imagery
132 ability characteristics and the relationship they have with imagery use, which to date has
133 received sparse empirical attention particularly amongst golfers. Furthermore, although the
134 Movement Imagery Questionnaire-3 (see Williams et al., 2012) was also validated to
135 separately assesses external and internal imagery perspectives, it does so without specifically
136 measuring an images vividness. Of which has proven to be a reliable individual difference
137 that can distinguish between vivid and nonvivid imagers based on self-report responses as
138 well as accompanied by distinct variations in neural activation (see Marks & Isaac).

139 To this end our study sought to examine the differences in skilled golfers VMIQ-2
140 and SIQ scores and the extent participants vividness of movement imagery predicted
141 functions of imagery use. Similar to previous literature (e.g., Gregg, Hall, & Nederhof, 2005)
142 we hypothesised movement imagery ability would be strongly associated with CS and CG

143 imagery use due to the activities these functions ordinarily serve, but with the additional
144 opportunity to record the unique contribution made by both internal and external visual
145 imagery perspectives. Finally, based on the findings of Bernier and Fournier (2010) and
146 Callow and colleagues (2017) we predicted that internal visual imagery would be the
147 strongest predictor of these two functions followed by kinaesthetic imagery.

148 **Method**

149 *Participants*

150 A total of 101 male skilled golfers ($M_{\text{age}} = 27.80$, $SD = 11.03$) volunteered to
151 participate in the current study. Their ages ranged from 18 to 53 years and had participated in
152 golf for ($M_{\text{years}} = 14.19$, $SD = 8.91$). All participants had a recognized handicap from The
153 Council of National Golf Unions (CONGU) ranging from plus 4 (four below 0) to 5 ($M =$
154 1.32 , $SD = 2.74$). The investigation adhered to the British Psychological Society's guidelines
155 and had received institutional ethical approval. Participants were presented with an
156 information sheet outlining the purpose of the study after which written consent was provided
157 in the knowledge that as a participant they could withdraw from the study at any time.

158 *Measures*

159 *Vividness of Movement Imagery Questionnaire-2 (VMIQ-2; Roberts et al. 2008)*. The
160 VMIQ-2 uses twelve movements (e.g., running upstairs, riding a bike) to measure the
161 vividness aspect of imagery ability for internal visual imagery (IVI), external visual imagery
162 (EVI), and kinaesthetic imagery (KI). Participants are instructed to rate the vividness of their
163 images on a 5-point Likert scale ranging from 1 (perfectly clear and vivid as normal vision)
164 to 5 (no image at all, you only know that you are thinking of the skill). Roberts et al. (2008)
165 have documented that the VMIQ-2 possesses strong factorial credentials alongside good

166 construct and concurrent validity scores. The reliability analysis for IVI, EVI imagery, and KI
167 subscales has recorded Cronbach alpha scores of .95, .95, and .93 respectively (Roberts et al.,
168 2008).

169 *Sports Imagery Questionnaire (SIQ: Hall et al. 1998)*. The SIQ assesses cognitive and
170 motivational functions of imagery use: CS (“*When imaging a particular skill, I consistently*
171 *perform it perfectly in my mind*”); CG (“*I make up new plans/strategies in my head*”); MS (“*I*
172 *imagine other athletes congratulating me on a good performance*”); MG-A (“*I imagine the*
173 *emotions I feel while doing my sport*”) and MG-M (“*I imagine giving 100%*”). For the
174 purposes of this investigation we adopted Gregg and Hall’s (2006) version of the SIQ where
175 the wording of items was modified to make the measure more specific to golf (e.g., CG: “*I*
176 *image each section of a game*” (e.g., par 5’s, front nine)). The SIQ-golf consists of thirty
177 questions with between 5-7 items that are added together to record the frequency of each
178 imagery function. Items are anchored on a seven-point Likert scale with 1 representing
179 (*rarely use that function of imagery use*) and 7 (*often use that function of imagery*). The SIQ-
180 golf has satisfactory internal reliability scores with alpha coefficients that range from .77 to
181 .88 (Gregg & Hall, 2006).

182 *Procedure*

183 Following ethical approval, participants were approached at their local golf course
184 after completing a round of golf and presented with an information letter that explained the
185 purpose of the investigation. For those who agreed to take part a consent form was
186 completed, followed by the two imagery measures; VMIQ-2 and SIQ. To reduce order effects
187 the questionnaires were counterbalanced across the sample. Participants were asked to
188 provide their current CONGU handicap as this was deemed to give the most precise and

189 current indication of skill level. Prior to the imagery questionnaires being completed
190 participants were provided with a definition of what imagery is, which imagery modalities
191 were under consideration (i.e., visual, kinaesthetic), and that images needed to be of the self.
192 In addition, examples were provided to contextualize the two imagery perspectives under
193 investigation. There was no specified time limit to complete the questionnaires.

194 *Data Analysis*

195 Data Analysis was conducted upon all SIQ and VMIQ-2 subscales using SPSS
196 (version 26; SPSS inc., Chicago, IL, USA). We conducted Little's Missing at Random
197 (MCAR) test and no missing values were reported. Standardized scores for skewness and
198 kurtosis were calculated with z-scores highlighting four of the eight subscales violated
199 normality (Ghasemi & Zahediasl, 2012). Based on evidence that parametric tests are robust
200 against non-normal distributions (Carroll, 2017), we decided to use the original scores.
201 Estimates of internal reliability (Cronbach's α) for all variables exceeded Nunnally and
202 Bernstein's (1994) recommendation of $\alpha > .70$ (see Table 1). Mean and standard deviations
203 for each subscale across the sample were calculated (see Table 1). Two one-way repeated
204 measures ANOVA's with post-hoc analyses were performed to examine differences between
205 the subscales of the SIQ and VMIQ-2. A Pearson bivariate correlation across all variables
206 was conducted followed by five bivariate hierarchical regressions to determine the extent
207 vividness of movement imagery predicted imagery function.

208 **Results**

209 *Main Analysis*

210 To examine differences in participants VMIQ-2 and SIQ scores we conducted two
 211 repeated measures ANOVA's. For the VMIQ-2 Mauchly's Test reported the assumption of
 212 sphericity had been violated ($\chi^{(2)} = 22.08, p < .05$), consequently we adopted Greenhouse-
 213 Geisser estimates of sphericity ($\epsilon = .83$) to correct the degrees of freedom. The results
 214 demonstrated there was a significant difference in vividness of movement imagery scores F
 215 (1.70, 166.7) = 13.03, $p < .001, \eta^2 = .12$, power = .99. Interpretation of Bonferroni post-hoc
 216 pairwise comparisons demonstrated participants had recorded higher KI vividness scores than
 217 EVI scores. There were no significant differences between the IVI and KI subscales. For
 218 differences in SIQ scores the assumption of sphericity was also violated ($X^{(9)} = 37.90, p <$
 219 $.05$) resulting in adopting Greenhouse-Geisser estimates of sphericity ($\epsilon = .83$) to correct the
 220 degrees of freedom. The results recorded a significant difference in imagery use F (3.31,
 221 300.7) = 158.74, $p < .001, \eta^2 = .61$, power = 1.00. Post-hoc pairwise comparisons recorded
 222 significantly higher CS scores compared to all other imagery functions. CG imagery was used
 223 significantly more frequently than MS and MG-A imagery use. MG-M was used significantly
 224 more frequently than both MG-A and MS imagery (see Table 1).

225 Table 1: Descriptive statistics for imagery ability and imagery use

Variable	Mean	SD	α
Age	27.80	11.00	
GH	1.30	2.74	
EVI	3.57	0.96	.94
IVI	4.01	0.84	.94
KIN	3.93	0.97	.95
CS	5.52	0.99	.82
CG	5.29	1.11	.72
MS	4.44	1.40	.75
MG-A	4.43	1.17	.70
MG-M	5.22	1.14	.80

Abbreviations: GH = golf handicap, EVI = external visual imagery, IVI = internal visual imagery, KIN: kinaesthetic imagery, CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, MG-M = motivational general-mastery

Note: VMIQ data was recoded so that 5 represents high vividness and 1 no image at all

227 Pearson bivariate correlations were calculated for the VMIQ-2 and SIQ subscales (see Table
228 2)

229 Table 2: Pearson bivariate correlations for golf handicap and imagery variables

Variables	1	2	3	4	5	6	7	8	9
1. GH	1.00								
2. EVI	-.22*	1.00							
3. IVI	-.37*	.48**	1.00						
4. KIN	-.33**	.23*	.62**	1.00					
5. CS	-.35**	.21*	.45**	.50**	1.00				
6. CG	-.19	.16	.29**	.23*	.63**	1.00			
7. MS	-.05	.06	-.01	.03	.22*	.39**	1.00		
8. MG-A	-.22*	.17	.07	.09	.39**	.47**	.51**	1.00	
9. MG-M	-.11	.12	.16	.18	.66**	.61**	.46**	.52**	1.00

230 *Abbreviations:* GH = golf handicap, IVI = internal visual imagery, EVI = external visual imagery, KIN =
231 kinaesthetic imagery, CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A =
232 motivational general-arousal, MG-M = motivational general-mastery

233

234 Finally, five hierarchical regression analyses were conducted with golf handicap
235 entered into the model first to control for differences in skill level as it has previously been
236 reported to influence self-report scores when using imagery measures. For example, Gregg
237 and Hall (2006) found that golf handicaps, a normative and objective measure of skill level,
238 was a significant predictor of all five functions of imagery use. Based on the results of our
239 repeated measures ANOVA and previous empirical evidence we elected to enter IVI in step
240 2, followed by KI then EVI (see Table 3).

241

242 Table 3: Hierarchical Regression for golf handicap and vividness of movement imagery ability predicting
243 imagery use

Variable		<i>B</i>	<i>SEB</i>	β	<i>R</i> ²	ΔR^2	<i>R</i> ² _{change}
CS	Step 1: GH	-.88	.24	-.35**	.12	.11	.12
	Step 2: KIN	-.28	.06	.44**	.29	.27	.17
	Step 3: IVI	.12	.08	.18	.31	.29	.09
	Step 4: EVI	.01	.06	.02	.31	.28	.05
CG	Step 1: GH	-.48	.25	-.19*	.06	.05	.03
	Step 2: KIN	.11	.06	.19*	.05	.05	.03
	Step 3: IVI	.12	.09	.18	.07	.07	.03
	Step 4: EVI	.03	.07	.04	.06	.06	.01
MS	Step 1: GH	-.13	.26	-.05	.01	-.01	.00
	Step 2: KIN	.02	.07	.03	.03	-.02	.00
	Step 3: IVI	-.05	.09	.09	.01	-.03	.01
	Step 4: EVI	.06	.08	.09	.01	-.03	.00

MG-A	Step 1: GC	-.56	.26	-.22*	.05	.04	.05
	Step 2: KIN	-.01	.07	.02	.05	.03	.00
	Step 3: IVI	-.03	.04	-.05	.05	.02	.00
	Step 4: EVI	.12	.08	.18	.05	.04	.02
MG-M	Step 1: GH	-.28	.26	-.11	.01	.00	.01
	Step 2: KIN	.10	.07	-.16	.04	.02	.02
	Step 3: IVI	.05	.08	.07	.04	.01	.00
	Step 4: EVI	.04	.07	.07	.04	.00	.00

244 *Abbreviations:* GH = golf handicap, IVI = internal visual imagery, EVI = external visual imagery, KIN =
 245 kinaesthetic imagery, CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A =
 246 motivational general-arousal, MG-M = motivational general-mastery

247

248

Discussion

249

The purpose of this study was to investigate differences in skilled golfers' vividness of movement imagery ability and their functions of imagery use and to examine the extent of movement imagery ability predicted functions of imagery use. Previous studies have demonstrated that golfers use all five functions of imagery use (Gregg & Hall, 2006), however, there is a paucity of research concerning the association between vividness of movement imagery ability and imagery function, especially in skilled golfers.

255

The results of our study demonstrated that there were no significant differences between IVI and KI scores, however, participants recorded significantly higher KI scores than EVI scores. These are similar results to a series of studies conducted by Parker and Lovell (2011, 2012) who reported in samples of youth sports performers higher levels of vividness for IVI and KI than their EVI scores. In the current investigation, based on the VMIQ-2's response scales, these golfers present vividness of imagery scores which are broadly clear and reasonably vivid (see Roberts et al. 2008). Regarding imagery use, participants used all five functions of imagery use, however, higher CS scores were recorded than any of the other SIQ's imagery functions. Our result differs to that of Gregg and Hall (2006) who demonstrated that golfers used MG-M imagery more frequently followed by CS.

264

265 These different findings could be a result of the greater range of golfing handicaps (i.e., 0-
266 25+) contained in their sample. Indeed, the mean averages in our sample for both CS and
267 MG-M functions of imagery use are higher than those reported by Gregg and Hall (2006) and
268 could indicate what functions of imagery use golfers in a high skill category are likely to
269 adopt (see Slimani, et al., 2016). Finally, in using CS and CG imagery more frequently than
270 the other functions of imagery use the golfers in our study display a similar imagery use
271 profile as the elite level golfers interviewed in Bernier and Fournier's (2010) investigation
272 who reported using imagery to perfect technique and develop tactical and strategic aspects of
273 their golf games.

274 The first regression model indicated that golf handicap ($R^2 = .12$) significantly
275 accounted for the variance in cognitive specific scores with further independent contributions
276 made by IVI ($R^2 = .12$) followed by KI ($R^2 = .07$). EVI was not a significant predictor in this
277 model. For CG imagery use, golf handicap ($R^2 = .04$) made a significant contribution to the
278 model followed by IVI ($R^2 = .05$). KI and EVI made no additional improvements to the CG
279 model. The final model to reach significance was MG-A with golf handicap ($R^2 = .05$) a
280 significant predictor of this function of imagery use.

281 The results echo previous work that has shown that a golfer's skill level is associated
282 with imagery use (see Gregg & Hall, 2006). Of note, our sample in comparison to Gregg and
283 Hall's (2006) was exclusively composed of participants with golf handicaps from plus 4 (four
284 below 0) to 5, often referred to as category 1 players (see CONGU). These results indicate
285 that within this category sufficient skill level differences existed to significantly predict
286 imagery use. Furthermore, inspection of the standardized beta weights indicated that lower
287 handicaps in our sample resulted in participants reporting a higher frequency of CS, CG, and
288 MG-A imagery use (see table 3). It is apparent this result highlights imagery ability is a

289 cognitive skill where expertise differences can manifest within a narrow range of golf
290 handicaps. Therefore, researchers and practitioners should be mindful that these homogenous
291 categories (e.g., category 1 handicaps) may contain sufficient variation in skilled behaviors to
292 warrant controlling for its effects and consider that a one size fits all regarding imagery
293 interventions is possibly best avoided.

294 As hypothesised IVI was the most significant predictor of CS and CG imagery use.
295 Regarding the CS function this result aligns with investigations that have shown that
296 movement sequences when performed in a stable and predictable environment, with objects
297 acted on by the individual, and executed in a self-paced fashion experience better imagery
298 results when using an internal visual perspective (e.g., Cumming, Nordin, Horton, &
299 Reynolds, 2006). CS imagery usually pertains to imagery that is used for the purposes of skill
300 rehearsal. Previous empirical research has reported skilled golfers use imagery to perfect their
301 technique (Bernier & Fournier, 2010) with a preference for utilising an internal perspective.
302 Similarly, the golfers in our sample are likely using CS imagery to provide information about
303 the sequence and position of their golf swings from a 1st person perspective (i.e., seeing the
304 imaged movements through their own eyes). Although this result can be anticipated based on
305 studies that have reported there are advantages for closed skills when internal imagery is used
306 (Dana & Gozalzadeh, 2017), the contribution of both KI ability and IVI suggests modality
307 and perspective may play a collaborative role in the images these golfers generate when
308 creating CS imagery content. Indeed, Callow and colleagues (2017) propose that the
309 cumulative contribution of these modalities and the internal visual perspective is likely to
310 create images that provide a richer representation. Therefore, practitioners should monitor
311 modality, perspective, and function integration to ensure the best imagery outcome for
312 golfers.

313 The current investigation was not without limitations. As with previous research (e.g.,
314 Gregg & Hall, 2005), our results suggest that the VMIQ-2 does not successfully predict the
315 MS, MG-A, and MG-M functions of imagery use. Therefore, scholars should utilise imagery
316 ability measures that can more widely assess a golfer's imagery ability. For example, Greg
317 and Hall (2006) designed the Motivational Imagery Ability Measure (MIAMS) to measure
318 the ease by which participants experienced generating motivational general images and the
319 subsequent emotion these images create. However, a noteworthy drawback is worth
320 highlighting when employing the MIAMS in that it does not measure MS and cognitive
321 imagery functions of imagery use. An additional candidate is Williams and Cumming's
322 (2011) Sport Imagery Ability Questionnaire (SIAQ) which assesses athletes' skill, strategy,
323 goal, affect, and mastery imagery ability. The SIAQ was designed by adopting similar
324 content found in the SIQ, therefore it is plausible that it will better predict the SIQ's
325 motivational functions than the VMIQ-2. However, the VMIQ-2 provides additional
326 information regarding the vividness aspect of movement imagery ability, two imagery
327 modalities, plus both visual imagery perspectives which have been found to have an
328 independent effect on skilled performance (Callow et al., 2017). Therefore, we encourage
329 practitioners to consider adopting these measures in tandem to achieve the most accurate
330 measurement and means of screening a golfer's imagery ability.

331 In conclusion, the present study demonstrated that skilled golfers IVI and KI ability
332 are significant predictors of CS and CG functions of imagery use. In addition, golf handicap
333 accounted for a significant proportion of the variance in CS, CG, and MG-A imagery use
334 with lower handicaps associated with increased levels of imagery use. Players, coaches, and
335 practitioners should therefore consider the implications of these results based on the
336 following recommendation. Interventions should in the initial stages target creating imagery

337 scripts that develop skilled golfers IVI and KI ability with an orientation towards script
338 content that pertains to cognitive specific and cognitive general imagery use. Indeed, our
339 results highlight that that elite/skilled golfers have more vivid IVI than EVI and that increases
340 in vividness for IVI alongside the contribution made by KI may play an important role in
341 determining the frequency by which skilled golfers deploy CS and CG imagery use.

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