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‘Think Aloud’ as a facilitator of self-regulation in golfers

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20 **‘Think Aloud’ as a facilitator of self-regulation in golfers**

21

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Abstract

23

Think Aloud (TA) has been used as a tool to promote self-regulation and reflection within

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coaches, yet it has not been employed within the same context to support athletes. The aim of

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the present study was to understand golfers’ perceptions of using TA at two time points:

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immediately post performance and after a six-to-eight-week reflection period. Six golfers (5

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males, 1 female; age: $M = 30.8$ years, $SD = 14.8$; handicap: $M = 6.92$, $SD = 3.9$) used TA

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during the performance on six holes of golf and listened back to their TA audio. Using semi-

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structured interviews and subsequent thematic analyses, we generated four themes: increased

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awareness, awareness of how behaviour influences performance, disruption of thought

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processes and performance, and application to coaching. Preliminary evidence provides

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support for TA as a potential tool to promote self-regulation in golfers which could be used to

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inform coaching interventions.

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Keywords: Reflection, perceptions, performance, golf

Introduction

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Learners who self-regulate are defined as “metacognitively, motivationally and behaviourally active participants in their own learning process” (Zimmerman, 1986, p. 308). Self-regulated learners generate their own thoughts, feelings, and actions to attain their learning goals, which in turn, facilitates the problem-solving process and improves effectiveness of learning. Given the demands placed on athletes (e.g., Sarkar & Fletcher, 2014), self-regulation plays an important role in one’s development when striving for goal attainment (Jonker et al., 2011). Zimmerman’s (1986, 2006) self-regulation model includes three cyclical phases. Firstly, the forethought phase concerns how the individual approaches a task and consists of planning and analysis strategies (e.g., goal setting). Secondly, the performance phase occurs during a task and is concerned with the use of self-control strategies (e.g., self-instruction, imagery, attention focusing). Finally, the self-reflection phase occurs after each performance bout and is concerned with deliberate efforts to adapt one’s performance in a systematic manner (e.g., casual attributions). This process of self-evaluation is argued to facilitate causal attributions about one’s success and failures.

Reflection is argued to be a sub-facet of metacognition and can be defined as an individual’s ability to apply previous experiences to improve future performances in a goal-directed manner (Peltier et al., 2006; Zimmerman, 2000). Metacognition is particularly important as it enables one to evaluate their own thinking and can be defined as “the awareness of, and knowledge about one’s own thinking and consists of planning, self-monitoring, evaluation and reflection” (Jonker et al., 2010, p. 902). Zimmerman (2000) posits that learners can direct their reflection to the result (self-judgement) or to an objective (self-reaction). Specifically, self-judgement comprises of sub-processes referred to as self-evaluation and causal attributions (e.g., an athlete’s assessment of their own performance),

60 while self-reaction comprises of sub-processes referred to as self-satisfaction and adaptive
61 inferences (e.g., an athlete's emotional and cognitive response to their attributions).

62 Zimmerman (1986, 2006) began developing his theory in education settings and
63 researchers have applied its principles to sport. Athletes who have developed high levels of
64 self-regulation compare self-observed performance against goal attainment, previous
65 performance of themselves and of others or contribution to performance of the team (i.e.,
66 self-evaluation). They calibrate their causes of success and failure to their self-observed
67 performance (i.e., causal attributions) and feel satisfied or dissatisfied during reflection by
68 their performance (i.e., self-satisfaction). Athletes with high self-regulatory skills also modify
69 their decision making and behaviour accordingly to adopt more proficient learning and self-
70 regulation strategies to improve in the future (i.e., adaptive inferences; Zimmerman, 2000).

71 Despite the importance placed on developing self-regulation in athletes, relatively few
72 studies have considered how athletes can develop their own reflection processes. Clearly and
73 Zimmerman (2001) examined differences in self-regulatory forethought and self-reflection in
74 adolescent basketball players. Findings showed that expert basketball players set more
75 specific goals, displayed higher levels of self-efficacy, made more strategy attributions, and
76 selected more technique-oriented strategies than non-experts and novices. Experts were also
77 better able to relate their success and failure experiences meaningfully by using appropriate
78 strategies to modify future performances (i.e., strategy attributions). More recently, Tan et al.
79 (2016) investigated the effects of a guided reflective diary on elite archery accuracy and the
80 factors facilitating and hindering the usage of a guided reflective diary. Elite archers reported
81 that completing a reflective diary enhanced motivation, helped them forward plan, and
82 enabled them to understand their feelings during shooting. Nevertheless, the process of
83 keeping a reflective diary was also perceived as time consuming and repetitive in nature. It is
84 therefore important to ensure that the methods used to promote self-regulatory skills are

85 efficient and athletes are challenged regularly to limit the negative impacts associated with
86 repetition. Collectively, these findings highlight the importance of self-reflection, the factors
87 that impact reflection efficacy, and ultimately, the processes underpinning the development
88 of self-regulation. Researchers and practitioners should therefore consider the available
89 reflection methods when striving to develop self-regulatory skills within athletes.

90 One method that has been previously used within practitioner (e.g., coaching and nursing)
91 settings to promote reflection is Think Aloud (TA: Ericsson & Simon, 1993; Whitehead et
92 al., 2016a). TA involves an individual verbalising his/her/their thought process continuously
93 as they are performing. Ericsson and Simon (1993) proposed three levels of verbalisations.
94 Level 1 verbalisation is simply the vocalisation of inner speech where the individual does not
95 need to make any effort to communicate his/her/their thoughts. Level 2 verbalisation involves
96 the verbal encoding and vocalisation of an internal representation that is not originally in
97 verbal code. Level 3 verbalisation requires the individual to explain his/her/their thoughts,
98 ideas, hypotheses, or motives.

99 Previous research within the sport psychology literature using TA has predominantly
100 adopted the technique to collect in-event cognition (Kaiseler et al., 2012) and decision-
101 making data (Whitehead & Jackman, 2021). For example, TA has been used to collect data of
102 stress appraisals and coping in trap shooting, golf and tennis (e.g., Calmeiro et al., 2010;
103 Kaiseler et al., 2012; Swettenham et al., 2018), expert-novice differences in planning
104 strategies in golf (e.g., Whitehead et al., 2016b), pacing in endurance sports such as running
105 and cycling (e.g., Whitehead et al., 2018) and decision making and anticipation (e.g.,
106 Whitehead & Jackman, 2021).

107 Despite the appeal of using TA to capture in-event cognitions, it is important to consider
108 the reactivity that TA may elicit within a participant when engaging in the method. Reactivity
109 refers to instances where participants may modify their behaviour as a result of being

110 measured or observed. In the case of TA research, the process of verbalising thoughts
111 throughout the duration of a task may increase positive behaviour or increase negative
112 behaviour (Double & Birney, 2019). Although Fox et al. (2011) found that level 2
113 verbalisations are nonreactive, Double and Birney (2019) highlight this potential issue where
114 participants might attend to internal cognitions in a way that they would not have without
115 thinking aloud. Nevertheless, thinking aloud could facilitate metacognition and possibly
116 reflection during the performance of the task. Within Whitehead et al.'s (2018) study, some
117 cyclists reported becoming more self-aware, and in turn, they felt that it helped their
118 performance. Research is therefore needed to explore whether TA informs the self-regulation
119 cycle.

120 The use of TA has been used as a reflective practice tool in a range of domains. For
121 example, Banning (2008) adopted TA as an educational tool to develop and assess clinical
122 reasoning in undergraduate nursing students. It is proposed that the process of thinking aloud
123 facilitated the nurses to “verbalise their thought processes and rationale for the types of
124 questions that they ask during a history or physical examination and for the diagnostic
125 examination and for the diagnostic hypotheses that they consider” (Lee & Ryan-Wenger,
126 1997, p. 102). Conversely, Whitehead et al. (2016a) asked sports coaches to verbalise their
127 thoughts during their live coaching sessions and partake in reflection by listening back to
128 these verbalisations and by reflecting with their peers. Findings revealed an increased
129 perceived self-awareness in coaching practice and a perceived improvement in
130 communication and pedagogical practice. The evidence appears to suggest that practitioners
131 developed self-regulatory skills and developed a sense of self-awareness of their own
132 knowledge and thinking in relation to their context of practice. The facilitation of the meta-
133 cognitive process (Banning, 2008) may aid self-reflection and discovery of ineffective
134 thought processes.

135 A growing body of literature supports the importance of self-reflection in developing self-
136 regulatory skills (e.g., Zimmerman, 1986; Jonker at al., 2010; Brick et al., 2015). Previous
137 research has predominantly examined how coaches learn to reflect and how coaches stimulate
138 reflection in athletes. Subsequently, there is potential to examine how TA may facilitate the
139 process of self-regulation in golfers. Given the inherent limitations in using retrospective
140 methods to facilitate self-reflection (Bernard et al., 1984), we sought to advance the
141 knowledge base by examining the use of TA as a tool to promote self-regulation. Although
142 TA was originally intended to capture naturalistic thought processes for research purposes, it
143 is important to note that we employed TA to facilitate reflection. Therefore, the aim of the
144 present study was to understand golfers' perceptions of using TA at two time points:
145 immediately post performance and after a six-to-eight-week reflection period.

146 **Method**

147 **Philosophical position**

148 This study was underpinned by a realist ontology and constructivist epistemology.
149 Ontological realism assumes that a reality exists, but that it is independent of the conceptions
150 researchers have of it (Sayer, 2000), while epistemological constructivism posits that
151 knowledge is theory-laden and fallible (Wiltshire, 2018). In accordance with to our
152 philosophical stance, we recognise that knowledge can be refined, revised, or refuted
153 (epistemological constructivism) and that the views reported by participants reflect real
154 properties and events experienced by the participants, independent of the research
155 (ontological realism). We adopted a qualitative approach to understand the subjective
156 behaviours and beliefs of participants in terms of their use of TA as a reflective practice tool
157 (Samdahl, 1999). We believe that our findings can be applied with reference to naturalistic
158 generalisability, where readers may be able to take their own meaning from the findings
159 (Tracy, 2010; Smith, 2018).

160 **Participants**

161 Using personal contacts of the second author, we approached participants via email.
162 The second author had existing rapport with the participants due to her professional
163 involvement at the golf club where the data was collected and participants regularly attended
164 (Smith & Sparkes, 2016). Purposeful sampling was used to capture a broad skill level of
165 golfers (Braun & Clarke, 2013; Sparkes & Smith, 2014). Similar to sample sizes used in
166 previous research that have captured perceptions of TA to facilitate reflection (e.g.,
167 Whitehead et al., 2016a; Swettenham & Whitehead, 2021), participants were six golfers from
168 a golf club in the South of England (5 males, 1 female; age: $M = 30.8$ years, $SD = 14.8$;
169 handicap: $M = 6.92$, $SD = 3.9$). We recruited two high skilled golfers (handicap ≤ 5.4), two
170 intermediate skilled golfers (handicap 5.5 – 12.4) and two low skilled golfers (handicap \geq
171 12.5). Participants had an average of 11.2 ($SD = 4.9$) years competitive playing experience,
172 played at least once per week and had played an average of 12.2 ($SD = 10.5$) competitions in
173 the 12 months prior to participation. All participants identified as white British. Institutional
174 ethical approval and informed consent were obtained prior to participation.

175 **Materials**

176 *TA training video*

177 Participants were instructed on how to TA using a training video developed by Birch
178 and Whitehead (2019). The video consisted of visual and verbal instructions and provided
179 participants with an understanding of how TA works so that participants could competently
180 perform the technique. In line with Ericsson and Simon's (1993) guidelines, example
181 instructions included "think aloud involves you saying out loud everything that you are
182 thinking as you are performing the task." Given that we aimed to examine level 2
183 verbalisation, we used instructions to promote level 2 verbalisation and deterred level 3
184 verbalisation (e.g., "I don't want you to try to plan out what you say or try to explain to me

185 what you are saying”). It is important to note that we instructed participants to refrain from
186 thinking aloud during skill execution to reduce possible interference with motor movement
187 (Schmidt & Wrisberg, 2000). The remainder of the video comprised of three different
188 hypothetical golf scenarios (tee shot, fairway shot, green side shot) that required participants
189 to think aloud their planning strategies. The TA training video was 4:14 minutes in duration
190 (see Birch & Whitehead, 2019).

191 **Procedure**

192 We conducted a pilot study using one intermediate skilled male golfer (handicap of 7,
193 13 years competitive playing experience) who completed the full procedure. The participant
194 was confident that the TA training enabled him to understand how to competently TA and
195 that three practice holes enabled him to apply the technique on the golf course. The
196 participant also stated that the equipment (e.g., microphone) did not hinder his performance.

197 Interviews were conducted as a method to explore participants perspectives,
198 experiences, emotions, and personal meanings of experiences of TA (Smith & Sparkes,
199 2016). Data collection was completed by the second author, who had a high level of golf
200 knowledge and experience. It may be inferred that the quality of information gained from the
201 interviews was enhanced by the researcher’s involvement in data collection. Additionally, the
202 existing rapport between the researcher and participants during the on-course TA may have
203 allowed for more honest and authentic verbalisations from the participant. Finally, the second
204 author was familiar with TA in that they had previously completed traditional TA training
205 (Ericsson & Simon, 1993), golf specific TA training (Birch & Whitehead, 2019), and
206 completed six holes of golf using TA as part of their familiarisation to the procedure adopted.

207 Participants viewed the TA training video using an Apple iPad and Sony MDR
208 ZX660AP headphones. During the training exercises, the researcher ensured the participant
209 was competently thinking aloud in accordance with Ericsson and Simon’s (1993) guidelines.

210 Participants then completed three holes of golf while thinking aloud to apply the learned
211 principles of TA. Feedback was given in instances where the participant deviated from the
212 previously outlined instructions (e.g., ‘you are not required to explain your thoughts while
213 thinking aloud’). Data collection did not take place until the researcher was satisfied with the
214 quality of verbalisation which was classified as when the participant no longer needed
215 prompting to verbalise all their thoughts, the participant’s thoughts were characteristic of
216 level 2 verbalisation, no level 3 was evident (although impossible to fully determine), and the
217 participant did not verbalise their thoughts during shot execution.

218 Participants then individually completed six holes of golf on their home course whilst
219 thinking aloud. The researcher walked behind the participant and there was no
220 communication beyond reinforcing the need to TA (Nicholls & Polman, 2008). If the
221 participant did not verbalise their thoughts for 20 seconds, the researcher would state the
222 phrase “please think aloud.” In an effort to facilitate authentic performance cognitions,
223 participants were told they were competing against each other with the lowest nett score (total
224 shots taken minus handicap) winning a £30 pro shop voucher. Research by Baumeister and
225 Showers (1986) has used similar means to facilitate competitive state emotions and research
226 by Nicholls and Polman (2008) deemed six holes to be sufficient to gather authentic in-
227 performance cognitions in golf. To manage this competitive element, the researcher recorded
228 the participants’ scores on each hole, calculated the participants’ nett scores and updated a
229 leaderboard of the nett scores. To maintain a consistent level of pressure experienced between
230 participants, the researcher did not reveal the participants’ competitors scores until after they
231 had completed the six holes. To ensure confidentiality, names and handicaps of competitors
232 were not shared to the participants when scores were conveyed.

233 *Immediate and follow-up interviews*

234 Immediately following the completion of the six holes of golf, participants completed
235 the immediate interview in the clubhouse. Participants were then sent an audio file with their
236 TA from the six holes of golf and were required to listen to their verbalisations. Follow-up
237 interviews took place at the golf course clubhouse six-to-eight-weeks after the six holes of
238 golf. During this six-to-eight-week period, participants were not instructed to continue to use
239 TA, but were not restricted to do so if they desired. During this period, participants listened to
240 their on-course TA recording and reflected on their experience.

241 To examine participant experiences of using TA and listening back to their audio
242 verbalisations, we conducted semi-structured follow-up interviews. The follow-up interviews
243 were conducted with the aim to increase the richness and depth of data captured by offering a
244 personal insight into participant experiences (Newton & Burgess, 2008). Using Page and
245 Thelwell's (2013) guidelines, an interview guide was developed based on the aims of the
246 study and previous research that has used TA as a reflective tool (e.g., Whitehead et al.,
247 2016a) to help facilitate the gathering of rich, in-depth data (Smith & Sparkes, 2016).
248 Example interview questions for the immediate interview included 'what aspects of TA have
249 been specifically useful/not useful for you?' Example follow-up interview questions included
250 'can you tell me about your experiences of reflecting upon your use of TA?' Probing
251 questions (e.g., can you provide me an example?) were used to glean more in-depth
252 understandings of participant experiences in both interviews. Immediate and follow-up
253 interviews ranged from 11 mins 15 secs to 19 mins 33 secs and 13 mins 48 secs to 20 mins 36
254 secs in duration, respectively.

255 **Data analysis and research credibility**

256 All audio interview files were transcribed verbatim. Interviews ranged from five to
257 eight pages of A4 1.5 spaced text and between 2465 - 3409 words. We conducted a thematic
258 analysis to explore participant perceptions and beliefs regarding TA (Braun & Clarke, 2019).

259 To ensure credibility and trustworthiness a team approach to analysis was employed with the
260 aim of promoting critical reflexivity rather than consensual agreement (Braun & Clarke,
261 2019; Smith & McGannon, 2018). We engaged in a reflective thematic analysis process
262 (Braun & Clarke, 2021) and began by reading all transcripts of interviews (immersion in the
263 data) in Nvivo 10 (step 1). Once complete, we developed a list of codes from the first two sets
264 of interviews. To further emphasise credibility, the initial codes were reviewed as a team and
265 considered (step 2). Collaborative coding is supported by Saldana (2013) as it allows a
266 “dialogic exchange of ideas” (p. 34) that support interrogation and discussion from multiple
267 perspectives. Following this critical review, codes were amended and definitions of codes
268 were established. At this stage, all authors engaged in peer debriefing through formal
269 meetings (Creswell & Miller, 2000) and discussed the aim of the study and how interpreting
270 the data related to both our own biases as researchers and our interpretations of the
271 interviews. One discussion concerned the third author’s biases towards using TA as a self-
272 reflection tool and this discussion enabled the remaining authors to challenge some of these
273 initial codes. At this stage, we generated 25 codes. We agreed that these codes would be
274 condensed into four main themes, however, a discussion on the agreement of these themes
275 included changes of theme names. Specifically, ‘becoming aware of lack of focus’ was
276 changed to ‘increased awareness,’ ‘reinforcing positive behavior’ was changed to ‘awareness
277 of how behavior influences performance,’ and ‘recognizing negative behavior’ was changed
278 to ‘disruption of thought process and performance.’ The theme ‘application to coaching’
279 remained the same. We felt these updated theme names better represented the data and the
280 aims of the study.

281 The codes were then adopted as a starting point to analyse the remaining transcripts.
282 Once all interviews were coded, the second author searched for themes across all codes (step
283 3). Once more, these themes were reviewed by the third author (step 4). In light of the

284 potential limitations of inter-rater reliability, an external and independent researcher acted as
285 a critical friend to ensure data collection and analysis was plausible and defensible (step 5;
286 Smith & McGannon, 2017). This step was continued during the peer review phase. During
287 this stage themes were reviewed and through a team discussion, the main theme names were
288 modified, and sub-themes were identified. Therefore, we developed the results via an
289 iterative process of theme generation. These additional sub-themes provide the reader with
290 more detail and insight into the findings of the interviews conducted. Following this final
291 stage of refining and naming of themes, we generated our findings (step 6) which are
292 presented in the following section.

293 **Results**

294 We present the themes and sub-themes that were generated from the data. An
295 increased awareness of golfer's thought processes relative to their performance was present
296 throughout all interviews. Within this increased awareness emerged many more specific
297 themes, such as being aware of drifting and losing focus and an awareness of overthinking. In
298 addition, participants were able to articulate how they became aware of their thoughts
299 impacting their performance. More specifically, golfers recognised the presence of positive
300 routines and how their emotions or negative reactions may have influenced their
301 performance. Although TA was reported to have positive benefits, we generated a theme
302 relating to the disruptions of thought processes and performance. This theme linked to how
303 some participants found it difficult to verbalise thoughts following less successful shots and
304 how TA disrupted putting performance. Finally, participants reported the potential benefits of
305 TA within a coaching context and recommended specific suggestions for a coach using TA to
306 gain an understanding into a golfers/client thought processes.

307 **Increased awareness**

308 Increased awareness refers to how participants became aware of different elements of
309 their thought processes. Specifically, within this theme, being aware of drifting through the
310 use of TA and being able to prevent this was evident. In addition, participants reported being
311 aware of their overthinking and how TA had helped them to understand their own thought
312 processes.

313 *Drifting*

314 The term drifting refers to when a participant recalled thoughts relating to past
315 experiences, projected thoughts into the future and/or thought about irrelevant cues. The
316 participants in this study reported that they became aware of this drifting and as a result were
317 able to reverse this process. Participant four explains below:

318 When I hit the pitch left, I was pretty pissed off about it, but by the time I had got to
319 the next chip I had verbalised that I was pissed off about it, but I can do a little chip
320 up and putt her in and it will still be a par ... I think it helped me see that something
321 that I do struggle with is how I often drift off and find myself not thinking about shots
322 at all and that's when I can cock up (P4, immediate interview).

323 Again, this idea of not being focused on the present performance was also reported by
324 participant six who explained how he realised that he was not fully focused on his
325 performance. Nevertheless, he recognised this within the interview and explained how he was
326 able to reflect as a result of using TA:

327 This (TA) has actually made me realise that there's a process that I need to go through
328 every time and to keep that focus really. I've realised that I need to work on my
329 concentration and every ball you go to hit you have to approach in the same manner
330 and just try and make sure you get that process of talking through what you're
331 planning on doing and don't get distracted like I do when I'm playing in a

332 competition ... I think that is something that I need to do when I'm playing in a
333 competition, it's worth focusing in on it (P6, follow-up interview).

334 This theme was also evident in participant one, who reported how her mind wandered.

335 Nevertheless, using TA enabled the participant to be more focused on her game:

336 I find that my mind wanders and that is kind of the same with golf. When it is in your
337 sub-conscious your mind wanders and does other things, but when you're having to
338 actually say it out loud your mind is focused on the words you are saying so I can see
339 that would be useful. (P1, immediate interview).

340 *Awareness of overthinking*

341 This theme represents participants experiences of having too many thoughts during
342 performances, which was perceived to have a detrimental impact on performance. Participant
343 one articulated how using TA raised awareness of the number of thoughts present during
344 performance:

345 The most interesting bit (about TA) is that I think I need to improve on the most is the
346 preshot. ... You know I think there's a couple times where I say 'make a full turn' and
347 talking about the backswing. In my own head that means about five things ... There's
348 way too much stuff going on in my head. Rather than doing all the analytical bit, pick
349 the shot and then go right 'commit to hitting the shot' (P1, immediate interview).

350 Participant one reinforced this idea of overthinking in her follow-up interview, where she
351 recognised how TA could help herself understand how much she should be thinking during
352 her performance. In the following quote, participant one is referring to how TA could help
353 understand this: "Sometimes not having too many thoughts can be a good thing, but I think
354 there's a balance to be had and actually knowing where you've got too many thoughts or not
355 enough thoughts could be quite helpful."

356 Participant two echoed the notion of having an optimal number of thoughts in that he
357 reported how he sometimes get into a loop of overthinking. Although participant two did not
358 report any immediate change or improvement in performance, they became aware of the
359 effect or danger of overthinking:

360 I realised (through using TA) the dangers of how sometimes I'm overthinking. I have
361 this tendency to think about my own thinking and it can be a dangerous loop for me to
362 get into. I think that it (TA) highlighted this for me even more (P2, follow-up
363 interview).

364 **Awareness of how behaviour influences performance**

365 This theme refers to how participants not only became aware of their thought
366 processes, but also how being able to articulate their thoughts impacted their performance. A
367 range of sub-themes were identified, namely, following a set thought process, reflecting on
368 emotional instability, and learning from TA.

369 ***Following a set thought process***

370 Participants reported that using TA enabled them to be more aware of some of the
371 more positive processes that they followed. The theme of following a set thought process
372 refers to how some participants became aware of the pre-performance routines or thought
373 processes that they perceived as being positive to their performance. Participant one reported
374 how TA allowed them to illuminate their methodical thought process:

375 It (TA) made me aware of the processes I go through. For example, before the shot I
376 would go through the same thing of; 'ok what's the wind doing?' 'Where's good to go
377 on this hole?' 'Where's a good miss?' 'What kind of shot shape do I want?' 'What
378 club am I hitting?' 'Is it the right club?' Going through it quite methodically definitely
379 helped me see how I'm quite methodical (P1, immediate interview).

380 The perceived benefit of being aware of one's thought processes was also evident in the
381 follow-up interviews:

382 Yes, I think it (TA) reinforced what I think I do; 'what's my yardage?' 'What club am
383 I going to use?' 'Where am I going to aim the shot?' 'Am I going to have to take
384 more club or less club because it's uphill or downhill?' I think it reinforces that I
385 actually do that even though I'm not sure in my normal process that that's a conscious
386 thought but it was quite reassuring that I do go through that process (P1, follow-up
387 interview).

388 Participant four echoed this perceived benefit in that TA reinforced the process or routine that
389 he followed: "So that's the good bit in confirming that I think I've got a fairly good routine
390 and reinforcing that has helped me understand and confirm my own process" (P4, immediate
391 interview).

392 *Reflecting on emotional response*

393 The theme of reflecting on emotional response refers to how using TA enabled
394 participants to identify negative emotions during performance. Participant three explains how
395 listening back to his TA audio file reinforced some of his original thoughts about his
396 behaviour on the course and allowed him to see how he could improve his performance as a
397 result:

398 Listening back to it (TA) was really useful as well. I can learn what makes me angry
399 and ... eliminate that from my game and don't let it bother me too much. Hearing on a
400 scale of how angry I get and I will be able to remember the shot I am sure. So yeah,
401 measuring my temperament and what my limits are (P3, follow-up interview).

402 Furthermore, participant five reflected on how he is hard on himself and he acknowledged
403 how he needed to be more positive and focused on his good performances:

404 Generally, when you're playing on your own or whenever it may be, you do focus on
405 the bad because that's what needs improving ... Being a bit kinder to myself when I
406 do hit a good shot can be really useful and maintain a positive mind-set. That is
407 something that I need to do more as I am very hard on myself as I found throughout
408 the TA (P5, follow-up interview).

409 In his follow-up interview, participant three explained how he felt embarrassed after listening
410 back to his audio file, due to his language and swearing. Nevertheless, he was able to reflect
411 on this and consider how he has become calmer as a result:

412 I used to be quite well contained but it sort of built up and built up and built up so if I
413 ever did have a bad hole it ruined the rest of my game and I'd swear a lot. Whereas
414 now I try and be a lot calmer and when I walk off the green I can go onto the next tee
415 with no worries because I have got it out. So, yeah quite embarrassing (listening back
416 to TA) would be the best way to describe it (P3, follow-up interview).

417 Furthermore, participant four reinforces how he developed awareness of their emotional
418 responses to performance and how they might be able to rationalise this in future
419 performance:

420 As I was speaking aloud it made me more aware of the situation, almost aware of the
421 emotional response I was giving to it. The main thing was making me aware of the
422 current situation rather than losing my head over a shot (P4, immediate interview).

423 **Disruption of thought process and performance**

424 The use of TA itself was reported to cause some disruption to thought processes, and
425 in some participants, to performance. Specifically, it was reported that verbalising
426 unsuccessful shots and performances was sometimes difficult and some participants may
427 employ an avoidance focused coping strategy of ignoring this perceived negative

428 performance. In addition, putting performance seemed to be most affected, especially when
429 participants first started to use TA during this skill.

430 *Difficulty verbalizing and evaluating negative performance*

431 It is important to note that participants acknowledged the process of TA to be
432 challenging at times. For example, participant six reported the potential difficulties of
433 verbalising his thoughts after a bad shot. Although this highlights how TA has potentially
434 changed the focus of his natural attention, the following quote provides evidence of how this
435 illumination of negative behaviour has been used to improve his thoughts process:

436 Something that I found particularly difficult when thinking aloud was verbalising
437 everything even when I'm hitting a bad shot. If it is something that is an unforced
438 error and it's not necessarily the fact that my swing was bad, I just didn't hit the shot
439 that I wanted to and it was just a one off maybe. I would maybe overlook it but where
440 I'm verbalising everything I'm kind of focusing more on the bad shots which actually
441 turned out to be really positive because I'm really focusing on those shots and making
442 sure that I don't do them again and making the same mistakes again (P6, follow-up
443 interview).

444 Participant four also explained the potential difficulties of verbalising less successful
445 performance. This links to the emotions that are elicited following both positive and negative
446 outcomes. Participant four, perceived the negative emotions following an unsuccessful
447 performance to be a potential issue when using TA:

448 If someone was playing bad I think it would be harder for them to say their true
449 thoughts. I would probably struggle with it a bit more because you know you get
450 emotional when you play badly or you miss a putt. (P3, follow-up interview).

451 *Potential distraction to performance*

452 This theme refers to some participants reporting how TA could possibly act as a
453 distraction to their performance, especially when verbalising thought processes while putting.
454 For example, participant two reported how he initially thought more about TA and less about
455 his putt, which resulted in a negative outcome: “especially with the putts at the start, it
456 affected me quite badly, because I was focusing more on speaking aloud at times rather than
457 my actual shot” (P2, immediate interview).

458 One participant reported being distracted during putting performance due to his putting
459 routine being visual and how having to verbalise his thoughts directed his attention away
460 from the visual cues he would usually use when putting:

461 I am visual with putting. I’m like ‘that is the spot I want to hit it on’, and if I’m
462 talking to myself I’ll almost forget where that spot is and if I don’t look at it again, I
463 have to keep looking at the spot until I’m like that is exactly where I want to hit I
464 now. If I keep talking I put myself off where I’m trying to aim. Even though I’m
465 saying where I want to aim it, I’ve lost that visual connection with my reference point.
466 So as a result, on putts, I found it a lot more difficult (P4, follow-up interview).

467 The potential issue of TA being a distraction during putting is an important consideration for
468 how TA is employed and in what environment. For example, the evidence may suggest that
469 TA is best used in practice conditions only, given that it might be detrimental to competitive
470 performance.

471 **Application to coaching**

472 All participants recommended the use of TA as a useful coaching tool. Although this
473 is only from the perspective of the golfer and not the coach, participants reported how the
474 coach could use TA to understand, monitor, and challenge the golfers thought processes.
475 Participants stated that coaches could use TA to better understand their player’s thoughts, and
476 in turn, be able to implement appropriate coaching interventions as a result. Specifically, the

477 sub-themes of gaining an insight into a golfer's thought process and coach intervention were
478 identified.

479 *Gaining an insight into a golfer's thought process*

480 Our participants reported how TA could help the coach to gain an insight into what the golfer
481 is thinking:

482 I could see how actually articulating (TA) is actually quite useful from a coaching
483 perspective, because if you're actually articulating what you're thinking your coach
484 knows whether you're actually going through a routine to your thinking which is
485 actually quite important and whether you're actually thinking in the correct way (P2,
486 follow-up interview).

487 Participant four also provides support for the use of TA in coaching, specifically when
488 making the coach aware of the golfer's thoughts relating to course management and focus:

489 If you've got an athlete that you feel has poor course management, is thinking the
490 wrong thoughts or is losing their head at some point in the round then you can use
491 think aloud to assess what they are thinking and see where you might be able to
492 change it (P4, follow-up interview).

493 *Coach intervention*

494 Through providing an awareness of thought processes, it was suggested that this could
495 lead to a range of possible coaching interventions. Participant two explains the potential
496 benefits of using TA as a remote coaching tool, where a coach could gain insights into their
497 golfer's thought process and then suggest relevant coaching points:

498 I think it (TA) gives a coach ... an idea of the routine that you're going through and it
499 would enable them to help you by making suggestions by saying you're doing this,
500 how about if you try and do x, y and z. I can see that it would have benefits. Good
501 things that you're doing, bad things that you're doing, things that my help. Also, if

527 appeared to compare their self-observed performance against goal attainment, and in turn,
528 calibrate the causes of success and errors to their self-observed performance (causal
529 attributions). For example, close inspection of participant four's quotes suggest that he
530 attributed performance errors to controllable processes that may sustain motivation as he
531 implies that developing a strategy to manage drifting may lead to future success
532 (Zimmerman, 2002).

533 Despite the findings of the present study suggesting that TA developed self-awareness
534 through reflection, participants did not report using TA as a reflective tool between the
535 immediate and follow-up interviews. Subsequently, participants did not engage in the sub-
536 process of adaptive reactions as there was an absence of effort to adjust one's method of
537 learning. Individuals who judge their success and failure as opportunities to learn may
538 develop a more adaptive attribution style, which in turn, may enhance emotional control
539 (Zimmerman, 2000). Given the absence of adaptive reactions, caution should be taken when
540 interpreting the findings regarding the extent to which an improvement in self-regulation was
541 identified. Notwithstanding, these collective findings illustrate the reported benefits of TA
542 and its capability to facilitate increased self-awareness through the process of self-reflection.

543 Golfers reported that TA could be used by the coach to better understand their golfers
544 thought processes, and in turn, implement coaching interventions. These interventions could
545 cover a variety of areas such as pre-performance routines (e.g., monitoring pre-event anxiety
546 symptoms), performance strategy (e.g., pacing strategy), and psychological strategies aimed
547 at responding to stressful situations (e.g., monitoring attentional control strategies).

548 Researchers (e.g., Swettenham et al., 2018; Kaisler et al., 2012; Whitehead et al., 2016a) have
549 supported the notion that TA could be used as a performance enhancement tool by coaches
550 and sport psychologists. To date, only one study has explored a sport psychologist's use of
551 TA to improve emotional control in a tennis player (Moffat et al., 2021). Therefore, more

552 research is needed to develop a better understanding of how practitioners may employ TA
553 within their practice.

554 One suggestion could be to focus on how coaches challenge athlete learning. Hansen
555 and Anderson (2014) suggest that challenging an athlete's reflection may enhance more
556 reliable learning experiences. Hansen and Anderson (2014) present the concepts of the coach
557 being the sense-giver and the athlete being the sense-maker, where the coach's role is to
558 stimulate athlete reflection through intervening in the sense-making process. This process of
559 sense-giving is where the coach challenges the way the athlete perceives and interprets
560 training advice (Jones et al., 2012). Sense-giving interventions involve giving direction to
561 athletes via training plans, observing and interacting with the athlete, encouraging the athlete
562 to reflect on their training, and asking challenging questions (Hansen & Anderson, 2014).
563 Using TA may provide an additional method of sense-making for the athlete where they are
564 able to not only self-reflect, but also have their TA challenged by the sense-giver (coach).
565 Given that self-regulated learners are eager to challenge established behavioural patterns
566 (Zimmerman, 1986, 2000), using TA alongside the sense-giving process may provide a
567 fruitful means of developing highly valuable self-regulatory skills in athletes. Further
568 research is therefore warranted to examine the collaborative use of TA in developing self-
569 reflection, and possibly self-regulation, in athletes.

570 As can be seen from the themes, golfers reported both positive and negative
571 perceptions of using TA. Participants reported that thinking aloud helped identify problem
572 areas (e.g., drifting) in their game. Being able to identify drifting of focus and concentration
573 is a key component of successful performance in that drifting into the past or the future may
574 inhibit performance (Wilson et al., 2006). Therefore, being able to identify this drift through
575 the use of TA is an important finding for the present study. Despite participants not reporting
576 using TA between the immediate and follow-up interviews, they did, however, consider

577 applying what they had learned to competitive environments. For example, participants
578 reflected on how they could apply the use of TA to competitive environments, where this
579 drifting could be identified to improve their focus. The six-to-eight-week reflection period
580 and the process of listening back to one's TA were also perceived positively by participants.
581 Participants reported the benefits of listening back to their TA and the collective findings
582 encompassed by the increased awareness and awareness of how behaviour influences
583 performance themes highlight the value and positive perceptions of golfers using TA.

584 Despite the reported benefits of using TA, some golfers revealed concerns about using
585 TA in that it caused disruption in thought processes and performance, especially after
586 executing poor putts. The theme of disruption of thought process and performance highlights
587 the prevalence of reactivity from thinking aloud during performance. This evidences how
588 metacognition occurs where participants are potentially becoming more aware of their
589 thoughts and decision-making by virtue of TA directing attention towards the conscious
590 process. Indeed, a recent review of reactivity to measures of metacognition argued that TA
591 may cause reactivity whereby participants may attend to internal cognitions in a way they
592 would not have ordinarily done and may be compounded by the nature of their verbalisations
593 being recorded (Double & Birney, 2019). Although metacognition has been associated with
594 positive developmental (e.g., Lior, 2004; Theodosiou & Papaioannou, 2006) and performance
595 benefits (e.g., Jonker et al., 2011; Nietfeld, 2003), it may also promote conscious control of
596 movement that is argued to potentially hinder skill execution. According to Masters' (1992)
597 theory of reinvestment, automated motor processes can be disrupted if the performer tries to
598 consciously control skill execution. Research (e.g., Pijpers et al., 2005; Wan & Huon, 2005)
599 has generally supported the contention that consciously controlling movement hinders
600 performance in conditions of high anxiety. Given that participants in the present study used

601 TA under simulated competition conditions, reinvestment theory could explain the
602 discomfort experienced.

603 Nevertheless, this element of reactivity and leading participants to attend to internal
604 cognitions becomes somewhat of a double-edged sword. By becoming aware of these thought
605 processes, golfers may increase his or her understanding of how their cognitions impact their
606 practice, and in turn, potentially develop self-regulatory skills to facilitate more effective
607 learning (Zimmerman, 1986, 2000). Conversely, directing one's attention towards cognitions
608 that underpin skill execution can potentially hinder performance. Stephenson et al. (2020)
609 found that coach's use of TA during practice enabled them to become more aware of their
610 own cognitions and coaching behaviours, yet TA also became a distraction from the task of
611 coaching and thus negatively impacted overall coaching performance. Despite the
612 overwhelming body of literature supporting the use of TA as a valid and reliable means to
613 capture in-event cognitions (for a review, see Fox, Ericsson, & Best, 2011), the present study
614 highlights the need for researchers and practitioners to acknowledge the potential for
615 reactivity when using TA as self-regulation tool. This also leads to considerations about the
616 learning of TA and that it is a skill. Initially, participants may become distracted as they are
617 in the cognitive phase of learning (Fitts & Posner, 1967). Consequently, researchers should
618 consider the length of TA training to overcome such impacts.

619 Although this is the first study to consider the use of TA as a tool to facilitate self-
620 regulation within athletes (golfers), it is important to acknowledge the limitations of the study
621 and consider how future research may develop this area further. We understand that reflection
622 is more than just listening back to your thoughts. Future research may consider how the wider
623 social environment and development of the individual athlete plays a role in how they reflect
624 and engage in the TA process. Using TA in isolation also means that participants are only
625 able to self-correct, which may result in an individual only knowing what they know or not

626 knowing what they don't know. Howell (1982) termed this phenomenon unconscious
627 incompetence. This may explain why participants acknowledged the importance of using TA
628 collaboratively with their coach. Research within coaching has emphasised the role of
629 guidance or a critical friend in enhancing reflections (Szedlak et al., 2019). Furthermore,
630 using TA through a collaborative process with other coaches has also been suggested in
631 previous research (Stephenson et al., 2020). Future research should therefore consider
632 triangulating methods (e.g., performance measures) and gaining perceptions of others (e.g.,
633 the coach).

634 Due to the exploratory nature of the present study, participants were instructed to
635 listen to and reflect upon TA audio using an open and unstructured process. We acknowledge
636 the benefits of structured reflection approaches and encourage researchers to harness
637 frameworks (e.g., Gibbs' reflective cycle; Gibbs, 1988) to facilitate deeper reflections. We
638 also acknowledge that caution should be taken when interpreting the findings regarding the
639 extent to which an improvement in self-regulation was identified. We encourage researchers
640 to analyse TA content and/or harness follow-up interviews more explicitly to assess changes
641 in self-regulation to further shed light about the use of TA as a tool to promote self-regulation
642 in athletes.

643 Furthermore, it is important to consider and acknowledge how reactivity,
644 metacognition, and reflection are also very individualised processes, where some individuals
645 may benefit from reporting on their metacognition, while others may be impaired and some
646 do not react at all. This was evidenced by Whitehead et al. (2018) where some cyclists
647 reported perceived benefits of using TA "it helped me pace myself better" (p.106), whereas
648 others reported negative reactivity "it slowed me down" (p.106) and others reported no
649 reactivity "I was probably as per normal" (p.106). The absence of any long-term follow-up
650 interviews and the lack of questioning surrounding participant's effort to adjust one's method

651 of learning limit the scope of the study to reveal the wider implications of using TA to
652 develop the broader self-regulation process. Therefore, we encourage researchers and
653 practitioners to examine how TA could be used longitudinally and how the content of TA
654 may change with the potential development of self-regulation skills.

655 **Conclusion**

656 The aim of the present study was to glean golfers' perceptions of using TA, and
657 ultimately, to advance understanding of its use as a tool to promote self-reflection and self-
658 regulation in golfers. Talented athletes are more likely to self-reflect during athletic
659 performance in comparison to lower-level peers (Jonker et al., 2011). Therefore, it is
660 important that research and practice considers how best to facilitate this process within the
661 athlete population. More specifically, using TA may help athletes to better understand how
662 they think and feel within real-time performance in comparison to retrospective reflections
663 such as diary methods (Tan et al., 2016). Although the present study does pose
664 methodological questions for research using TA as a data collection tool for capturing
665 naturalistic cognition, TA offers a potential tool to promote self-regulation for golfers and
666 other athletes who wish to self-evaluate their in-situ thought processes. Researchers are
667 encouraged to examine the use of TA as a self-regulation tool to further support or challenge
668 these preliminary findings.

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