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How Do Coaches Operationalise Long-Term Technical Training in Elite Golf?

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Running Head: LONG-TERM TECHNICAL TRAINING IN ELITE GOLF

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Abstract

Long-term training is a common approach within the applied setting for components of physiology and strength and conditioning, for example. However, less is known about the reality of training across similar timescales from a technical perspective. Taking the highly-technical sport of golf, current research rarely considers coaching technique beyond a single-session, nor with the aim to understand the *reality* for, or challenges faced by, coaches working at the elite-level. Accordingly, this qualitative study explored the goals, structure and methods of coaches' long-term technical work with players at macro, meso and micro levels. Findings revealed, (a) coaches attempted to undertake technical refinement with players but without a clear systematic process, (b) there is little coherence and consistency across the levels of work, (c) the process and timescales of technical work is considered unpredictable and uncertain and, (d) long-term planning is seen as subservient to meeting players' immediate performance needs. These results highlight the complexity of long-term technical work at the elite level and the need for coaches to develop both a sound and clear rationale through a more comprehensive case conceptualisation process, as well as a greater alignment to the scientific literature, in order to advance future practice.

Keywords: decision making, professional practice, skill development, technical refinement

43 How Do Coaches Operationalise Long-Term Technical Training in Elite Golf?

44 Within professional sport, coaches strive to promote peak athletic performance at key
45 events, often across yearly and/or quadrennial cycles. Indeed, this level of planning is highly
46 embedded within strength and conditioning for instance, where, through the utility of
47 structured progressions, training is intended to induce desirable adaptations to optimally
48 support sport-specific functioning; a process termed ‘periodisation’ (Bompa, 1983).
49 Emerging evidence also suggests that such planning approaches can usefully inform work
50 with athletes beyond the physiological, such as the delivery and development of mental skills
51 (Blumenstein & Orbach, 2020), optimisation when performing and learning risky skills with
52 a high emotional load (D. Collins et al., 2018) and training new tactics in team sports
53 (Tamarit, 2015). There are several advantages to long-term planning in this regard. Firstly,
54 the variety of athletes’ needs will differ in how long they realistically take to implement,
55 therefore, this needs consideration against other performance factors. Secondly, it promotes a
56 necessary focus and motivation to achieve improvements. Thirdly, it can proactively help
57 address known and meaningful challenges, such as demanding performance conditions or a
58 transition due to aging. However, not all support disciplines have explored long-term
59 planning in detail or from an applied perspective, such as technical, or skill development,
60 specialists (Farrow & Robertson, 2017). Therefore, this paper focuses on the applied
61 demands and practices of coaches working within the highly technical sport of golf, to better
62 understand what is happening at the elite-level.

63 As already identified, periodisation is commonly used when planning long-term
64 interventions (Lorenz & Morrison, 2015; Plisk & Stone, 2003). Whilst there are multiple
65 definitions of periodisation, physiology-based literature explains it as essentially a systematic
66 method to control a training response by varying the load in preparation for performance
67 (Mujika et al., 2018). When there is a known and pre-determined ‘peak’ to work towards, this

68 process is considered more efficacious than using a random approach or overusing a single
69 method (Plisk, 2004). Accordingly, a key principle of periodisation is the division of time
70 into cycles of various training goals. Micro-cycles refer to the shortest duration and represent
71 what will be achieved within a single or small number of training sessions, typically lasting
72 for about a week. Combining these micro-cycles to realise a specific component of the
73 overall intention is called a meso-cycle; that is, a 'phase' within a more complex process and
74 lasting in the region of weeks or months. Finally, the conceptualisation of different meso-
75 cycles over a long-term timescale of many months or year(s) is called a macro-cycle.
76 Importantly, implementing periodisation in this way relies on coherence to address the
77 underpinning mechanisms of a particular training need. Examples of where periodisation has
78 been reported within the literature include cycling (Rønnestad et al., 2014), kayaking (García-
79 Pallarés et al., 2009) and swimming (Pyne, 1996). Interestingly, these sports typify the
80 literature in that they mainly feature continuous/cyclic and/or open skills, but notably under-
81 address closed, self-paced and discrete skills such as in golf, nor do they relate to a technical
82 perspective. Despite its intuitive sense, periodisation has been criticised. For instance, linear
83 and generalised templates do not cater well for sports requiring multiple peak performances
84 per year rather than once every 4 years, nor does every athlete respond biologically in the
85 same way (see Kiely, 2018). In principle however, these ideas can still be useful, but must be
86 critically considered against complex contextual and individually specific demands. Whether,
87 or how, these ideas reflect elite-level technical golf coaching, therefore, remains a necessary
88 area of research to better support the transition from training to competition (Orr et al., 2021).

89 A scarcity of periodisation research in this context *could* be due to perceived
90 theoretical incoherence. For instance, traditional information-processing approaches to motor
91 learning explain that once a movement has been learnt, the athlete is in a final autonomous
92 stage, whereby there is limited need to attend to the execution (Fitts & Posner, 1967). From

93 an ecological approach, technique is self-organised based on unique perception-action
94 couplings *emerging* from the interaction of task, organismic and environmental constraints; in
95 other words, technique is continually adaptive and should not be prescribed (Davids et al.,
96 2013). Therefore, from these fundamental perspectives it is unclear *what* needs periodising at
97 the elite level. However, applied research and practice tells us that being able to achieve and
98 maintain effective technique is challenging during elite athletes' performance. Indeed, even at
99 the top level, technical issues can manifest as regressions or losses in the execution process
100 which, could be due to how the movements are practiced (see Day et al., 2006) or when
101 protecting against an old injury (see D. Collins et al., 1999). Although 'lost move syndrome'
102 and technical blocks are rare, athletes must prepare to maintain specific confidence and trust
103 in their technique (Beaumont et al., 2015), know how to recover when debilitating technical
104 thoughts take over and interrupt the execution (Montero, 2015), manage the transition
105 between successful subconscious (e.g., flow) and conscious (e.g., focus on 'core' action
106 components) performance states (Bertollo et al., 2016), be capable of adapting their technique
107 for less familiar situations (Toner & Moran, 2015), prevent bad habits or interference caused
108 by previous coaching experiences from creeping in (Carson & Collins, 2014; Huys et al.,
109 2009) and make small but long-term permanent and pressure resistant tweaks or refinements
110 to their movements in response to a range of internal and/or external factors (Carson &
111 Collins, 2011). So, contrary to fundamental theory, efforts to ensure effective technical
112 execution are a constant feature of high-level performances (see Carson & Collins, 2020).
113 Consequently, working to achieve these exemplar outcomes requires consideration of
114 processes and associated timescales governing skill execution control, or what Carson and
115 Collins (2016a) call the 'motoric dimension'.

116 Whilst periodisation has historically been a tool to plan for a specific major event
117 (i.e., the Olympic Games), elite level golf is unique due to players competing up to 35–40

118 weeks per year and in many instances, during what is normally seen as the off season (i.e.,
119 October–March; EuropeanTour, 2021). Indeed, each week players are confronted with a
120 variety of conditions and course layouts as they tour the globe between events, placing a high
121 demand on technical precision, reliability *and* adaptability. In professional golf, there is huge
122 earning potential where, for less established players, earning enough money to maintain
123 playing rights for the following year is often a high priority. Therefore, *every* week is
124 important and puts pressure on the need for effective technical execution. This provides
125 unique challenges for the support team of not just *what* technical work to undertake, or *how*
126 this work will be implemented, but *when* this will occur within such a congested schedule.
127 Timing therefore is critically important. At present, however, the dearth in research to better
128 understand such demands and working practices limits the ability to make evidence-based
129 inroads for enhanced support provision. Against a variety of athlete needs, planning must
130 consider ‘what’ and ‘how’ outcomes can be delivered and, for the best chance of getting these
131 two right, know ‘why’.

132 Within golf, much research has concerned micro-level interactions. For example,
133 Toner et al. (2012) examined coach behaviour during a reflective account of a single
134 coaching session. More recently, Orr et al. (2021) examined the nature and rationale of
135 attentional cues used by coaches with elite players during a single coaching session. In
136 contrast, Schempp et al. (2004) studied expert coaches working with beginners during a
137 single session. Carson et al. (2013) interviewed elite players and coaches and surveyed high-
138 level golfers to understand the longitudinal processes employed and nature of technical
139 refinement in already well-established golf skills. Whilst these exemplar investigations have
140 merit, there are clear limitations, particularly relating to longer-term and *broader*
141 mechanisms, practices and challenges needing to be addressed in the real-world of elite-level
142 golf.

167 Driven by the study's purposes, and reflecting the principles of pragmatism, a
168 decision was made to work at the interpretivist end of the epistemological continuum
169 (Chowdhury, 2014). Using an interpretivist lens allows researchers to focus on gathering rich
170 data on the experiences, practices and rationale of those involved. Accordingly, a qualitative
171 research strategy was also thereby employed (Jupp, 2006) because this research aims to
172 generate a map of the world as perceived by participants and is well suited to work that aims
173 to understand what people believe and do, as well as why they believe and do it (Streat,
174 1998). More specifically, semi-structured interviews were selected as a suitable approach to
175 collect data on coaches' practices—plus the rationale for these—in relation to long-term
176 technical work with their players.

177 **Participants**

178 Data were collected from 10 male PGA Professional golf coaches. Each coach was
179 purposively selected through personal contacts of the lead author based on the following
180 selection criteria, (a) a minimum of 10 years coaching experience ($M = 21.2$ years, $SD = 5.3$),
181 (b) status as UKCC level 3 qualified or above and/or had been awarded 'Advanced' status or
182 above by the PGA and (c) worked with professional and/or elite amateur players. The
183 rationale for selecting coaches from amateur and professional levels was due to the
184 similarities in performance demands placed on coaches, plus the nature of coach–player
185 relationships in each (e.g., similar regularity of contact). Reflecting our focus on long-term
186 technical work, it was also required that the coaches had experience of working with high-
187 level players over an extended time frame (minimum 1 year) and were open and able to
188 discuss their work with one specific player in detail.

189 To define the 'elite' status more clearly, all amateur players discussed were world
190 ranked inside the top 100 and the two professional players discussed were inside the top 50 in
191 the official world golf rankings at the time of coaching. Furthermore, two of the coaches had

192 coached recent Major champions (the biggest four professional events in golf). Two other
193 coaches had also coached recent Ryder Cup players/European Tour winners. Four coaches
194 had coached multiple Curtis Cup and Walker Cup players (the highest levels of team
195 competition in amateur golf). Therefore, the participants had the status, experience and
196 coaching success to offer a realistic and representative view of practices within coaching at
197 the truly elite level.

198 **Data Collection**

199 Prior to the interview, participants were sent information relating to the purpose of the
200 study, a consent form and a copy of the interview guide. Once all participants had given
201 consent, the interviews were arranged for a relevant time. Five of the interviews took place
202 face-to-face at the participants' place of work and five took place on the online platform
203 Zoom (Zoom Video Communications, California). Interviews were conducted between
204 December–March, with this being golf's off-season and therefore (relatively) easier for a
205 coach to commit to participating. All interviews were recorded on a Dictaphone and all
206 procedures were approved by the lead author's institutional ethics committee.

207 Based on the study purposes, the interview was supported by adopting a chronological
208 timeline approach. This was used specifically because: a) its ability to support participants'
209 accurate recall; and b) to help expand and supplement the interview data collected.
210 Specifically, the coaches were asked to draw visually on a blank page how they phased their
211 work with their selected player, from a long-term (i.e., macro-level) down to a short-term
212 (i.e., micro-level) perspective. The macro-level timeline was established by nine coaches as a
213 full season, while the remaining coach conceptualised their macro-level work as the time
214 between the professional season's four Major championships (almost a season long).

215 Against this timeline, the interview then focused on a series of open-ended questions.
216 More specifically, these questions explored the coach's goals, structure and methods at the

217 macro level (i.e., the biggest block), meso level (i.e., intermediate blocks) and micro level
218 (i.e., smallest blocks) of technical work with their chosen player, as well as their rationale for
219 these. The participants were free to discuss any relevant part of the game, but all chose to
220 discuss their players' long-games (full swings). Example questions related to macro level
221 work included: Where were you trying to take this player technically from a big picture
222 perspective (i.e., *goals*-related)? Why were your phases of work laid out this way (i.e.,
223 *structure*-related)? How would you know if you had been successful (i.e., *methods*-related)?
224 An example from meso level work included: What were you trying to achieve in this specific
225 phase (*goals*-related)? How often did you see player 'X' across this phase and why (*structure*
226 *related*)? Why did you choose this approach and not another (*methods related*)? Finally,
227 example questions on aspects of micro level work included: What did the player do in this
228 session to achieve their goal (*goals related*)? How often did you see player X in the run up to
229 the key event and at the event itself (*structure related*)? How do you get the player
230 tournament ready keeping in mind their technical goals (*methods related*)? Based on these
231 exemplar core questions, follow up probes and prompts were also developed for purposes of
232 clarity and elaboration. These core questions, prompts and probes also helped to support a
233 level of consistency of topics covered across all participants (Patton, 2002)

234 The data collection procedure was preceded by a pilot study involving a golf coach
235 who met all of the inclusion criteria. This helped shape the clarity and coherence of the final
236 interview guide. As a result, small adjustments were made to the start of the interview guide
237 to clarify the questioning against common coaching terminology so that the focus was clearer
238 for participants, rather than using overly scientific language.

239 **Data Analysis**

240 Interviews were transcribed verbatim, then read several times to generate familiarity
241 and understanding of the data. Against the study aims, data were coded deductively according

242 to whether they related to the goals, structures or methods that coaches employed at a macro,
243 meso and micro level (Cruickshank & Collins, 2015). Following this initial organisation
244 process, an entirely separate inductive analysis, following the steps of Côté et al. (1993) was
245 undertaken to generate themes from the raw data that summarised the actions and perceptions
246 of the coach within each specific area; as well as the rationale for their approaches.

247 **Trustworthiness**

248 Beyond the appropriateness of the participants in relation to the study aims, plus the
249 profile of the research team, several other approaches were taken to enhance the
250 trustworthiness of the data collection and analysis procedures. Regarding the former, a key
251 factor was the development of trust and rapport with the participants (Sparkes & Smith,
252 2009). This was enhanced by the fact that several of the participants were already
253 professionally known to the lead author. Of course, this familiarity meant that the researcher
254 had to be particularly cognisant of a number of potential biases that could have interacted
255 with data collection (e.g., impression management; Goffman, 1959). Additionally, for those
256 coaches less well known to the lead author, extra efforts were made to gain familiarity with
257 these participants' coaching histories, achievements and experiences to encourage openness
258 in the discussion. As a marker of the levels of rapport achieved, all participants involved
259 expressed an interest to be informed of the study's findings.

260 From an analysis perspective, the second and third author also acted as critical friends
261 throughout, helping the lead researcher to reflect on potential assumptions, biases and
262 interpretation of data during the deductive phase, and suggesting alternative codes in the
263 inductive phase, with this process also working vice-versa (Faulkner & Sparkes, 1999). This
264 was further supported by the lead author's use of a reflective diary and recorded memos to
265 carefully monitor and review the data analysis as it evolved (Smith & McGannon, 2018). To
266 support the fairness and accuracy in the findings, member reflections (Smith & McGannon,

267 2018) were also obtained through email and follow up phone calls post-interviews, with
268 participants encouraged to add any further insights or highlight any gaps in their responses
269 (four of the participants added minor details to their existing interview and none suggesting
270 any major amendments).

271 **Results**

272 The results of this study are presented in two parts. Firstly, Table 1 presents the
273 higher-order themes relating to the goals, structure and methods of the coaches' work across
274 macro, meso and micro levels; followed by a brief summary and supporting quotes.
275 Secondly, findings pertaining to the rationale for these approaches at macro, meso and micro
276 levels are presented.

277

278 ***Insert Table 1 here***

279

280 **Macro Level: Goals, Structure and Methods**

281 Regarding the *goal* of the work undertaken on a macro-level (i.e., over the course a
282 full year), all coaches described wanting to change an element of the players long-game
283 technique; albeit the coaches defined this slightly differently (e.g., “technical change”,
284 “rebuild”, “adjustment”). Specifically, these were changes to the movement of their players’
285 body and/or club (e.g., arm/body connection, length of arc, better pivot in the right hip).
286 Furthermore, four of the coaches highlighted the desire to also develop wider meta-cognitive
287 skills as a necessary concomitant of the technically-oriented outcome; specifically, the
288 development of autonomy, the ability to self-diagnose and take ownership of their own
289 technical development. For example, Coach 4 highlighted: “It was important for her to
290 understand her swing. To be able to self-diagnose and be more self-aware”.

291 In terms of conceptualising a *structure* to achieve the macro goal, all coaches reported
292 that their work took place over a full year, but that the actual ‘end point’ was undefined or
293 open-ended (i.e., it was not clear in the coach’s mind at what point those macro goals would
294 be achieved). Reflecting the common macro goal, the coaches’ primary *methods* related to
295 diagnosing the ball flight issues the player had and the corresponding technical principles that
296 were perceived to be causing them. In addition, all coaches reported that this took place
297 within a wider assessment of the player by observing multiple aspects of the players’ game,
298 with 80% of coaches observing on the golf course, either in competition or a non-competitive
299 environment. Forty percent of the coaches also spent over a day in this assessment phase to
300 be able to get to know the player and form clear opinions on their game. Reflecting this,
301 Coach 7 highlighted the potential negative impact of not getting to know the player: “If you
302 miss out the psychosocial stuff then you are screwed. This influences the ‘what’ and ‘when’
303 of technical change”. Highlighting the importance of the time taken to assess, Coach 8 said,
304 “I watched him on the course, how he structured his practice. I got a two-week picture of his
305 game. So, we had plenty of time to build up a picture”. Finally, three coaches reported, at this
306 stage, getting input from other stakeholders involved in the player’s game, specifically other
307 coaches the player may have had.

308 **Meso Level: Goals, Structure and Methods**

309 Meso *goals* were not distinct from the macro goal in that the purpose was still to bring
310 about the desired changes in both ball flight and subsequent technique. In other words, the
311 macro goal was not split into separate meso-goals to reflect distinct phases (i.e., the
312 mechanisms) to success. From a *structure* perspective, all but one of the coaches broke their
313 work down into simple phases (or meso cycles); with one phase being the playing season
314 (February to October) and the second phase being the off season (November to January).
315 Against this structure, some coaches actively passed the responsibility to the player to book

316 the coaching sessions rather than this being led by the coaches themselves: “The off-season is
317 more my time. During the season is their time. And it is up to them to book with me” (Coach
318 2). This approach was supported by Coach 10: “When in the playing season I’m listening to
319 how the player is playing and for them to come to you. So, it’s a little bit more player-led”.
320 Finally, during both phases, there was no discussion by the coaches of the link between
321 sessions undertaken, but instead discussed as individual, stand-alone sessions.

322 Reflecting the similarity of the macro and meso goals, the *methods* used by the
323 coaches at the meso-level were also not particularly distinct between in-season and off-season
324 phases. Of those employed, the coaches reported using a variety of methods to attempt to
325 bring about the desired technical changes. Notably, coaches reported using both suggestively
326 implicit and explicit methods. Several coaches advocated using external cues to change
327 technique. Coach 1, coach to a recent professional Major champion, said: “The swing
328 changed when the shot changed... focusing on the outcome changes the swing...I’ve no
329 concern what the swing looks like”. Conversely, Coach 2 advocated the opposite strategy,
330 hitting shots in front of a net, to remove the ball flight completely: “The net removes the
331 flight and puts her attention onto what needs to be worked on...you can get buy-in from the
332 player as the outcome is removed. If they see poor outcomes, you can lose buy-in”. Further
333 methods used for both strategies are highlighted in Table 1. In sum, there were no consistent
334 methods—or sequencing of methods—across all of the coaches to indicate a formal approach
335 to achieving the desired outcome.

336 **Micro Level: Goals, Structure and Methods**

337 At the micro level during the off-season, all coaches reported the same *goals* as at the
338 macro level; that is, to improve the players’ technique, which was not broken down into a set
339 of smaller sub-goals. During the season, however, almost all coaches shifted priorities to a
340 *goal* of immediate performance (i.e., to help the player perform their best at the immediately

341 next tournament). Notably, one coach did offer a different viewpoint. Reflecting a longer-
342 term view of the player's performance, Coach 7 based the goals of tournament week on the
343 level of importance of the event; in lower-level events, therefore, goals *other than immediate*
344 *performance* were emphasised: "At lower-level events we will be working on shots for other
345 bigger events. We would also practice certain clubs in smaller events. Also, psychological
346 skills are practiced in smaller events before being put into play in bigger events".

347 Regarding *structure*, coach–player interactions were infrequent and irregular across
348 both off-season and in-season phases. In terms of the off-season, and while some coaches
349 were able to occasionally spend several days with their player at national camps on a one-to-
350 one basis, typically the player and coach met for 1–2 hours per month, some less than this.
351 For example, Coach 7, who supports a recent professional Major champion highlighted the
352 challenge faced: "Sometimes we can have a lesson with an elite player and then we don't see
353 them for 6 weeks. Ideally with a top player, you want them to turn up the next day".

354 Notably, levels of micro-level interaction were similar, or even less during the playing
355 season. In this respect, some work was undertaken during gaps in the player's tournament
356 schedule; however, the majority of work was undertaken across a tournament week itself
357 (i.e., when a coach attended a tournament to provide support). While the coaches all reported
358 working with their player every day at an event, finer details regarding the structure of work
359 were different between coaches and often for each coach at different events due to the
360 variable nature of the current form of their player. For example, coaching input was provided
361 'as needed', particularly should any issues arise where a player was not playing well and
362 needed some immediate work to improve. Alternatively, Coach 8 stated: "Sometimes it is
363 only 5 minutes per day".

364 Turning to *methods*—and firstly in relation to the off-season—all coaches reported
365 similar strategies and tools within the meso-level section above (see Table 1); so again,

366 without any distinctions made across levels. In contrast, much more data relating to methods
367 were provided about the in-season phase, predominantly in relation to tournament weeks.
368 More specifically, the *methods* employed could be separated into three distinct categories:
369 practice strategies, attentional strategies and broader psychological strategies. In terms of
370 competition-related practice strategies, the coaches used several forms: including technical
371 maintenance drills, simulation of competition, practice intensity, variation and stress
372 exposure. Reflecting Coach 8's desire to add variation to practice, simulating the demands of
373 the event, he said: "We don't hit the same shot twice on the course ... so we are trying to
374 simulate what we are doing on the course in our practice. So, we are more able to transfer that
375 onto the course". Three of the coaches emphasised drills to maintain the technical work that
376 had been done pre-event, particularly if the player has not performed well in practice, whilst
377 the other seven coaches actively introduced different practice strategies to prepare for
378 competition. Coach 10 discussed putting the player under stress before an event: "I would
379 introduce levels of discomfort and stress to see if the game holds up under pressure".

380 Regarding attentional strategies, all coaches reported that the player's technique
381 would be in a state of flux throughout the season, where the player would be somewhere on
382 the continuum of change yet still having to perform. To support immediate performance (the
383 micro-level goal for almost all), coaches reported trying to find a feel or cue that would work
384 for the week ahead and move the player away from a more positional focus of attention to a
385 more, kinetic, feel-related focus. Reflecting the challenge, Coach 7 said "Technical work is
386 still in progress when the season gets underway... We try to become more performance
387 focused and find a cue that works for that week. Technical work creates interference". Coach
388 9 also highlighted the importance of this for his player: "It's shifting from mechanics to
389 feel/outcome/performance focus. He doesn't play any good the other way". Similarly, two
390 other coaches reported that some of their methods were aimed at: "understanding where the

391 player is directing their attention. Do they have a clear mental process, target, shot
392 shape...The mental feeds into the technical” (Coach 1) and “I will ask the player to state out
393 loud the shot they want to hit...this creates clarity and commitment to the shot” (Coach 8). In
394 line with this, many of the methods in this area were aimed at reducing the volume of
395 technical information to help get the player ready to compete. In parallel with helping the
396 player to identify cues for the week, Coach 7 reported simply intentionally *saying less* to the
397 player, whereas Coach 3, Coach 6 and 8 reported using *a smaller number of technical*
398 *instructions* whilst Coach 9 was simply *present with the player less* and only attended warm-
399 ups and practice at the request of the player. Coach 9 helped his player with a menu of
400 thoughts that had worked in the past, and rather than offering anything new would encourage
401 the player to self-select an appropriate cue through his own practice.

402 Finally, the coaches reported the use of other psychological strategies which could be
403 separated into two categories: task-specific psychological strategies and broad meta-cognitive
404 strategies. Firstly, the task-specific, these included methods that helped the player to increase
405 their levels of confidence (Coach 2), tension awareness and the robustness of their routines to
406 execute correctly. Reflecting the training of metacognitive skills, reflection, decision making,
407 self-regulation (e.g., “helping the player to set their own plan for the week”: Coach 8) and
408 self-diagnosis/self-coaching (e.g., “helping players to work through technical challenges and
409 ball flight problems on their own”: Coach 7) were all deemed important and indeed impactful
410 on the technique the player displayed. Coach 7 commented; “We engage in deep reflection
411 after the round. I want them to become better players rather than just swingers”. Coach 4
412 commented: “I want her to understand her swing. To be able to self-diagnose and be more
413 self-sufficient...it’s more psychology than technical stuff”.

414 **Summary of the Approaches Taken**

415 Findings point to preferred examples of technical work as being entirely an attempt at
416 technical change that is driven by short-term performance demands. Also, there is a low level
417 of coherence and consistency across the macro, meso and micro levels. Put another way,
418 there appeared to be little translation from what the coach was trying to achieve over the
419 season (macro level) to what the coach did during blocks of the season (meso level), or to
420 individual sessions or tournament support (micro level).

421 **Rationale for Approaches Taken: ‘The WHY’ of Long-Term Technical Work**

422 The following section explains the coaches’ intentions for impact, or rationale; the
423 underpinning *why* for *what* they did, therefore shedding light on the decision making and
424 judgements used throughout the process.

425 **The Perceived Uncertainty and Unpredictability of Technical Change**

426 There was a difference of opinion for how the coaches conceptualised the technical
427 work from both a mechanistic and timescale perspective. Coaches spoke about a lack of
428 knowledge of how long the technical work would take, with opinions ranging from 1 week to
429 a lifetime and also the difficulty in undertaking technical work. Coach 7 reflected a general
430 lack of certainty on timescales for change “I didn’t put a time on the changes because I don’t
431 think you’ve got any clue how long a motor pattern takes to change and be robust”. Coach 9
432 supported this view, “It may take 6 months, 6 years or 60 years. You really don’t know how
433 long any movement change will take. The player thinks 3 weeks, you think 3 years, the
434 reality is somewhere in the middle”. Difficulty, along with previous failures, was further
435 described by Coach 10: “Everybody gets into a pattern that is very hard to change...from my
436 perspective there is times when I’ve tried to do it and it’s been a disaster”.

437 A further theme to emerge was a lack of perceived value in long-term planning. This
438 was almost universally agreed upon by the coaches, however for slightly different reasons.

439 Coach 2 highlighted a number of factors, including the unique challenges of elite level golf
440 compared to that of cycling:

441 There isn't a long-term swing plan. It was more short-term than long-term. The game
442 is so unpredictable, and confidence fluctuates. You are always putting out fires.

443 Cycling you can have a 3-year plan, but golf is a lot less predictable.

444

445 Coach 1 further corroborated the position of unpredictability as a reason against long-term
446 planning and more a position in support of responding to short-term demands:

447 There wasn't a long-term swing plan. When you get to the next step who knows where
448 you'll be...we make so many assumptions such as being injury free, family etc., that
449 these conversations are a bit no-show...You can get way off track with planning.

450

451 **The Scheduling and Immediacy of Performance**

452 A key factor as to why the coaches worked to the goals, structure and methods they
453 did was the tournament scheduling and need for immediate performance. Coaches described
454 the busy playing schedule (for some players, close to 12 months of the year) as a limiter to
455 what they were able to do technically: "You back off what you're doing depending on what
456 she is competing in and also the level of importance of these events" (Coach 4). In turn, this
457 same coach perceived the consequences of the playing schedule as a potential reason for
458 changes not remaining, "Playing so much hindered her at times. There was always that
459 reversion. If I could have stopped her paying for tournaments for one summer, I think we
460 could have got there quicker". Similarly, Coach 9 highlighted the potential negative effects of
461 long-term planning:

462 Work must be done on what's going to make me better now. If you base your work on
463 let's work on 5 years' time you probably won't have a Tour card in a year...there
464 was never any timescales...we identified the path and then just worked towards it.

465 Coach 7 also discussed long-term planning as being subservient to the needs of the player at
466 that moment in time:

467 Any long-term plan is a bit pie in the sky because if they are moaning about their
468 putting then you have to make them feel comfortable there and then...There is never
469 that big block of time when they are not competing.

470

471 In summary, Coach 7 put the challenges of the schedule on technical work most succinctly:

472 "The player has almost no windows in her year to do technical work".

473 In this regard several coaches expressed a desire for their player to have played less to
474 undertake important technical work, tournament golf "was a distraction" (Coach 6). Coach 10
475 even stressed that "valuing those gaps in your year when you are periodising things to leave
476 space to address these factors in your game is golden time". However, whilst stressing the
477 importance of this, none of the coaches encouraged their players to remove events and
478 intentionally orchestrate these gaps in their schedule to achieve the aforementioned aims.

479 **Influence of the Player's Readiness and Commitment to Long-Term Technical Work**

480 Finally, it was also clear that decisions were shaped by their players' perceived
481 psychological state. Coach 7 highlighted the general importance of psychology in the work
482 undertaken: "Psychology has a huge influence. If they are in a bad place, they can be fragile...
483 With her mindset there isn't anything I can do technically right now". In this respect, the
484 player's mentality at the start of their work with the coach was noted as a significant factor by
485 many. For example, during the initial assessment with the player, 70% of coaches raised the
486 issue of planning; specifically, that at the start of the relationship, the player arrived without a

487 clear plan of what they were trying to achieve. One coach described this issue as a
488 consequence of too many stakeholders having an opinion, “He had several coaches
489 suggesting things to him previously. There was a lack of clarity”. Expectations at the start of
490 the relationship were also noted. For instance, Coach 9 also highlighted the player having
491 little tolerance for poor play before looking for different answers for improvement:

492 Players will not tolerate low levels of performance for an extended period. He
493 would commit to seeing an improvement up to a point. But if it’s not doing exactly
494 what it should be doing on the course, he will find a different solution.

495

496 In summary, a lack of knowledge of timescales for completion of work and a lack
497 of perceived value in long-term planning created a short-term approach to technical
498 work. Moreover, a busy tournament schedule, need for regular and immediate
499 performance and the players’ readiness for change, all influenced the coach’s rationale.

500

Discussion

501 The purpose of this study was to explore the nature of and underpinning rationale for
502 coaches’ long-term technical work with elite-level golfers. Specifically, it aimed to explore
503 the goals, structure and methods on a macro, meso and micro level and the rationale for the
504 approaches taken. Ultimately, we aimed to develop an account of current coaching practice in
505 long-term technical work, against which opportunities for a realistic, ‘next step’ progression
506 in the coaching community could be considered and identified. Overall, findings show a
507 fundamentally low level of coherence and consistency across levels of coaches’ long-term
508 technical work. There appeared to be little translation between what the coach was trying to
509 achieve over the season (macro level), what the coach did during blocks of the season (meso
510 level) and to individual sessions or tournament support (micro level). As explained by the
511 participants, this might relate to perceived uncertainties when implementing technical change,

512 the scheduling of tournaments with an immediate need for optimum performance and the
513 influence of players' readiness and commitment to long-term technical work.

514 While the level of incoherence is partly due to factors outside of coaches' control, the
515 known entity of the tournament schedule and ability to find out which events players wish to
516 compete in, points to a need for greater consideration of decision-making processes from the
517 outset in terms of the *macro-level goal* and *macro-level plan* (encompassing the structure and
518 methods used to achieve the goal). Regarding the *goal*, it was notable that changing technique
519 was presented as the exclusive outcome of long-term technical work, rather than considering
520 alternatives that might more suitably meet the presenting demands. Regarding the *plan*, there
521 also seemed to be a universal absence and rejection of systematically designed, long-term
522 programmes. We will now consider how these two areas (*the macro goal* and *the macro plan*)
523 could further explain the pattern of results and inform future practice.

524 **'Changing Technique' as *the* Exclusive Outcome of Long-Term 'Technical Work'**

525 As previously discussed in the Introduction, technical work can encompass several
526 different goals and objectives. In this study, however, technical work undertaken could be
527 explained as technical change only, with little consideration of other alternatives. Perhaps
528 reflecting a research–practice gap, none of the coaches used the specific terms 'refinement' or
529 'regaining' technique (both formally recognised distinct technical change outcomes; Carson
530 & Collins, 2011) when attempting to explain the nature of their work. This decision to change
531 technique in a general sense was due to, at the assessment stage, a recognition of an
532 undesirable ball flight characteristic that was underpinned by a technical problem and a desire
533 to change it. This is also consistent with the view of the need for the coaches to influence
534 performance in the immediate short term. This perhaps reflects a cultural belief within golf
535 coaching of the need, and ability, to see observable changes quickly, a view held by expert
536 golf coaches within the domain (Schempp, McCullick, Busch, et al., 2006).

537 **The Absence and Rejection of Systematically Designed, Long-Term Work Programmes**

538 Perhaps reflecting the need for a technical training framework (Farrow & Robertson,
539 2017), none of the coaches explained the process of technical work systematically, or
540 mechanistically, as outlined in the literature and there was a lack of consensus regarding its
541 implementation (cf. Carson et al., 2013). Broadly, some coaches preferred what have been
542 explained as implicit methods for *learning* new movements, allowing for subconscious
543 movement processes (Wulf et al., 1999), whilst others chose to utilise explicit methods to
544 bring about greater levels of expertise (Toner & Moran, 2015). It is therefore apparent that
545 coaches in this study are using a fragmented and inappropriate process for technical work.
546 Evidence even shows that implicit methods are ineffective at changing already well-
547 established skills (see Rendell et al., 2011). It is, therefore, possible that the coaches are
548 working based on experience and intuition (Schempp, McCullick & Mason, 2006), with little
549 consideration of critical factors identified within current evidence (Carson & Collins, 2011).
550 Further, coaches stated that they did not know how long the process would take, ranging from
551 a week to a lifetime, nor providing insights into the causative factors that might underpin
552 such differences, and did not discuss a clear session to session link. This lack of within and
553 between participant consistency within expert level golf was also found by Carson et al.
554 (2013) when investigating systems for technical refinement.

555 Reflecting this evidence-base, the Five-A Model, which is designed to bring about
556 long-term permanent and pressure-resistant technical change in well-established skills
557 (Carson & Collins, 2011), provides a macro-, meso- and micro-level conceptualisation,
558 however, this was *not* comprehensively followed or mentioned by the coaches. Generally,
559 though, coaches did describe an initial Analysis (Stage 1) as well as elements of raising
560 Awareness of the intended movement (Stage 2), albeit not clearly staged or comprehensive in
561 nature (e.g., limited or no attempt to de-automate the existing kinematics). Notably, the

562 Adjustment (Stage 3) and (Re)Automation (Stage 4) stages were not discussed, when the
563 movement is gradually modified and internalised to subconscious control. Finally, the
564 Assurance stage (Stage 5), which is when the new kinematics are made resistant to the
565 negative effects of pressure with coach and athlete convinced that change is no longer
566 necessary, was only mentioned by one coach. Notably, five coaches reported ‘regression’ in
567 their player’s technique (i.e., where the technique changed back toward its original
568 condition), and this may be in due to a lack of adherence to and/or completion of any of the
569 five stages. Typically, when a change *is* decided as the best course of action, this can be due
570 to insufficient de-automation of the existing kinematics targeted for change; thereby
571 maintaining greater familiarity, automaticity and consistency of an old version (Rendell et al.,
572 2011). However, in the context of the coaches reported constraints on time to implement
573 change, we suggest that the decision to proceed itself could represent a more plausible reason
574 for limited success (i.e., the Analysis stage). Addressing the issue of timescale to implement
575 change in this regard, Carson and Collins (2015) demonstrated that this process was possible
576 to complete in 3 months, however, depending on the complexity, level of establishment and
577 extent of change required, as some examples of key factors, it may take up to 12 months from
578 start to finish (Carson & Collins, 2016b). Therefore, it is a process that must be thought out,
579 understood, planned and agreed on by the coach and player.

580 All coaches, however, rejected the *value* in long-term planning. Indeed, these findings
581 appear consistent with those of Schempp, McCullick, Busch, et al. (2006) where expert golf
582 coaches seem to view planning through a narrow lens pertaining only to the lesson structure,
583 but significantly, did not mention the long-term development of training or the linked
584 decision making between sessions to impact on long-term player needs (i.e., the macro-level).
585 Whereas, Abraham et al. (2015) argued that effective planning *is* an important skill in
586 coaching. Planning appears to be important from investigations reporting the behaviours of

587 renowned coaches (Gallimore & Tharp, 2004) and across different sports (e.g., Toner et al.,
588 2020). However, Loturco et al. (2016) suggest that such effective planning should more
589 critically use the principles of periodisation due to, 1) its low rate of effectiveness in athletic
590 performance and, 2) the need for more applied and effective methods of planning for athletes
591 who compete several times per year and have to maintain consistently high levels of
592 performance. Kiely (2018) argued that rather than seeing planning as *only* the implementation
593 of pre-established training structures, which the author acknowledges to have some benefits,
594 it should be seen as the implementation of systems designed to detect threats and
595 opportunities at the earliest time. Therefore, there appears a need to reconceptualise, clarify
596 and update specifically what effective planning is within elite level golf coaching.
597 Specifically, we need to understand how and why coaches are making decisions and,
598 crucially, whether they are making *effective* ones as part of the framework for
599 reconceptualising planning (Martindale & Collins, 2005).

600 **So What? Explaining Current Practice and Future Progress Through Case** 601 **Formulation**

602 When examining the above findings, there are several important considerations for
603 practitioners and researchers. Practitioners seem to understand and view their technical work
604 through a fairly narrow lens of only technical change but driven by short-term performance
605 demands. Furthermore, there appears to be a lack of mechanistic appreciation of work in
606 terms of the nonlinear progression, timescales involved and influence of complex factors
607 when undertaking this work, with long-term planning seen as less important than responding
608 to immediate issues of performance. Therefore, we should now consider how practitioners
609 conceptualise or formulate a case for their work and how case conceptualisation may be a
610 way for understanding more effective practice in the future. When looking at other fields
611 such as psychotherapy (Sperry, 2005) and more recently, sports psychology (Hutchison &

612 Johnston, 2013), case formulation is seen as an essential bridge between what the specific
613 client's needs are and the interventions chosen. John and Segal (2015) go further and state
614 that "the strength of treatment choice is often reflected in the strength of the case
615 conceptualisation from which it originated" (p. 1). Case conceptualisation would allow the
616 coach to synthesise player experience with coaching theory and research, reduce the tendency
617 to make decisions based on biases and heuristics, allow for consistent session-to-session
618 coherence and to address the complex factors that are often required for optimum impact.
619 This process would allow a coach to establish and develop over time a clear rationale for
620 what work they are doing, as well as how, when and why.

621 Currently, there are no investigations of how golf coaches do this. Therefore, future
622 research in golf could investigate case conceptualisation and consider factors such as choice
623 of interventions, plus the planning, structure and adjustments to behaviour and reflections
624 through the process. It can be utilised at all levels of delivery from the macro to meso to
625 micro levels and help coaches consider not just what work to undertake (i.e., alternatives to
626 technical refinement), but importantly why, when (i.e., the timing and frequency of
627 interactions) and how to undertake it to produce consistent results. In doing so, such a meta-
628 cognitive process has the potential to expand coaching repertoire, effectiveness and ability to
629 adapt to a range of different athlete needs and performance demands (L. Collins et al., 2016).

630 **Strengths and Limitations**

631 A strength of the study was its methodological coherence, where our pragmatic
632 philosophy guided our research questions, use of participants, epistemology, methods and use
633 of theories (Judge et al., 2009). This was consistent with attempting to generate meaningful
634 insights to inform future practice and to more effectively address applied issues. Therefore,
635 we ask the reader to consider the 'so what?' principle (Bryant, 2009) when considering if this
636 aim was met. In addition, the participants were representative of coaches operating at the true

637 elite level end of the performance spectrum. Despite these strengths, this study was not
638 without limitation, one of which was the reliance on retrospective recall. Whilst some of the
639 participants referred to training diaries and training plans for recollection, some only used
640 memory for recall of actions and steps taken (which perhaps reflect the limited planning and
641 design activities reported in the results). Additionally, this study does not offer player
642 perspectives. Furthermore, it is acknowledged that some responses may have been influenced
643 by impression management and indeed the desire to respond in such a way to gain credibility
644 (Morgan, 2007).

645 **Conclusion**

646 In conclusion, this paper highlights coaching practice with elite level golfers to
647 understand current approaches and the rationale for such approaches. Findings revealed, (a)
648 coaches attempted to undertake technical refinement with players but without a clear
649 systematic process, (b) there is little coherence and consistency across the levels of work, (c)
650 the process and timescales of technical work is considered unpredictable and uncertain and,
651 (d) long-term planning is seen as subservient to meeting players' immediate performance
652 needs. Accordingly, while the coaches in this study are recognised as high(est)-level, in
653 practice there is a need for greater utilisation of case formulation in practice, which would
654 incorporate a systematic approach, taking into consideration the *nature* of technical work
655 including planning, timescales for implementation, the *content* of that work (what to do and
656 how) and also the psychosocial concomitants that influence the *delivery* this process. It is
657 acknowledged that driving change/development about current coaching practice is not easy
658 since golf, like many sports, has long standing traditions and will require some shift in culture
659 as well as the style of coach education. However, this step is worth pursuing to the benefit of
660 both practitioners and pragmatic researchers alike.

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835 **Table 1**836 *Macro, Meso and Micro Goals, Structure and Methods*

Phase	Defined Timescale (% of coaches)	Goal(s) (% of coaches)	Structure of Work to Achieve Goal(s) (% of coaches reported by)				Methods to Achieve Goal(s) (% of coaches reported by)		
			Nature	Frequency	Duration	Considerations [*]	Physical	Psychological	Organisational
Macro	Calendar Year (90%)	Identify, and improve ball flight and related technical change required (100%)	Coach-led (100%)	Scheduled during gaps in playing schedule (70%)	Varied	Present Future	Observation of all aspects of players' game (100%)	Observation under tournament pressure (50%) Assessment of personality (10%)	1–2-day assessment (40%) On course (80%)
	Around 4 Majors (10%)	Improve ownership / autonomy (30%)		At national training camps (30%)					Discussion with other key stakeholders (30%)
Meso	Off-Season: Nov–Jan (90%) (3 month period)	Technical change (100%)	Coach-led (80%)	Varied from 2 sessions per week to once per month.	Varied (5min–2 hr)	Present Future	Remove ball Exaggeration. Slower swings. Sticks on ground. Use of shorter club.	Focus of attention: club movements, specific ball flights, sticks on the ground. Self-diagnose swings through observation and questioning (i.e., if the ball does this, why?) Problem solving (i.e., how do you hit this shot?)	Use of net to remove outcome.
	In-Season: Feb–Oct (90%) (9 month period)	Technical change (100%)	Player-led (70%)	Varied / Infrequent	5 min–2 hr per week	Future Present	Methods for technical change as per those reported in 'off-season' work.		
	Time between each major (10%)	Technical change (100%)	Coach-led	Every week	1 hour				
Micro	Tournament Week (100%)	Optimise immediate performance (90%)	Collaborative on coach attendance (100%)	Every day at event	Varied	Present Future	Technical drills a week before or early in week if needed. Target weakest areas	Reflection post-round, confidence, visualisation, pre-shot routine, self-awareness, decision-making, reduced volume of swing thoughts, commitment.	Stress exposure Educate Caddy Increased time on golf course (instead of range) Competitive scenarios Reduce time with player.
		Smaller events as prep for key events (10%)	Collaborative	Every day at event		Future	Train shots required for key events	Train mental skills required for key events	

837 *Note: Bold denotes primary consideration*