Thinking Aloud: An exploration of cognitions in professional snooker

James C. Welsh, Stephen A. Dewhurst, John L. Perry

University of Hull, Cottingham Road, HULL, HU6 7RX, UK

Corresponding author: James C. Welsh, School of Life Sciences, University of Hull, Cottingham Road, Hull, HU6 7RX, UK. Email: j.c.welsh@hull.ac.uk

Abstract

Objectives: Presently, there is no exploration into the cognitive processes of super-elite and elite professional snooker players during real-time performance. Therefore, this study explored the cognitions of seven professional snooker players during real-time solo practice performance. Design: A Think Aloud (TA) protocol analysis. Method: This involved players verbalizing and explaining their thoughts within naturalistic practice environments. Player's verbalizations were recorded during each solo practice performance, transcribed verbatim, and analyzed via protocol analysis. Results: Analyses revealed an array of continuous reactive-adaptive cognitions relating to stressors and coping strategies during performance, as well as general snooker-specific related thoughts. Specifically, the results highlighted key stressor themes which were coded as: Table Conditions, Distractions, and Mistakes. Our main finding was: Shot Preparation being essential to problem-focused coping, with Rationalizing integral to emotion-focused coping. Further results highlighted the visualperceptual and cognitive expertise of players, with regards to identification of problem balls and cueball spatial awareness, insofar as unearthing the deliberate structure to practice routines. Conclusions: The study's original and novel findings lend further support to the transactional process of coping. Whilst accordingly, the utilization of TA significantly contributed to our limited understanding of super-elite and elite real-time cognitions in professional snooker and self-paced sports generally. Future research should continue to dissect the sport-specific nuances that underpin real-time performance, not only during practices, but within competitive play. TA is an appropriate methodology to use in the domain-specific sport of snooker.

Keywords: Coping, Think Aloud protocol, Professional Snooker, Super-Elite, Cognitions, Practice

Introduction

A proliferation of studies exploring the *real-time* cognitive processes of performers in sport has yielded researchers and practitioners with perspicacity over the last decade (Kaiseler, Polman, & Nicholls, 2013; Nicholls & Polman, 2008; Whitehead, Taylor, & Polman, 2015, 2016b). Verbal-cognitive data has been collected from various sports using a Think Aloud protocol (TA) in self-paced closed skill sports, such as golf (Calmeiro & Tenenbaum, 2011; Eccles & Arsal, 2017; Kaiseler et al., 2013; Nicholls & Polman, 2008; Whitehead et al., 2015), and trap shooting (Calmeiro, Tenenbaum, & Eccles, 2010), which have concentrated upon appraisals, *coping*, and differences in stress. TA primarily involves participants to continuously verbalize their thoughts during the performance of a task. Furthermore, researchers have investigated the planning strategies of expert and novice players in tennis (McPherson & Kernodle, 2007). And recently, researchers have extended their verbal cognitive pursuits into endurance sports, such as, cycling, endurance running, as well as coaching in rugby (e.g., Sampson, Simpson, Kamphoff, & Langlier, 2015, Whitehead et al., 2016a; Whitehead et al., 2017, 2018). Yet unanticipatedly, there remains an exiguity of research exploring the real-time cognitions of *super-elite* and *elite* performers *in situ,* and in other sports, such as, *professional snooker*.

In general, findings from these verbal protocol enquiries have typically identified how performers thoughts are directed to managing (e.g., cope, mental strategies) continual internal and external dynamical cognitive processes (e.g., stressors) during sporting performance (e.g., Lazarus, 1999). For example, Nicholls and Polman (2008) found that high level golfers appraised a range of stressors and coping strategies during performance, but the golfers frequently experienced a variety of stressors before deploying a coping strategy. Conversely, in a recent TA study on the real-time thought processes of distance runners, Samson et al., (2015) identified three major themes containing sub-themes relating to; Pain and Discomfort (e.g., stressors), Pace and Distance (e.g., coping/strategies), and Environment (e.g., coping/strategies). And Whitehead et al. (2017) found very similar results (e.g., pacing

strategies and stressors) with cyclists thought processes changing continuously and becoming more prominent at different times.

To capture such detailed on-line thought processes of expertise, researchers have moved to utilize Ericsson and Simon's (1993) Think Aloud (TA) protocol analysis as their *modus operandi*. This is due to limitations of retrospective recall investigations (e.g., forgetfulness, retrospective bias) and growing calls to increase methodological rigor in qualitative research in sport and exercise psychology (e.g., Nicholls & Polman, 2008; Eccles & Arsal, 2017; Smith & McGannon, 2017; Whitehead et al., 2017, 2018). Nevertheless, TA has shown to be an effective method to collect real-time cognitive thought processes in other disciplines, such as chess (de Groot, 1964; Gobet & Charness, 2006) and algebra (Cook, 2006).

According to Ericsson and Simon (1993) there are three differing types of verbalizations; Levels 1 and 2 are purported to not affect performance outcomes, and Level 3 verbalization requires the individual(s) to explain their thoughts, ideas, hypotheses, or motives. Though, Level 3 verbalization is suggested to impede performance through reinvestment (e.g., Beilock & Carr, 2001; Masters, 1992). However, Whitehead et al., (2015) demonstrated that Level 3 TA verbalizations did not lead to reinvestment (i.e., disrupt motor performance) among skilled golf performers during a putting task and over six holes of play. Data showed that Level 3 TA protocol generated richer detailed and nuanced information in both the quantity and quality when compared with the Level 2. And despite the preferential use of Level 2 verbalization within TA studies, it is suggested that there is no assessment of completeness under some conditions because some cognitive processes do not form part of focused attention, or are readily verbalized (Whitehead et al. 2015; Wilson, 1994). More explicitly, Level 3 enabled the golfers to provide greater explanations of their performances, with regards to planning and evaluation of shots, about the score, and the pre-performance activities they engaged in prior to a shot.

Unequivocally, such TA literature has augmented our theoretical understandings of the transactional nature of psychological variables and coping processes experienced by performers in sport. However limitations remain, as it could be argued that particular certain sports have been overly employed (e.g., golf, cycling, running etc.) throughout the sport and cognitive psychology literature. Thus, in order to progress our theoretical appetite of how experts appraise and cope with the ever-changing cognitive demands during sporting performance (e.g., Lazarus, 1999), it is vital that other types of sports are brought to the fore.

Exploring the cognitive dynamics of professional snooker theoretically widens the opportunity to understand how performers' cognitions unfold in real-time elite sport and generally. Indeed, such is the limited research into professional snooker, Abernethy et al. (1994) remain to our empirical knowledge the closest and sole TA contribution in deciphering the cognitive differences between various skill levels of Australian snooker players (i.e., novice, intermediate and expert), albeit using artificial stimuli. Thus, naturalistic endeavors capturing the real-time mental representations of super-elite and elite world professional snooker players *in situ* currently do not exist.

Notwithstanding the concerns of ecological validity, Abernethy et al.'s research is highly commendable. From their battery of visual (i.e., pattern recall and pattern recognition tasks) and sport-specific perceptual and cognitive tests, they found that expert snooker players did not differ from novices in their general visual skills, but rather in their ability to rapidly encode, recall, and recognize structured perceptual information. In addition, expert players had greater cognitive ability to evaluate and discriminate the strengths and weaknesses of varying game situations, as well as planning six or more shots in advance of the current shot.

Drawing on comparable research that involves strategic thought processes, Gobet and Charness (2006) established that expert chess players possess heightened procedural (i.e., knowhow and pattern recognition) and strategic knowledge (i.e., concepts and rules) during a TA protocol. More specifically, that expert chess players exhibit more depth, breadth, and

speed when searching for a correct move than novices (e.g., Abernethy et al., 1994; Chase & Simon, 1973; de Groot, 1965). Concurrently, studies on algebra tasks using TA protocol have shown that experts firstly expend a considerable amount of time in qualitatively understanding the problem, then construct mental representations of the problem to define the situation and constraints (Cook, 2006). Therefore, collectively speaking, it would appear experts (across various disciplines) strategize their cognitive processes towards pondering more alternatives, thinking more ahead in moves, and are better adept at evaluating the options more rapidly than novices (e.g., problem/task focused).

To date, the TA sporting literature has provided rich in-depth of cognitions of self-paced and endurance sports, insofar as demonstrating that thoughts occur as an ever-changing process (e.g., Lazarus, 1999). However, despite these efforts, there appears to be an overuse of particular sports investigated. Also, there is a highly notable absence of super-elite and elite performers employed within TA research and across the sport psychology literature.. And even though the TA protocol has been used within laboratory settings on snooker (Abernethy et al., 1994), no naturalistic studies examining the real-time thoughts of super-elite or elite professional snooker players during practice exists. According to Lazarus (2000), the hallmarks of best research on cognitive processes ought to involve a framework which allows data to be process orientated, and the TA method has been utilized well when investigating expertise (Whitehead et al., 2015). Collectively therefore, TA offers a propitious methodology to capture the real-time cognitions of world professional snooker players in their environments for the first time.

As such, the purpose of this study was to employ a ‘think aloud’ procedure to examine the real-time cognitions of professional snooker players during solo practice performances within naturalistic settings. Crucially, whilst we offer no *a priori* hypotheses due to the exploratory nature of this study, we remained cognizant of the extant TA and coping literatures findings.

Method

Participants

Participants were seven male UK professional snooker players, comprising super-elite (rank, < 5, $n = 1$), elite (rank < 17 – 48, $n = 2$), and lower ranked professionals (rank > 64, $n = 4$). As such, this cohort included a "Triple Crown Winner" (i.e., World Championship, UK Championship, and Masters). In addition, other participants had reached ranking finals, semi- and quarter-finals, as well as multiple Crucible (i.e., World Championship) and TV appearances (e.g., BBC, ITV, Eurosport UK). Participants ranged from 27 to 40 years of age ($M = 34.0$, $SD = 4.5$) with a total of 185 ($M = 26.4$, $SD = 3.6$) years of playing experience between them. All participants were to known the first author and initially contacted by phone, with written informed consent subsequently provided by all participants. The participants were assigned pseudonyms of James, Michael, Steven, Anthony, Dene, Paul, and Stuart.

Pilot study

Following ethical approval from a UK Higher Education Institution, a pilot study was performed to refine the material and procedural elements of this study. Based upon the rich in-depth findings and discovery that Level 3 verbalizations do not lead to reinvestment in skilled performers (e.g., Whitehead et al., 2015), we posited that Level 3 would not disrupt our super-elite and elite sample. The pilot study consisted of a former professional snooker player verbalizing (Level 3) and explaining his thoughts during a solo snooker practice session (various routines) within a naturalistic practice setting (private matchroom in club). This aided in determining the feasibility for; (a) a snooker player to freely verbalize and explain their thoughts, ideas, actions in their own environment; (b) whether the snooker players cueing would be obstructed by recording equipment; and (c) if cueing sound would interfere with clear recordings of verbalizations.

For brevity, the pilot study participant followed the Level 3 TA guidelines as set out in the main procedures below. The participant demonstrated his ability to freely verbalize and

explain his thoughts and actions using Level 3 without disrupting play. Unfortunately, it was discovered that cueing noise interfered with the capture of verbalizations, as well as the microphone wire detaching from the digital voice recorder when at full stretch across the snooker table on certain shots. Therefore, to counteract these issues, a longer microphone wire and readjustment of microphone position was enforced. Subsequently, from playback of the pilot study's audio recording it was deemed 40 minutes of playing time was appropriate for sufficient data collection (i.e., demonstrated a highly rich and detailed overview of real-time cognitions).

Materials

Olympus DS-50 digital voice recorder with a small microphone attached to the collar was used to capture all participants' verbalizations.

Procedure

In alignment with Ericsson and Simon's (1993) guidelines, all participants took part in a TA pre-practice exercise, specifically: (1) counting the number of dots on a page, (2) an arithmetic exercise, and (3) an anagram problem-solving task. Additionally, participants were asked to explain how they completed their exercise (Level 3 TA). Whereas during play, this related to asking participants to describe their thoughts before and after shot execution as well as providing explanations for their actions (e.g., why a certain shot was played/chosen). Also, snooker players were told that they could engage in TA between shots if they had any thoughts they wished to verbalize. Sequentially, participants were instructed to, "Think Aloud and say everything/anything that comes into your mind before and after each shot you take. Every time you TA can you please explain your thoughts on this" (apart from the striking of the cueball phase). In accordance with the extant literature (e.g., Nicholls & Polman, 2008; Whitehead et al., 2016), if in the event that participants fell silent for an extended period (20 seconds), they would be asked to resume thinking aloud by using prompts, such as, "Please think aloud" and/or "Please continue to explain your thoughts". However, such reminders were extremely minimal as players demonstrated excellent abilities

in talking amidst playing. Throughout the whole of the data collection period, the first author was present during each participant's solo practice session.

All participants were permitted to practice whatever routines they felt comfortable with during their solo practice sessions. These sessions resulted in familiar routines, such as, line-up's, T's, color clearances, actual frames of snooker, and hypothetical pressure game situations requiring clearances (e.g., 49 behind with three reds left and all of the colors, 70 behind with five reds left and all of the colors etc.). Thus, all players routines were deliberate (i.e., goal-driven or stressor induced), with the emphasis on total clearances, or imagining themselves playing in match pressure situations.

Data Collection

All participants were wired up to a digital voice recorder, with a small microphone attached to their t-shirts. The microphone wire was placed under the t-shirt and connected to the digital voice recorder which was placed inside their trouser pocket or on the back of the trouser attached to their belts. Participants recorded their chosen routine from the onset and before the commencement of any other routine performed during their solo session.

Data collection commenced from the player setting up their practice routine(s). Data collection lasted from 41 minutes, to the longest at 166 minutes ($M = 83.71$, $SD = 54.04$). These times varied due to the players availability (and table availability within snooker clubs), playing speeds, shot/decision times, and articulation of verbalizations. Each snooker player played on his own table (tournament standard), used their own snooker cues (various makes) and played with tournament match balls.

Data Analysis

Each participant's TA verbalizations were transcribed verbatim and checked for relevance and consistency using inductive analysis. This allowed for content to be grouped into raw themes. To adhere to the relevance criterion the verbalizations associated to snooker performance, and in relation to the consistency criterion, there was a consistency of verbalizations with verbalizations that preceded those (Nicholls & Polman, 2008). The

constancy of these verbalizations typified cognitive processes that, “can be used as evidence for the course and nature of these processes” (Ericsson & Simon, 1993, p.170). Critically however, we took all verbalizations into account (i.e., not those just deemed task relevant) following calls from researchers who assert that “unimportant information” could be interpreted as an external dissociation strategy (e.g., Brick, McIntyre, & Campbell, 2014; Whitehead et al., 2017).

In keeping with the extant TA literature (e.g., Nicholls, & Polman, 2008; Samson et al., 2015; Whitehead et al., 2017) we used line-by-line inductive content analysis to identify recurring themes (Maykut & Morehouse, 1994). Thus, our idiographic methodology positioned ourselves in ontological relativism, with a subjectivist epistemology (e.g., Sparkes & Smith, 2009). Furthermore, during this exploratory inductive approach, it became eminent to the researchers that the cognitions elicited from the participants generally aired towards stressors, coping strategies, and further snooker related aspects. Therefore, in order to deduce what stressors and coping strategies were, we drew upon the phenomenological findings of Nicholls, Holt, and Polman (2005). Thus, we identified verbalizations that had the potential to cause snooker players concern or negative worry, which were coded as stressors. Alternatively, verbalizations that highlighted attempts to manage stressors, or facilitated performance in an optimal way were coded as coping strategies. Concurrently, all stressors and coping strategies were tallied across the sample.

Stressors and coping strategies were grouped together as first-order themes and assigned a descriptive label, with a rule of inclusion written for each theme. For example, one first order theme was described as “planning shot” with the rule of inclusion “The snooker players planned all aspects of the shot (e.g., cannons, screw, stun etc.), including the cueball path, cueball and other balls’ landing areas/spatial awareness, and cushion use”.

Credibility

Following calls to further strengthen methodological rigor, provide transparency, and attempt to deepen our analyses (Smith & McGannon, 2017), we adapted a member

reflections procedures (Bloor, 2001, p.395). According to Tracy (2010, p.844), this umbrella term is applicable to wide ranging paradigmatic approaches, which in our case, complimented the cognitivist underpinnings of the think aloud protocol and our position of ontological relativism (e.g., participants individual realities) and subjectivist epistemology (Sparkes & Smith, 2009). According to Eccles and Arsal (2017, p. 515) "the results from the method would be different from, and not better or worse than, those obtained by alternative methods of studying thinking." Hence, it is suggested that the number of criteria used in each project can be modified for certain purposes (e.g., Sparkes & Smith, 2009; Smith & McGannon, 2017). Critically member reflections allowed us to adhere to our ethical commitments, whilst allowing participants to reflect upon and critique the understandings (e.g., meaningfulness) and accuracy of our findings.

For example, during the taxonomy of raw data, the researchers were divided upon the criteria underpinning the major themes found. Therefore, we liaised with the participants in order to ascertain if the criteria pertaining to the second order themes were true in their associability to first order themes. This provided the participants with the opportunity to define their thoughts and include any further information. Following lengthy discussions and determining of findings with the participants, the researchers then consulted with two independent leading snooker coaches (i.e., critical friends) to provide further reflective scrutiny of our findings. Following this robust feedback and elaboration from the coaches, we conversed with the participants again to ensure all parties were content that the criteria underpinning second order themes were credible in their understandings.

Results

Participants' transcripts revealed 761 stressors from 85 sources (Appendix 1), and 1349 coping strategies from 103 sources (Appendix 2). Key stressors identified by the participants were; *table conditions*, specifically, ball polish (35), pace of cloths (36), and kicks (18); *distractions*, specifically, negative/anxious thoughts and commentary (20); and *mistakes*, specifically, shot errors (189). Participants engaged more in problem-focused

strategies (1139) than emotion-focused strategies (210) and reported more frequently on *planning shot* (339) and *cueing thoughts* (92) in relation to problem focused strategies, whereas *rationalizing* (99) and *positive appraisal* (44) were essential to emotion-focused coping.

Idiographic profiles present a combination of general ongoing cognitions in relation to stressors and coping strategies in-action as well snooker related aspects, hence this combination aided in heightening the completeness of verbalizations. Akin to Nicholls and Polman (2008), to exhibit our coding of TA data, all stressors are followed by the code [S], whereas coping strategy is followed with the code [C].

Stressors

Ball polish/new balls. From Michaels's responses (line-up routine), one key stressor was immediately evident and throughout his solo practice session, which was backed up with multiple coping strategies. As explained by Michael "…When we were in Gibraltar the white was like a bar of soap [S], they were slippy [S]…it did not work if you hit any side [S], any sort of unwanted side [S]…even if you played a shot like this you could miss that easily" [S]. Following on from these comments Michael reveals how he has tried to cope with ball polish, by altering his technique to control the cueball more efficiently, and use of cueing thoughts, "Well, a lot of time spent in trying to shortening up at the minute [C], especially as I've polished the white [S], hence there's too much on this [S], just center ball [C] and short cue action [C]. Put more simply, Michael says "Just concentrating on the middle of the white [C], I know the potting angles so just running through for this one" [C]. Evidently, Michael plans his shots beforehand in order for him to employ his coping strategy, thereby maximizing his attention on cueing delivery [C] (feathering/timing of strike) and shot execution [C].

As Michael's solo practice progressed his responses on coping strategies increased on the issue of ball polish, so much so that Michael declares, "I have to play a little higher on the white [C]…I'm still learning, still recalibrating yeah [C], like that one, due to reaction of polished white [S], awful shot" [S]. But this is followed up by Michael's trying to rationalize

(positive appraisal) the outcome of his shot "…but its fine, I'm still on a red [C]…long as I'm hitting middle of the white [C] and I can feel the weight of the cueball on my tip" [C].

Interestingly it has emerged that Michael uses a form of bio-sensory feedback (i.e., body-cue-cueball striking) as a coping strategy to counter the effects of ball polish on the cueball [C]. Markedly this has the potential for Michael to adapt his technique (e.g., timing, striking, and visual-cognitive functioning) more rapidly to the varying playing conditions he is likely to encounter across tournaments and practices [C]. Thus aptly, Michael summates, "Centre of the white [C], so when a problem comes up [S] that's what you're trying to do, give a distraction [C], not necessarily to eradicate but to help you" [C].

On another slant, Thomas offers his insight to the difficulties of playing with new balls on thinner cloths, with regards to how they react much differently, and how this creates a multitude of ambiguous cognitions:

> The other thing as well that I've noticed, like when you're away, if you're playing with new sets of balls or polished balls it's like it seems to break wider [S], and it don't help with the thinner cloth [S], and you just think well "is the polish done that [S], is the slide done that, the slide [S], you think the cloth coz it's so thin [S]" and then you do start to think "is it me, is it the way I'm cueing [S], honestly it's such a strange balance really.

Pace of cloths. In close proximity of balls, the varying cloths on tables resulted in participants giving differing conceptual views of how cloths affect their playing style/approach. For example, Dene narrates the challenges faced when trying to adapt from naturalistic practice conditions to practice and match conditions at a venue:

> You go onto a practice table at a venue and you do like a similar routine to this and you think "well I'm all over the place why can't I clear them up or anything?" [S] and because, it's like you say it's because this is my table I'll play the shot a certain way and it's just like, I feel like I have to concentrate more on another table [S], as if I'm not concentrating enough on this table [S], does that make sense?

To further clarify his points on the difficulties faced when adapting to tournament cloths Dene explains how he has to readjust to angle displacement. So much so that he feels that deliberately practicing more routines involving potting is more beneficial to his game than safety exercises.

> And sometimes I feel when you go onto the match table from the practice table, because obviously the angles are different [S], so it's like even though I'm practicing the safety [C], you've got to be able to adapt [S]…Yeah not nice when you can't flow [S]. So like I say I think I'll naturally prioritize potting routines over safety routines [C], erm just because it's the name of the game.

In substantiation of Dene's remarks on adapting to the table conditions, James reveals that he has had to aim higher on the white [C] and shorten his cue-action [C] to help acclimatize to the thin cloths:

> On these delicate tables [S], because you know I like to get through the ball erm [C], and sometimes you feel like you've got to, I've started to play the white a lot higher [C], I can still get through it but I get less spin [C], you still aim on these slippy tables [S], on brand new cloths [S] with brand new balls [S], you just hit the ball in the same place, you lose the white all of the time, I do anyway [S]. If you're not willing to change your strike and have a much shorter action [C], which is difficult, because you're adapting that for every shot [S].

Distractions

Negative/Anxious thoughts. As pointed out in the results, negative thinking was frequently referenced to by the participants' during their solo practice sessions. Here, Anthony explains how anxious thoughts during play affect his thoughts and actions:

> Generally as the match goes a bit scrappy [S], I don't know if anxious is the right word but you feel alright but you just want to get in amongst the balls [S], you know my strengths are to try and win frames in one visit, one go or both [C]…well sometimes you start turning balls down you would normally go for [S] because you

start thinking “oh if I miss it there’s an easy 20 or 30 on you know [S], you just ain’t got to worry about it [C], play to, try and play to your strengths if you can [C], obviously there’s times when you might not be feeling very good about yourself [S], so I might have to start turning the odd ball down [S]…erm I think it’s just you want to perform [S] rather than emphasize “it should be I want to win”[C], so if I’m struggling, fuming, angry, getting a little bit annoyed with myself [S], remind myself you’re here to win [C].

Furthermore, Anthony highlights the haphazard nature of anxious thoughts [S], in relation to moods and feelings experienced during matches [S], and claims that these issues may be more situation-specific during matches [S].

Erm I don’t know, it’s situations [S], sometimes obviously you get a bit nervous a bit more [S], other times, sometimes you’re just potting them ain’t ya, I don’t er, yeah you get in the zone or whatever it is, it’s not always in the zone all of the time [S], fucking hell I wish I could, I wish I knew how to get in the zone all of the time [S], I don’t, sometimes I’m thinking “what am I going to have for dinner ?” [S] do you know what I mean…it can happen in big games where you’re supposed to be excited [S], I’m sure at one stage…at the crucible I was just thinking about “what’s for tea?” [S] It’s mad. I mean obviously sometimes, sometimes it’s, they should be the most nerve-wracking moments of your life, but they’re not, calmish…and other times where’s there’s absolutely no need to stress or worry about anything and you’re like fucking nightmare with yourself [S], but that’s when you’ve gotta say “get a grip, do what you do” [C] that’s where the pre-shot routine comes in [C].

Commentary/earpieces. In the following excerpt, James highlights the challenges he faces when dealing with commentary during his matches:

There’s a lot of criticism that goes on in a match [S], in a commentary box [S], whereas in my opinion you’re there to paint the picture of what’s going on on the table [C], and explaining the nuances of the game [C], and the if’s, but’s and maybe’s

> [C], not really to slag 'em [S], there's a bit too much of that [S]. If I sense the crowd level of expectation [S], the level of expectancy to play a shot is getting higher [S], I know that's being fed to them in the commentary box that I can see [S], I think we're the only sport where I can see the people that are explaining the action [S]…there's so much I'm trying to keep out [S], keep it out of my brain [S]. You know we're not talking about camera moving [S], distractions in the crowd [S] and mobile phones going off [S], but there's so much going on that I'm aware of [S], or perhaps I'm too aware of [S], that at you, that's taking away from your focus [S].

Indeed, James further laments the potential deleterious effects of commentary and the earpieces in the following narration:

> I tell you what, it's terribly off-putting when you're out there concentrating and the crowd are silent and you know a certain commentator has made a joke in the box [S], so the crowd at home, he's commentating for the crowd at home, but the crowd in the arena have reacted to his joke and laughed while you're on a straight blue [S], well I can't think of anything, I can't think of another analogy for it, I can't think of another performance where that can be affected by that [S]…I remember playing a shot, I can remember playing it at the Crucible as I'm feathering up to the ball getting ready to go, as I'm literally about to take it back to the ball, I can literally hear the commentator say "this is a big shot" [S] and I had to stop [S], start again [C]. Now he knows, he knows saying this in the commentary box, he knows I've heard him because somebody has got their earpiece turned up [S], and then I'm going home, it's difficult…commentators are like "how's he missed that" [S] and I'm like "well, how long have you got, how long have you got mate?"

As a result of the aforementioned information, we can see how the interchangeableness of distractors becomes increasingly difficult to control, regrettably to the extent that it can cost a player a match. In greater ponderance James adds:

> It's the unexpected distracted noise [S], well for years I used to play through things like that [C], if a phone went off, if I was down on a shot and a phone went off [S],for lots of reasons I would carry on and play the shot [C], I didn't want anybody to know, and almost admit that it had distracted me, pride [C], I wanted to show, demonstrate, that I could play through that, you know that phone's not going to put me off [C], whereas it's already put me off, it's already in [S].

While in a humorously, witty grandiloquence, James says:

> I'm trying to win the World Championship [S], to this red and get up for the blue [C], and I'm also trying to demonstrate to the man in F6 that his phone hasn't put me off [S], but it's difficult isn't it.

Mistakes (e.g., shot errors, hitting thick, finishing straight, anxious thoughts). A high frequency was reported by players concerning the arbitrary nature of mistakes during play. To the onlooker, these mistakes go unnoticed, however to the expert player, there's an unceasing battle of emotions (e.g., dissatisfactory), judgements and/or calculations to consider when performing. Here Anthony reveals his thoughts:

> That's straight [S], 20, two behind, 6, 15, 20 [C], I need the red, color and the blue [C], potting the pink, stroking it and making sure I'm leaving plenty of angle [C], straight's no good to any man [S].

On the other hand, Steven demonstrates the extreme difficulties faced when the cueball is not under perfect control, and how the effects of this play havoc with conscious thought processing when performing:

> So if all of a sudden I've started to lose the white [S] and I've got to pull out a mid-range pot [S], after mid-range pot after mid-range pot [S], all of a sudden more pressure starts coming on your cue-action doesn't it [S], because everything has to hold up better [S] (64-68]…see how my white is a "loosey goose" [S]…that was because I finished almost straight [S], and I wanted to finish slightly lower on the blue [S], I'd just gone through slightly too much [S]…it's just because I'm trying to be so

precise [S], and I wasn't precise as I wanted to be [S], so it's not an annoyance [C], it's a realization of "ok well I'm trying to be this precise" so you know [C], just try and learn from what I'm doing [C]. Quite often I'm just over-cueing the backswing just slightly too much [S], so bringing it back too far [S].

Problem-focused coping

Planning shot. Evidently the key highlight of our findings was shot preparation. Shot preparation involves many aspects from; planning, decision making, knowing the shot, leaving the desired angles, pace of shots, identifying solutions and cueball paths among others (see Appendix 2). In respect of consolidating this information (e.g., Appendix 2) the critical reflections aided greatly with this (Bloor, 2001). Accordingly there were numerous amounts of similar explanatory verbalizations on this task-related topic from players. Here Dene explains:

Yeah options [C], I'll play into the area I think [C], I've come a little too far there [S], could have been a little closer to give myself choices again [S], but I'm straight enough on this red, the roll through here [C], with the other reds gone the position on the black is not as important so more space to move the white [C], so even if I leave myself straight or slightly off straight it's not too much of a problem [C].

In the following excerpt Steven highlights the ability to think shots ahead from his current cueball position, thereby showcasing his ability to problem solve his way through break-building:

Well I'm thinking now screw back [C], leave the white low on the black [C], so I can run through or stun through and play for one of these two [C], so I'm playing 2-3 shots ahead in this situation really [C], so yeah it's just playing for an area [C], although if you said I want you to play this red to the black for the bottom red [C], if you told what red to play for each time, then obviously you're thinking differently aren't you [C]. Depending on where the balls are, so like obviously I can play for any area here now [C], doesn't really matter but you're still at the same time "I don't want

to be moving my white from there to there to there" [C], it needs to be all within 5-6 inches of each other do you know what I mean [C], keep everything simple [C].

While here, James offers his unique insight to the thinking and planning of shots ahead with regards to; leaving the right angles, what colors to take, the outcome of potential shots, and identification of key balls to win the frame. However interestingly, James makes reference to how this situation heightens his senses at this point:

Right we're running out of loose reds [C], starting to look at the problem [C], getting close to the winning line in the frame, I've sensed that [C], probably need three or more reds [C], erm loose reds are at a premium [C], so here I'm trying to, knowing that the only loose red that pots is that one which is difficult to get to [C], I'm starting to see a situation where if I pot this red and leave it short on the blue but high on the pink [C], would leave the angle [C], then to move red [C] out of the way [C] which frees that one up [C], I will then be able to pot that red [C], this red [C], and that red near the corner [C], that also puts these two reds available to this middle pocket [C], and you know if I get the next two shots right the frame is there [C].

Cueing thoughts. The second most frequently cited problem-focused coping strategy by participants was their use of cueing thoughts. While there were many examples of cueing thoughts, here Michael gives an excellent example of how he uses cueing thoughts to manage stressors during performance:

I know when I'm going to play well if I'm nice and smooth [C], so if I'm struggling or anything like that [S] I consciously tell myself "smooth" on every shot [C], every time I'm down on the shot, on my backswing, I'm pulling it back and I'm saying "smooth" and "dead still"[C].

Interestingly, from within the extant literature (e.g., Beilock & Carr, 2001; Dreyfuss & Dreyfuss 1986; Masters, 1992) it is purported that if participants' consciously attend to or monitor their performance (i.e., execution) it is likely to prove deleterious to performance,

hence leading to reinvestment, yet in Michaels case, it aids in the facilitation of optimal performance.

To further explicate Michael says:

> I know if I stay dead still [C] and my cueing arm is smooth [C], don't matter if I'm shaking like mad [S], nervous [S], not nervous, sometimes totally chilled out [C], you know sometimes you don't feel like playing [S], but I know if I tell myself "stay dead still, dead still" [C] and "stay smooth, smooth" [C] they're the two words that make me lock my arm in how I like it [C], makes it feel like everything is going to go in if I'm like that, "smooth" [C], "head still" [C] and "smooth" [C], that's it, that's it, key word yeah. (159-166)

Emotion-focused coping

Rationalize. An essential part of coping in snooker was associated with players recognizing that they need to keep their emotions at bay during performance. This led to players explaining their thoughts on having to be rational in their thought processes. Here Anthony expresses his thoughts on recognizing that sometimes the balls do not run kindly by adding:

> So I'm going to play for the yellow [C], always the same, always play a shot [C], Selby never wastes a shot, erm know like when you get the hump sometimes [S], you know like trying to force the issue [S], pot balls, don't land on one [S], instead of just getting down and chipping a shot and just putting the white safe [C], instead of going back to your chair sulking [S], you know having a little second so you can actually do something with it [C], even though I'm not happy with what's just happened [S], "can I actually do something with this shot?" [C], do you know what I mean, so yeah try and have a purpose for every shot [C].

In similar vein, James extends upon Anthony's views by saying:

> I often dip into this when I play, I won't play for the blue [C], because playing for the blue brings in the risk of being short [S], and now you can just make 6 and play safe [S]. In a situation like this, just play for the green or the brown [C]…so just run away

and then come back [C], if you finish there the break is over [S], or it's much more difficult than it should have been [S].

While in philosophical tongue, Steven concedes that it is all about giving one's all irrespective of the outcome:

Because I'm a laid back person [C], so I don't always ever think "I must win this match at all costs [C]…you know I do obviously play every game to win [C] but it's more about 'do everything I can to win' [C] and if that's good enough it's good enough do you know what I mean [C],…I would just make myself as repeatable as possible [C].

Discussion

The novel and original exploratory findings of this study demonstrated that super-elite and elite professional snooker players' real-time cognitions were generally directed towards stressors, coping strategies, and snooker related aspects. From the collection of snooker players thought processes, three key stressor themes emerged: (a) Table Conditions, (b) Distractions, and (c) Mistakes. Alternatively, our main finding was that super-elite and elite professional snooker players engaged in an extensive amount of problem-focused strategies, explicitly Shot Preparation, than emotion-focused strategies, namely Rationalizing. Analogous to the extant TA and coping literature, the task orientated verbalizations varied continually over solo practice performances. The findings provide further support that coping occurs as a cognitive process to manage internal or external demands (Lazarus, 1999).

In reaffirmation, no naturalistic TA study on super-elite and elite professional snooker players' cognitions during solo practice existed. Although our TA study is the first to provide a significant contribution to the sport psychology literature on understanding super-elite and elite professional snooker players real-time thoughts within ecologically valid settings, there are limitations that necessitate consideration. Indeed, even though we utilized practice settings and real full-size matchplay tables, the fact that participants needed to be reminded to TA and continue to explain their thoughts would appear unnatural, especially in terms of

548 reinvestment (e.g., Beilock & Carr, 2001; Masters, 1992). However, as explained in the
549 procedures, players were very adept at verbalizing during performances suggesting they have
550 a high allocation of cognitive processing resources (e.g., attentional control, goal-directed).
551 As a matter of fact, only five pots were missed during nearly ten hours of playing between
552 seven players. Therefore, while we did not measure performance per se, the study signifies
553 that this procedure did not truly impede the performances of our super-elite and elite cohort.
554 Though, measuring performance would be desirable for future research purposes.

555 Within the TA literature (e.g., Nicholls & Polman, 2008; Whitehead et al., 2015,
556 2018) it is acknowledged that there cannot be complete certainty that verbalizations are a true
557 representation of the thought(s) being elicited at the time (i.e., not all cognitive processes are
558 conscious). Thus, individuals cannot explain what is happening outside of their awareness as
559 unconscious processes cannot be verbalized (e.g., Nisbett & Wilson, 1977). Hence, in our
560 study, players may have given implicit theories about their thought processes which may
561 directly relate to their general snooker cognitive processes during both practice and
562 matchplay (as pointed out in the results). Contrariwise, we argue that these generalizations
563 offer sport psychology practitioners and consultants to better understand all possible thought
564 processes during snooker performance. Undoubtedly this can help players to maximize their
565 performances and well-being. Nevertheless, our understandings of real-time cognitive
566 processes across all levels of snooker (and self-paced sports) would certainly benefit from
567 experimental studies employing competitive situations; such as practice matches (e.g.,
568 pressurized conditions and/or environments) to see how players cope. Hence, a limitation of
569 the current study is the absence of a competitive situation.

570 Moreover, key questions arising from our findings, such as: ‘how’ and ‘when’ do
571 stressors disrupt thoughts and motor processes? Some possible suggestions within our
572 findings (i.e., Anthony) are that stressors may become more negatively heightened during
573 situation-specific game scenarios (e.g., multiple shot choices), or around key pressure pots
574 (e.g., frame/match winning balls). Conceivably these situations would induce more

prominent anxious/negative thoughts than others (i.e., thinking time process). These appraisals draw comparisons with other TA investigations who found that verbalizations vary over distances in cycling time-trials and distance running, with more stressor related cognitions combatted by mental/pacing strategies during the early stages of performance (e.g., Samson et al., 2015; Whitehead et al., 2017, 2018). In contrast, to counter such thoughts in our study, the players explained that they use emotion-focused strategies (e.g., internal), such as, imagining themselves being another top player when playing certain shots (i.e., task-oriented coping strategy - imagery).

Highlighted earlier, the exploratory findings of this study provide some support for the transactional model within the context of sport (e.g., Lazarus, 1999), yet the study did not examine the emotional aspects of the model. Furthermore we did not examine the intensity of stressors experienced, so it is problematic in ascertaining how these stressors would be experienced during real-time matchplay performance (e.g., Nicholls & Polman, 2008; Samson et al., 2015). Thus, construct validity could be evaluated by comparing verbalizations with physiological measures, such as, heart rate and blood pressure, and psychometric instruments.

It may be judicious for experimental researchers in cognitive psychology to recreate naturalistic situation-specific snooker scenarios to determine how and when stressors truly impact upon performers cognitions during performance. Insofar as to greater understand why players appear to have the ability to cope with setbacks (such as forgetting mistakes) and continue to consistently perform. Whitehead et al. (2015) reported that higher skilled golfers did not dwell on mistakes or ruminate on technical errors, and actively sought out solutions through greater use of deliberate planning and gathering of information. Recognizably our findings accord with Whitehead et al. (2015) and Nicholls and Polman (2008), in terms of substantial planning strategies (i.e., shot preparation) used by the players. Alternatively, cognitive researchers using the directed forgetting paradigm have demonstrated that mentally tough individuals have the enhanced ability to prevent unwanted information from interfering

with current goals (Dewhurst, Anderson, Cotter, Crust, & Clough, 2012). Saliently therefore, it could be perceived that a key coping mechanism of our super-elite and elite cohort is their ability to forget, and this may be a contributing factor for the differences in their success. However, this should be explored further.

While this study did not measure behavioral coping, the Level 3 TA protocol enabled the players to describe, demonstrate, and explain their use of behavioral strategies (see Appendix 2) when confronted with situational game dynamics during practice. For example; getting up off the shot and walking around the table to clear their thoughts, having the cueball cleaned to gather their thoughts positively, slowing their pace of play down (e.g., build momentum, gamesmanship, aid decision making), timing/feathering the cueball an equal amount of times, and aiming/striking center of the cueball (e.g., plain ball potting to avoid playing with side/unwanted side). Comparably, Whitehead et al. (2017, 2018) found that cyclists used pacing strategies during certain phases of 16.1 km time trials that enable better effective cognitive control during stressful episodes (e.g., negative feedback) in relation to task goals.

Irrespective of this information, it is vitally important to stress that the criteria underpinning pacing in cycling (or running) is markedly dissimilar to that of snooker, with particular reference to the physiological aspects. Thus, while we feel it is important to make generalizations (Smith, 2018), what pacing is to cycling or running are poles apart to what pacing is in snooker. And what planning strategies are to golf and chess, are highly disparate to professional snooker, given that these strategies are underpinned by domain-specific nuances. For instance, and to our knowledge, there are no other sports like snooker which require a performer to strike a stationary ball onto another stationary ball and then onto a target (pocket). Indeed, this could warrant further investigation to gaze behavior. Still however, and using hedging prose (Chenail, 2010), the results potentially offer further support for the existing TA and coping literature in that mental strategies (i.e., planning, strategic thinking) are continually used to manage stressors across disciplines, but remain

distinct from one another at the same time. Thus, researchers should duly recognize that the findings from this study are snooker-specific.

Lazarus and Folkman (1984) concede that individuals rely more on certain strategies at different times throughout a stressful encounter because coping is a 'shifting process'. More explicitly, it is the constancy of appraisal and re-appraisal of a stressful situation that shapes coping, which alters the cognitive re-appraisals (Nicholls and Polman, 2008). Accordingly this process can be likened to the fundamentals of professional snooker, with coping in snooker described as "continual reactive-adaptive cognitions and behaviors to manage differing internal and external visual-somatosensory stimuli". Whitehead et al. (2017, 2018) assert that trained athletes employ both proactive and reactive cognitive control of focus of attention to facilitate performance, and have the ability to self-regulate attentional focus in response to internal (e.g., sensory monitoring) and external distractors (e.g., monitoring) during performance. And phenomenological researchers on esoteric expertise claim that this 'somaesthetic awareness' or 'embodied cognition' helps experts fine-tune their cognitive representations through heightened sensorimotor processes during real-time performance (Shusterman, 2008). Therefore, future TA studies on snooker could benefit from phenomenological research exploring the effects of 'touch' and 'feel' on cognitions during performance.

Moreover, it is important to note that the process of stress and coping varied both intra- and inter-individually throughout our findings. For example, there were occasions of players being able to experience a continuation of stressors before employing a coping strategy, and other instances of players consistently reporting problem-focused strategies without experiencing a stressor (e.g., Nicholls & Polman, 2008; Samson et al., 2015; Whitehead et al., 2017, 2018). Explanations for these variations may be that higher ranked players experience a lower frequency of stressors to their counterparts due to; their superior proficiency of cueball control and deep knowledge structures, their ability to rapidly encode, recall, recognize structured perceptual information, and superior accuracy of evaluative and

discriminative measures when comparing strengths and weaknesses of varying game situations, (Abernethy et al., 1994; de Groot, 1965; Gobet & Charness, 2006).

The findings of this study are representative of the cohort of players involved; hence the findings cannot truly represent all professional snooker players coping related thoughts. However, using Level 3 verbalizations enabled a higher amount of general snooker related thoughts, and with the world professional snooker circuit being relatively small (e.g., 128 players), the breadth of players (i.e., various rankings) thoughts may be hedged as generalizable to a greater extent (Chenail, 2010; Smith, 2018). Despite this, intra- and inter-individual differences do exist between our participants, for example; one has won multiple tournaments, and some have reached latter stages, while some are lower ranked. Certainly, it may be the case that the differences in achievements are due to other factors that affect coping, such as, personality, age, or their natural ability to cope with stressful situations (e.g., Kaiseler, Levy, Nicholls & Madigan, 2017). Thus, it may be wise for future TA studies to employ personality surveys to address such potential differences.

This exploratory investigation has provided a unique insight into the real-time relationship of stressors and coping in professional snooker, but there are other areas in which future snooker research could progress. Indeed our participant sample consisted only of male super-elite and elite players, thus making generalizations of coping across genders and sport difficult. Kaiseler et al. (2013) encountered differing cognitions in stress, appraisals, and coping between males and females using TA during a golf putting task. Hence, with the rapid growth of female professional snooker of late, it would be advantageous to examine the cognitive differences of super-elite and elite female and male snooker players.

Positively, it could be implied our findings do corroborate with many of Abernethy et al.'s (1994) overtures despite ecological concerns. Yet simultaneously, there needs to be greater clarification of the meaning and abilities of the 'experts' used in their study in relation to the 'super elite' and 'elite' performers of our study (i.e., true knowledge). Hence, although we can make inferences with regards to professional snooker players appearing to; recognize

683 structured perceptual information with rapidity, are able to evaluate and discriminate the
684 strength and weaknesses of varying game situations (i.e., percentage snooker), and have the
685 intuitive expertise to plan out multiple shots in advance of their current cueball position, we
686 did not measure these directly. Therefore, drawing accuracies is somewhat limited here.
687 Likewise we did not directly examine the visual components of real-time performance in
688 snooker, but critically, we do support Abernethy et al. in their view that snooker is very much
689 about problem-solving ability and not visual skills, based upon our findings. Thus, replicating
690 Abernethy et al.'s study with super-elite and elite players would be extremely advantageous
691 for theoretical purposes.

692 In this study we took an alternative stance to the extant post-positivist/cognitivist
693 approaches permeating the TA literature, and utilized a relativist position. Indeed, following
694 on from the recommendations of Smith and McGannon (2017), it is theoretically important to
695 offer insights on the other side of the philosophical coin. And in agreement with Eccles and
696 Arsal (2017), our results from this position were different but not better or worse.
697 Importantly, our theoretical position allowed us to go above and beyond our initial
698 interpretations of the data, and through the adoption of member reflections and critical
699 friends this enabled our findings to achieve heightened verification (Bloor, 2001).

700 This paper has provided a significant original and novel contribution to applied
701 cognitive science in sport psychology. The paper further contributes to the limited research
702 on super-elite and elite sporting performers *in situ*, and provides a rich and in-depth
703 understanding of professional snooker players' cognitive processes in an ecologically valid
704 sporting environment for the first time. Markedly, this study extends and highlights the
705 promising utilization of Level 3 TA verbalizations within the domain of expertise (Whitehead
706 et al., 2015) and we recommend future research to this consider this methodological
707 approach. Equally, this methodological procedure facilitated the discovery of stressors,
708 coping, and practices involved in professional snooker, also for the first time, and therefore
709 burgeons our knowledge of coping in self-paced sports generally. The exploratory findings of

this study extend previous research utilizing TA in self-paced sport and have afforded researchers the opportunity to examine thoughts during real-time practice performance(s), thus providing support for TA as feasible method. Likewise, we have provided many other exciting areas in which snooker could be further explored, particularly within the experimental and phenomenological areas of literature. Such endeavors are critical for theoretically enhancing our understandings of human cognition in general.

In conclusion, our evidence provides support for the transactional model of coping (Lazarus, 1999) whereby thought processes change continuously during performance, and in particular, at highly dynamical situation-specific moments. In addition, our exploratory findings further lend support to the knowledge that problem-focused strategies are vital psychological characteristics of expert and optimal performances in general. However, it is important to remain aware of the fact that the cognitions elicited from this study are purely snooker-specific and are reflective of super-elite and elite performers in professional snooker. Therefore, we warrant researchers and practitioners to remain cautious in their approaches to generalizations. Although concurrently, it would be desirable for future TA studies to continue to utilize a relativist lens, as it may lead to more robust and verifiable generalizations across sports. The findings ought to be used in assisting coaches, psychologists, and players in evolving the applied praxis of interventions and pedagogical understandings to maximize playing performance and support well-being.

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Appendices

Appendix 1. Stressors

Second order theme	First order theme	Frequency
Table conditions	Ball polish, new balls	35
	Pace of cloths (fast, slow, grip)	36
	The break-off	8
	Playing shots hard	2
	Inconsistent tables (e.g., heavy, fast)	6
	Cushions e.g., pings, squaring off, slide	20
	Kicks	8
	Bad contacts	1
	Cueball physics (throw) (9)	2
Table management	Ball positions/available shots (e.g., object balls, colors)	10
	Shot selection – e.g., screw, swerve, check-side, follow through, stun/stun-run, reverse-screw	5
	Shot difficulty (e.g., balls down side-cushions, funny angles, cueing over balls, cannons, cushion play, forcing shots, delicate holds, dead weight, straight)	29
	Cushion pings	8
	Shot pace	6
	Cueball distances (long) (6)	3
Distractions	Venue atmosphere	4
	Audience/crowd moving	3
	Other balls in peripheral vision	4
	Commentary/commentator remarks/terminology	22
	Stigma (negative play)	2
	Other players remarks	1
	TV negative sport promotion	2
	Social media abuse	10
	Wanting to perform	3
	Mobile phones	4
	Cameras	2
	Media	3
	Lacking confidence/uncomfortable	7
	Wanting to impress the audience, be appreciated	11
	Ear pieces	5
	Public expectation/perception/insecurity of types of shots you play, playing to the crowd	8
	Match pressure/pre-match nerves (e.g., not thinking clearly)	15
	Player status	12
	No practice time on match table	5
	Practice opportunities at venues/practice cloth speeds	2
	Poor preparation (e.g., not having table recovered) (21)	3
	Waiting to play shots	3
	Slow play/opponents/expertise of opponent	14
		7

	Playing arena	1
	Multiple shot choices/Indecision/decision-making	17
	Negative peer perception	1
	Negative/Anxious thoughts/moods/feelings, mind wandering, overthinking, boredom, frustration, sulking in chair, self-talk, thinking time, watching other player	45
	Lacking concentration	2
	Parental expectations	1
	Ego (e.g., trying to match opponent, go toe-to-toe)	10
	Gamesmanship	1
	Winning tournaments	4
	Winning (e.g., frames and matches)	3
	Tip	12
	Practice partners behaviors	3
	Amotivation with practice (e.g., tedious shots, routines)	11
	Pending shot outcomes	7
	Life issues (e.g., family)	2
	Travelling to tournaments	1
	Radio music	1
	High level playing consistency (e.g., expectations) (22)	9
Environment	PTC tables (heavily played)	1
	Warm venues	2
	Same modes of practice (knowing what to practice)	2
	Practice environment (e.g., no pressure, negative people)	4
	Time between tournaments	1
	Making the step up/learning curve	5
	Feeling comfortable	2
	Used to playing on same table (e.g., lack of concentration) (8)	2
Mistakes	Missed pots (2)	5
	Shot errors/dwelling (trying to be perfect, poor position/incorrect angle, take balls for granted, overrun, under-hit, loose white, finishing straight, deceleration, quick delivery/bad timing, cueball striking – e.g., hitting thick, unwanted side, potting off jaws/wobblers, bad break-offs, tying the black up, cannons, splitting packs)	190
Luck	Dealing with bad runs of the ball (1)	12
Frame scores	Score/points available (1)	5
Performance	Expectations	7
	Rest play	9
	Overall performance/embarrassment	4
	Pressure balls/game situations (e.g., frame balls, leaving everything if you miss)	14
	Remembering past negative shots/outcomes of matches	7
	Pressure clearances	2
	Own pace of play	3
	Scrappy frames	2
	Shot perfection (feathering too much)	1
	Middle pocket shots (e.g., thin cut blues, pinks, reds etc)	2
	Long blues	1
	Adapting to match table (and each shot)	10
	Not getting through the white (e.g., jabby)	2
	Bad losses	3
	Tactical game	2

Note. Number of stressors reported by the seven participants during their solo practice performances.

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Coping function / Second order theme	First order theme (frequencies)
Problem-focused coping	
Shot preparation	Planning shot (359) (e.g., decision-making, play cueball into areas, see/sighting/know the shot early, knowing various ways to play shots/knowhow, leave the right angle, cueball paths, use of cushions, identify key balls/angles, split packs, shots ahead, pace of shot, knowing the balls you need before getting to the table for the clearance) Identify solutions to obstacles (i.e., pattern recognition/shot templates, intuition)
Mathematics	Maths (13)
Strategic snooker	Percentage snooker (e.g., margins for error, knowing when and when not to take a shot) (39) Use experience (7) Focus on the table (5) Put opponent in for break-off (2); Take the loose reds (2)
Tactics	Play to strengths (e.g., turn odds into your favor, open the game up) (10); Good pace of play/rhythm (10) Make sure of the pot (9) Break-building/scoring (e.g., intimidating opponents) (8) Always use the cushion when playing brown to blue (6) Alter tactics to differing playing styles (4); Aiming thin not thick (4); Play the first shot (4); Playing up for a baulk color to clearance easier (4) Get around the black (3); Commit to the shot (3); Always play two cushions off black to yellow (3) Keeping it safe (2) Grinding (1)
Cueball control	Leave options/angles (60) Short cueball distances (10) Leave the white in the middle of the table (2)
Cueball physics	Manipulating the cueball (4)
Behavioral coping	Pre-shot routine (26) Get up off shot (walk around table, clear thoughts) (8) Trusting yourself (7) Feeding off opponents' bad shots/body language (4) Visualizing (e.g., seeing the ball go in) (3); Identifying technicalities (3)
Behavioral technique coping	Technique (e.g., timing/cue-action) (44) Alignment (e.g., straight cueing) (17) Centre of the white (16) Feathering the same amount/length, increase feathering (10) Head down/still (8) Stay down after the shot (4) Stance (3); Pause (3); Slower pace play (3); Have the cueball cleaned (3) Grip (2); Look at pocket (2); Bridge close to the white (2); Judgement (2); Confident body language (e.g., chest up) (2); Playing shots with purpose (2) Eyes on the object ball (1); Don't think on the shot (1)

	Cognitive technique orientated coping	Cueing thoughts/Positive instructions (92) Positive/firm cueball striking (35) – more control (e.g., use two cushions instead of one, stun shots) Staying high with the white (28) Biofeedback/somatosensory – tactile (e.g., chin, chest, bridge, grip)/auditory/visual/ (e.g., punching sound, looking at the arrows) (23) Painting a picture (5)
	Focus	Increased concentration on shot (e.g., pressure game situation) (20) Win the frame in one visit, play to win (8) In the zone/flow/bubble (don't think) (6) Keeping count of break (4); Concentrate on the table/shot (4) Being patient (1); Clearing to hurt your opponent (1)
	Deliberate practice	Working with coach (e.g., discuss all aspects of the game) (10) Getting through the ball, timing (8) The break-off (7) Shortened action (6); Safeties (6); Clear the colors (6); Pressurized game specific scenarios e.g., knowing available points, playing for imaginary money (6) Walking around/visualizing the table more (5); Never waste a shot/purposeful shots (5); Short games - Cross, line-ups (e.g., black with red), N's zig-zag for flow/finding groove – small cueball distance practices (5) Continual improvement (4); Slow cushions (4) Master cueball journey (3); Long blues (e.g., to baulk and black pockets) (3) Get the basics right (2); Work ethic (2); Potting clean/play it properly (2) Achieving mastery (1); Routines that work on weaknesses (1); Know every shot (1); Cueing balls across the D-line (1); Long pots (1); Middle pocket routines (1); Pink to middle, black to corner sets (1); Dedicated practice (1); Blue line-ups (1); Playing frames (e.g., train working memory) (1); Practice matches as proper matches (e.g., play for money) (1)
Emotion-focused coping		
	Positive attitude/feelings	Positive appraisal/mood (46) Enjoyment (2)
	Relaxation	Running commentary (15) Visualization (e.g., imagining being another top player) (9) Practicing imaginary snooker (1); Music (1); Take time to collect positive thoughts before match (1)
	Philosophical	Rationalize (99) Optimistic (seeing difficult shots/matches as challenging/rewarding) (9) Forgetting (8) Acceptance (5) Good performances irrespective of outcome (2)
	Cognitive avoidance	Disengagement (12)

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