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Cognitive characteristics of expert, middle of the pack, and back of the pack ultra-endurance triathletes

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Abstract

Objectives: The purpose of this study was to examine cognitive differences between expert and non-expert UE triathletes.

Design: Twenty-one UE triathletes were stratified according to finishing times into three groups; experts (<9.5 h), middle of the pack (~12.5 h), and back of the pack triathletes (>14.0 h).

Methods: Cognition was examined using a think-aloud protocol with the aid of a video montage of segments from an UE triathlon representing periods of high decision-making or cognition. Inductive qualitative analyses supported the classification of athlete cognitions as passive, active, or proactive.

Results: Expert triathletes reported a greater emphasis on thoughts related to their performance, while middle of the pack and back of the pack triathletes reported a greater number of passive thoughts. Furthermore, experts were more proactive in their approach to performance situations than mid- and back-pack triathletes.

Conclusions: Expert UE triathletes are cognitively different from non-experts, although future research is needed to determine the role these differences play in promoting expert performance.

Keywords: Cognition; Performance; Expertise

Much of our understanding of psychological differences between successful and less successful performers in endurance and ultra-endurance sports has come from research examining cognitive orientation during competition. Morgan and Pollock (1977) found that elite runners focused more on performance-related items such as pacing and relaxation (associative thoughts), while non-elite runners

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focused on external items such as scenery or singing a song in their head (dissociative or distractive thoughts). They postulated that cognitive orientation plays an important role during performance in endurance sport. After 20 years of research in this area, results still support the relationship between performance-related attentional foci and faster running times in endurance-level events (Masters & Ogles, 1998).

Very little is known about the influence of cognitive factors on performance in ultra-endurance (UE) sports. Studies of psychological factors in UE events (e.g. Acevedo, Dzewaltowski, Gill, & Noble, 1992) suggest that UE athletes have cognitive profiles that are notably different from endurance athletes. For instance, Acevedo et al. (1992) found that cognitive orientation did not discriminate highly successful and less successful ultramarathoners. The UE triathlon (2.4 mile swim, 112 mile cycle, 26.2 mile run) presents a unique environment to examine skill-based differences in cognition due to its extreme duration and combination of three endurance activities. The purpose of this study was to retrospectively examine the cognitions reported by expert and non-expert UE triathletes during periods of decision-making in a UE triathlon.

Method

Sample

This study used a sub-sample from a larger investigation of the acquisition and maintenance of expertise in UE triathletes (Baker, Côté, & Deakin, 2004). Twenty-one UE triathletes participated in the current study and were age-matched and stratified into three groups (expert, middle of the pack and back of the pack triathletes) based on previous UE triathlon finishing time. The expert group ($n=8$) had finishing times that were two standard deviations below the mean for the population (males 25–40; <9.5 h). The middle of the pack group (mid-pack; $n=7$) included athletes with finishing times at around the mean (mean finishing time approximately 12.5 h) and back of the pack athletes (back-pack; $n=6$) had finishing times greater than two standard deviations from the mean (>14:00 h).

Cognitive task

Cognition during competition was examined with the aid of a video montage. The purpose of the montage was to assist the recall of cognitive information stored in memory by viewing video footage of the situations under examination. This method has been used effectively in previous research (e.g. Trudel, Gilbert, & Tochon, 2001). To create the video montage, the question 'during what periods of an Ironman race do you experience periods of high decision-making or cognition' was posed on an Internet triathlon newsgroup to approximately 500 subscribers. A content analysis of the newsgroup responses ($n=57$) over a 4-week period resulted in 18 periods of high decision-making or cognition. Due to the nature of performance during the UE triathlon, collection of cognitive information during 'real time' was not possible. Therefore, existing video footage from the 1993 Ironman World Championships was used to create a video montage of segments, which was designed to cue the participants' memories of similar instances they experienced. Due to limitations associated with using existing video footage, four occurrences were not included in the final video montage. These included being passed during the swim, 'hitting the wall' on the run, choosing when to ingest food and other nutritional supplements, and mechanical difficulties such as flat tires. The segments included in the video montage were (1) pre-race set up, (2) immediately prior to swim start, (3) swim start, (4) approaching end of swim leg, (5) swim to bike transition, (6) beginning the bike leg, (7) being overtaken by an opponent during the bike leg, (8) overtaking an opponent during the bike leg, (9) approaching end of bike leg, (10) bike to run transition, (11) beginning the run leg, (12) being overtaken by an opponent during the run leg, (13) Overtaking an opponent during the run leg, and 14. Approaching the end of the run leg (race finish). Each segment was approximately 1 min in length.

The video segments were presented to the participants in their sequence of occurrence during triathlon competition. For the majority of athletes (17 out of 21), data were collected in a quiet room at the home of the athlete with the use of the participant's television and VCR. For the remaining four athletes, data were collected in a quiet laboratory setting. The cognitive task lasted for between 30 and 45 minutes and all sessions were audio recorded. Athletes were required to visualize themselves in the situation displayed and to 'think-aloud' regarding the thoughts going through their mind. To prevent leading the athlete towards a specific thought process, the probes used to elicit the cognitions were neutral.

Qualitative analyses. The objective of the qualitative analysis was to examine the information embedded in the athletes' responses to the video montage, which represented their thoughts during actual UE triathlon competition. The qualitative analyses adhered to previous guidelines established for the examination of qualitative data (Côté, Salmela, Baria, & Russell, 1993; Tesch, 1990). Responses to each specific segment of the montage were transcribed verbatim and analyzed independently. There was a detailed examination of the interview transcripts to ascertain the nature of the information provided in the athletes' responses. Athletes' reactions to each segment were read and reread and the research team met several times to establish a consistent understanding of the data. Once researchers were in agreement, raw data were tagged with a descriptive label to represent the type of cognition conveyed by the athlete.

A number of checks were incorporated to ensure the trustworthiness of the qualitative data interpretation. The first check ensured that the classification system used to categorize the athletes' responses was consistent with the content of the transcripts. Two members of the research team independently formulated a classification system to group the data. The two researchers then met to discuss the consistency between the two classification systems. After minor refinements, both researchers agreed that the classification system was a sound method of categorizing the data. A second reliability check was performed at the completion of the analysis to ensure that the athlete responses were classified appropriately. A random sample of 10% of the athlete responses were selected from the transcripts and analyzed by an independent analyst according to the classification system provided by the researcher. The independent analyst was given a half hour training lesson on the content of the classification system and was provided with a written outline of the classification system to refer to during the placing of the cognitions. The independent analyst and the primary researcher were in agreement for 26 out of 30 cognitions (87%). In addition, a peer debriefing process (Guba & Lincoln, 1989) was used to corroborate the findings with another researcher who was a high-level triathlete.

Results

A total of 293 individual cognitions were identified from the athlete responses. To facilitate data analyses and interpretation, video segments were re-grouped into four categories. The first included situations dealing with preparing for the next triathlon event (i.e. pre-race set-up, immediately prior to swim start, swim to bike transition, and bike to run transition). These segments were categorized as preparatory segments and contained 86 cognitions. Situations dealing with the start of an event (i.e. swim start, bike start and run start) were categorized as starting segments and contained 63 cognitions. Finishing segments (61 cognitions) included situations dealing with finishing an event. Lastly, situations dealing with either passing a competitor or being passed by a competitor on the bike and run segments were classified as passing segments and contained 83 cognitions. The individual cognitions contained in each category were then examined.

Preparatory, starting and finishing segments

In the preparatory, starting, and finishing segments (Table 1), three central types of cognitions were reported. The first type was made up of cognitions dealing with emotions or feelings associated with the segment. For instance, one mid-pack athlete reported that during the period before the start of the swim he felt ‘a feeling of sort of nervousness, excitement, anticipation, that kind of thing.’ These cognitions were labeled as ‘passive thoughts.’ The second type, ‘active thoughts’ incorporated cognitions regarding a specific, purposeful action that focused on responses to situations currently being experienced. For example, for the segment dealing with the period before the start of the race one expert athlete reported “I’ve got a list of things, kind of a routine that I go through…like warming up, stretching, making sure my gear is all done. I just go through it the same way for every race.” The final type of cognition included thoughts that were focused on how to perform in upcoming events and these cognitions were labeled ‘proactive thoughts.’ For instance, one expert reported that “during the last 5 km (kilometers) of the bike I like to quickly go through the transition in my head, so that I remember where I’m going and when I get there I’m not panicked and it’s nothing new.” In some cases, athletes reported focusing on more than one feature and in those cases features were categorized separately (e.g. if an athlete reported feelings of nervousness/anxiety as well as the needing to consume water then these would be classified as passive and active cognitions, respectively). In addition, the nature of the information contained in the qualitative data necessitated the division of the active and proactive categories into thoughts that were related to performance (e.g. nutrition) and thoughts that were unrelated to performance (e.g. interacting with spectators). A summary of the frequency of thoughts reported by the expert, mid-pack and back-pack groups for preparatory, starting, and finishing segments is presented in Table 1.

Preparatory segments. For the segments dealing with preparing for the next triathlon event experts typically reported active thoughts that were related to their performance. Experts also reported some proactive thoughts during these segments, which focused exclusively on strategy such as “finding where everybody is that you’re going to want to swim with.”

Although mid-pack triathletes reported some active thoughts during these segments they also reported a substantial number of passive thoughts, such as feelings of anxiety or nervousness or feelings of disconnection. One mid-pack athlete reported that prior to the start of the race, “It’s almost as if I’m not there, it’s the physical body going through the motions…kind of floating above, observing but not really partaking in anything at that stage.” In addition, this group reported proactive thoughts and active thoughts that were unrelated to performance.

The cognitions reported by the back-pack group were similar to the mid-pack athletes. There was a high incidence of active performance-related thoughts and passive thoughts. However, there were a greater number of active and proactive thoughts that were unrelated to performance reported by this

Table 1
Summary of results for preparatory, starting, and finishing segments

	Experts	Mid-pack, no. of cognitions (%)	Back-pack
Preparatory segments (segments 1, 2, 5, 10)			
Passive thoughts	0	9 (33%)	10 (34%)
Active thoughts			
Performance related	29 (91%)	16 (59%)	14 (48%)
Non-performance related	0	1 (4%)	3 (10%)
Proactive thoughts			
Performance related	3 (9%)	1 (4%)	0
Non-performance related	0	0	2 (8%)
Starting segments (segments 3, 6, 11)			
Passive thoughts	0	2 (9%)	0
Active thoughts			
Performance related	23 (88%)	19 (86%)	17 (80%)
Non-performance related	0	0	2 (10%)
Proactive thoughts			
Performance related	3 (12%)	1 (5%)	0
Non-performance related	0	0	2 (10%)
Finishing segments (segments 4, 9, 14)			
Passive thoughts	2 (9%)	11 (55%)	9 (50%)
Active thoughts			
Performance related	15 (65%)	7 (35%)	6 (33%)
Non-performance related	0	1 (5%)	2 (11%)
Proactive thoughts			
Performance related	6 (26%)	1 (5%)	1 (6%)
Non-performance related	0	0	0
Total			
Passive thoughts	2 (2%)	22 (32%)	19 (29%)
Active thoughts			
Performance related	67 (86%)	42 (62%)	37 (56%)
Non-performance related	0	2 (3%)	7 (11%)
Proactive thoughts			
Performance related	12 (15%)	3 (4%)	1 (1%)
Non-performance related	0	0	4 (6%)

group. For instance, one back-pack athlete reported that during the swim to bike transition “everyone’s high fiving you, and it’s pretty good. I focus on high fiving people. I really do.”

Starting segments. During segments dealing with starting one of the triathlon events, all three groups reported a predominance of active thoughts related to performance. The expert group also reported some proactive thoughts, but these were much less frequent. Additionally, mid-pack athletes reported some proactive and passive thoughts and back-pack athletes reported some active and proactive thoughts that were unrelated to performance.

Finishing segments. During segments dealing with finishing one of the triathlon events, the majority of thoughts reported by the experts were active and performance-related in nature. However, experts also reported proactive thoughts during these segments. Also, during these segments experts reported their only passive thoughts. These thoughts occurred exclusively at the end of the race and centered on feelings of accomplishment and reflection.

For the mid-pack and back-pack athletes, the majority of their thoughts were either passive or active performance-related in nature. Passive thoughts typically reflected feeling happy or relieved that a specific portion of the race was completed, while active performance-related thoughts centered on things like picking up speed at the end of the swim, stretching out tight muscles at the end of the bike and focusing on form at the end of the run. Additionally, the mid- and back-pack groups reported some proactive thoughts as well as some active thoughts that were not related to performance, such as focusing on looking good for the finish line photo.

Total (*all preparatory*, *starting*, *and finishing segments*). Due to the similar nature of cognitions reported during the preparatory, starting, and finishing segments, responses were collapsed so that differences among the groups could be investigated. Ninety-eight percent of experts' cognitions were focused on either active or proactive performance-related factors compared to 65 and 57% for the mid-pack and back-pack athletes, respectively. In addition, approximately 30% of the cognitions reported by the mid- and back-pack groups were classified as passive in nature and nearly 15% of the cognitions reported by the back-pack group were classified as unrelated to performance. Kruskal–Wallis tests were conducted to identify differences between the groups on the collapsed behaviors and results indicated significant differences between the groups on passive thoughts ($\chi^2 = 13.1$, $p < .01$), active performance-related thoughts ($\chi^2 = 10.9$, $p < .01$) and active non-performance-related thoughts ($\chi^2 = 10.3$, $p < .01$). Additionally, the result for proactive behaviors approached significance ($p = .07$).

Passing segments

Content analysis of the athletes' responses to the passing segments supported the creation of more sensitive categories (Table 2) since all thoughts reported by the triathletes were active in nature. Cognitions were classified as being associated with providing support for opponents (opponent-supportive), using strategy when dealing with opponents (opponent-strategic), focusing on one's own performance (self), or a combination of thoughts associated with one's own performance and the performance of their opponent (self and opponent-strategic).

For the expert group, the majority of thoughts during passing segments centered on their own performance relative to their competitors. Additionally, experts reported thoughts that were solely focused on their personal performance or on opponent specific strategies. In the mid- and back-pack groups, the majority of thoughts centered on personal performance, specifically, on the need to stay within their own physical and mental limits.

In addition, athletes in both groups reported some opponent-strategic thoughts, such as needing to pass decisively. Further, athletes in the back-pack group reported a large percentage of thoughts

Table 2
Expert, mid-pack, and back-pack performance-related active thoughts reported during passing segments (segments 7, 8, 12, 13)

	Experts	Mid-pack, no. of cognitions (%)	Back-pack
Opponent-supportive	0	0	9 (38%)
Opponent-strategic	4 (13%)	4 (14%)	2 (8%)
Self	6 (19%)	20 (72%)	10 (42%)
Self and opponent-strategic	21 (68%)	4 (14%)	3 (12%)

associated with providing support for fellow competitors. For instance, one athlete stated "I'll usually say to the person 'don't worry you'll see me on the second lap' or 'you'll see me again in a few minutes'." No expert or mid-pack athletes reported opponent-supportive thoughts.

Kruskal–Wallis tests indicated significant differences between the groups on opponent-supportive thoughts ($\chi^2 = 10.3$, $p < .01$), thoughts centered on their own performance ($\chi^2 = 9.8$, $p < .01$) and thoughts dealing with a combination of their own performance and opponent specific strategy ($\chi^2 = 10.9$, $p < .01$). No differences among the groups were found for thoughts focused on opponent specific strategy.

Discussion

Expert UE triathletes in the current study reported thoughts that were more relevant to their performance, while mid- and back-pack UE triathletes had more thoughts that were unrelated to performance (i.e. passive thoughts and irrelevant active thoughts). Furthermore, expert UE triathletes also reported cognitions that were more proactive. Researchers have indicated that proactivity (i.e. the ability to identify opportunities and act on them to bring about meaningful change) is an important personality characteristic in predisposing one to higher levels of performance in business and engineering (e.g. as measured by career success; Seibert, Crant, & Kraimer, 1999), suggesting that proactive individuals are able to positively influence their performance by managing situations and creating opportunities that enhance the likelihood of higher levels of performance.

Results of the current study also indicate that athlete cognitions during the UE triathlon were influenced by the specific situation being experienced. For instance, proactive thoughts occurred only during preparatory segments (i.e. immediately prior to swim start) and finishing segments (i.e. swim finish and bike finish). Furthermore, UE triathletes at all performance levels reported exclusively active thoughts during passing segments. It is likely that the specific constraints associated with each of the situations influence the nature and type of cognitions that occur. For example, preparatory or finishing segments may be conducive to proactive thoughts due to the inherent planning that likely occurs during this period (i.e. preparing for the next component of the event). On the other hand, periods dealing with passing someone or being passed require the UE triathletes to respond to a situation that is presently occurring, thereby reducing the likelihood for proactive thoughts.

A major assumption of the current study (and of all studies that measure athlete cognition during *simulated* competition) is that the cognitions reported during the video simulation were consistent with cognitions during actual competition. Additional research is needed to confirm the reliability and validity of these results. Furthermore, it is not clear why expert and non-expert cognitions were different. It may be that athletes at higher levels of skill have different goal orientations or that lesser skilled performers may not have the requisite knowledge necessary to consider more proactive approaches to performance. To this end, caution should be used before ascribing a causal relationship between these cognitive characteristics and expert performance in this sport (cf. Heyman, 1982). The influence that these cognitive differences have on performance is not known. In high decision-making sports such as basketball and field hockey, the impact of a decision-making error is obvious—performance suffers; however, in UE sports this relationship is not as clear-cut. Conceptually, focusing on performance-related concerns should promote higher levels of performance due to an increased ability to perceive performance relevant stimuli (e.g. knowing when competitors are fatigued and when to surge to break away), but this remains to be proven. Future research is needed to elucidate the relationship between cognition and performance in UE sports.

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