The Thin Line: A Phenomenological Study of Mental Toughness and Decision-Making in Elite High-Altitude Mountaineers

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Abstract

Mental toughness (MT) is a key psychological variable related to achievement in performance domains and perseverance in challenging circumstances. We sought to understand the lived-experiences of mentally tough high-altitude mountaineers, focusing primarily upon decisions to persevere or abort summit attempts. Phenomenological interviews were conducted with 14 mountaineers including guides, expedition leaders, and doctors (M_{age} = 44 years). A content analysis was employed to identify key themes in the data. Participants emphasised the importance of MT in extreme environments and described rational, flexible, and vigilant decision-making. Turning around without summiting was the toughest decision reported, with recognition of the thin line between persevering and over-stretching. In contrast to much MT literature, mountaineers accepted limits, demonstrated restraint, and sacrificed personal goals to aid others. Costly perseverance was also reported with some mountaineers described as "too tough": over-competitive, goal-obsessed, and biased decision-makers. These findings revealed both benefits and dangers of MT in mountaineering.

Keywords: Challenge; flexibility; perseverance; risk-management; self-awareness.

Introduction

Mental toughness (MT hereafter) is generally agreed to comprise values, attitudes, emotions and cognitions that enable people to pursue successfully their goals and produce consistently high-level performances regardless of obstacles or adversity (Coulter, Mallett, & Gucciardi, 2010; Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015; Hardy, Bell, & Beattie, 2014). The ability to withstand stress, persevere, maintain focus, and make effective decisions under pressure is indicative of MT (Coulter et al., 2010; Jones, Hanton, & Connaughton, 2002). Debates persist regarding the precise nature of MT, with some researchers proposing a multi-dimension conceptualisation (Coulter et al., 2010; Jones, et al., 2002) while more recent evidence supports a unidimensional construct that can vary *and* have enduring properties across situations and time (Gucciardi et al., 2015). Nevertheless, most researchers define MT as a relatively stable disposition / trait construct that is important during confrontations with stress and unlikely to change quickly over time (Hardy et al., 2014). In contrast to much previous work that has simply reported the attributes associated with MT, the present study explores the *lived experiences* of mentally tough high-altitude mountaineers, focusing on how MT influences decision-making (DM), and how participants' cognitions and behaviours play out in a dangerous activity that differs markedly from traditional team sports.

Since the seminal work of Jones et al. (2002), MT has become a central topic in sport psychology. Recent evidence shows significant and positive relationships between MT and performance outcomes such as race times in cross-country running (Mahoney, Gucciardi, Ntoumanis, & Mallet, 2014). Additionally, Gucciardi, Peeling, Ducker, and Dawson (2016) established perseverance as a behavioural signature of MT, using performance tests with Australian football players. Numerous studies have highlighted outcomes such as goal progress or attainment (Gucciardi et al., 2015) and transitions to higher levels of performance

(Cook et al., 2014) to be underpinned by perseverance. Despite the importance in performance domains, perseverance (when rigid, inflexible) is not always considered an optimal response. For example, high levels of commitment and perseverance were found in mentally tough exercisers, resulting in excessive training regimen, insufficient rest-periods, and a willingness to persist while injured; leading to more severe injuries (Crust, Swann, Allen-Collinson, Breckon, & Weinberg, 2014). This finding appears consistent with the concept of obsessive passion (Vallerand & Miquelon, 2007); a characteristic describing those who feel compelled to engage in an activity, displaying rigid persistence, and potential emotional dependence.

Research concerning the related yet distinct construct of psychological grit (see Credé, Tynan, & Harms, 2016) provides some interesting comparisons to MT. Duckworth, Peterson, Matthews, and Kelly (2007) defined grit as a perseverance and passion for long-term goals, with gritty individuals viewed as embracing challenges and maintaining effort and interest despite failure, adversity or performance plateaux. Like MT, grit is viewed as relatively stable, vital to high achievement but essentially a narrower construct related to long-term perseverance. Perseverance represents the point at which MT and grit overlap conceptually, but MT also refers to thriving in and approaching challenging situations (as opposed to simply surviving), exerting control in the moment, and maintaining effort when things are going well. Lucas, Gratch, Cheng and Marsella (2015) hypothesised that grittier participants would persevere for longer even if stubborn persistence came at significant personal cost. It was argued that in some cases it is better to pass over extremely difficult tasks in order to achieve a beneficial overall outcome. For example, in examinations, excessive time persisting with difficult questions could mean easier marks and better grades were not obtained. In testing this hypothesis using laboratory-based tasks (monetary risk), it was found that grittier participants tended to persist longer when losing, with the potential to

incur greater losses. In some circumstances, grit represented "not knowing when to quit"; this appears consistent with some of the MT literature (Cook et al., 2014; Crust et al., 2014; Jones et al., 2002). In contrast, there is value in knowing when to move on to avoid further losses. As there are such overlaps between both concepts, conceptual distinctions between MT and grit are needed.

One domain in which such concepts are particularly important is high-altitude mountaineering. This activity is generally regarded as a risky pursuit, occurring in some of the most hostile and dangerous terrain on earth where oxygen is sparse and survival tenuous (Burke, Durand-Bush, & Doell, 2010). Humans can survive only temporarily above 8000m, in the commonly-termed "death zone". While all aspects of high-altitude mountaineering involve danger, statistical evidence (Wickens, Keller, & Shaw, 2015) indicates that summit descent is most dangerous when the risk of death significantly increases, often directly (e.g., from falling) or indirectly (e.g., from having to bivouac above 8000m) related to greater exhaustion and oxygen depletion. Physical dangers resulting from low temperatures and lack of oxygen include hypothermia, frostbite, acute mountain sickness, and cerebral and pulmonary oedema. In addition, environmental conditions such as the steepness of ground, crevasses, rock/icefall, and risk of avalanche make high-altitude mountaineering a dangerous activity.

While physiological adaptation is crucial in such environments, psychological factors are equally vital to success and survival, with effective DM necessary in often stressful and challenging circumstances. Literature on high-altitude mountaineering is relatively sparse, although climbers have been found to be sensation-seekers (seeking out novel, stimulating encounters), who have different perceptions of risk to the non-climbing public (Ewart, 1994). Rather than pursuing risk *per se*, mountaineers search for extremely engaging and intrinsically rewarding experiences where high levels of challenge match skills and can

facilitate experiences of flow (Delle Fave, Bassi, & Massimini, 2003). Nevertheless, some evidence indicates elite climbers can become obsessed with goals, and this strong compulsion to achieve can mean that some place themselves in danger, with potentially grave consequences (Burke et al., 2010). This is evident in the so-called "summit or die" approach (see Wickens et al., 2015). Experienced climbers have been found to possess highly developed self-awareness, self-monitoring and ability to control internal and external situations, allowing them to remain confident and focused, distinct from recreational participants (Burke et al., 2010). Moreover, high-altitude mountaineering provides an ideal context to examine DM, as challenging and changeable conditions mean decisions such as to continue towards the summit or turn around, can have life and death consequences. Wickens et al. (2015) present an information processing approach to climbing DM, which includes factors such as perception, situation awareness, limited attentional resources, the adverse effects of cold, oxygen depletion, and health. These researchers identified the need to examine whether differences in personality may underlie good or poor DM, given limited existing research. The information processing approach highlights the complex factors involved when weighing risk against reward. Further knowledge of how individual differences (e.g., MT) influence such decisions is much needed, especially in the context of previous work highlighting MT as significantly and positively related to attitudes toward physical risks (Crust & Keegan, 2010). Given high accident rates and the potential consequences of poor DM in mountaineering (e.g., injury/death for oneself and others), understanding the influence of MT, alongside other situational factors, could substantially benefit the safety of participants (e.g., decision-making / awareness training, deliberate choice of climbing partner to offset risk).

One previous study used an interpretive phenomenological analytic (IPA) approach to examine MT in mountaineering. Fawcett (2011) provided a case example from a larger

sample of interviews with elite high-altitude mountaineers and explorers that examined the contextual nature of MT (e.g., whether MT was perceived differently across sports / activities). Safety and survival were found to be crucial and the participants reported keeping emotions in check, control of ego, self-knowledge, and the ability to make correct decisions under pressure as indicative of MT. Generally a realistic perspective was adopted, involving perseverance and suffering, calculated risk-taking, but also the acceptance that sometimes conditions were too dangerous to continue. This study provided a broad understanding of MT in mountaineering, with DM processes examined only briefly.

The aim of the present research was to examine the *lived experiences* of mentally tough mountaineers, with particular focus upon key decisions relating to continuing or aborting summit attempts. We focus upon both the benefits and drawbacks of being mentally tough in high-altitude mountaineering as perceived by participants and address the gap in research identified by Wickens et al. (2015). In the context of previous work on both the value (Cook et al., 2014; Duckworth et al., 2007) and costs of perseverance (Lucas et al., 2015), we examined whether MT was deemed important with regards to crucial decisions in the distinctive cultural milieu of high-altitude mountaineering.

Method

Participants

Fourteen high-altitude mountaineers participated in the study, with the gender ratio of ten men to four women consistent with participation rates in extreme endurance sports (Schüler, Wegner, & Knechtle, 2014). Of the sample, two participants were also experienced expedition leaders, four acted as guides for less experienced climbers, and two were high-altitude doctors who provided medical support[1]. Three participants had set high-altitude

[1]The high-altitude doctors had similar mountaineering experience to the other participants (including numbers of 8000m expeditions and summits). However, they *also* performed the role of doctor on those expeditions and were therefore able to offer an additional perspective (e.g., in terms of treating high and low MT climbers).

climbing records. The mean age of the sample was 44.4 years (*SD*=12 years) with participants averaging 19.4 years' mountaineering experience. Participants reported climbing in the Himalaya for a minimum of six years with some reporting over 30 years climbing 8000m mountains. On average participants had experienced 9.6 (*SD* = 8) high-altitude expeditions and summited 4.5 (*SD* = 3) peaks over 8000m.

The sample included mountaineers from the United States (*n* = 7), Great Britain (*n* = 3), Iran (*n* = 1), Germany (*n* = 1), New Zealand (*n* = 1), and Mexico (*n* =1). Twelve reported climbing as part of an expedition-style approach; this involves setting up lines of fixed ropes, establishing and stocking camps at various points with the aid of high-altitude porters (e.g., Himalayan Sherpas), and use of supplemental oxygen during summit attempts. Two participants reported climbing in Alpine style, carrying their own equipment and supplies, without the use of fixed-ropes or supplemental oxygen. While the main benefit of Alpine-style is less time on the mountain, and thus less time exposed to dangers such as avalanche or icefall, there is correspondingly less time for acclimatisation, and limited support (except from a climbing partner) in case of emergency. Commensurate with phenomenological methodology, our key selection criterion was direct lived experience of the phenomenon (i.e. high-altitude mountaineering).

The Phenomenological Interview

We utilised a form of empirical phenomenology (Allen-Collinson, 2009, 2011), in our case derived from Merleau-Pontian (2001) existential phenomenology, in seeking rich, in-depth accounts of individuals' own direct experience (the "lived experience") of high-altitude climbing. This form of phenomenology is primarily concerned with investigating *what* participants report as being experienced. Since little is known about MT in mountaineering, phenomenology is an appropriate approach for enabling the collection of descriptive information exploring the *life-worlds* of mentally tough high-altitude climbers.

The phenomenological interview is characteristically unstructured, open and "naturalistic", with the participant often described as a co-researcher (Brinkman & Kvale, 2005). Rather than being constrained by a fixed interview schedule, there is freedom to explore emerging concepts, positioning the participant as expert in the lived-experience of the phenomenon in question. Nevertheless, it is acknowledged that interviews do not provide transparent windows to some inner private-self (Smith & Sparkes, 2005) but are co-produced by researcher and participant in the interactional encounter.

The first and second authors conducted interviews lasting between 48 and 93 minutes (M = 73 min.). SKYPE™ and telephone interviews were used for most as participants spanned a wide range of geographic locations, although two interviews were conducted face-to-face. A standardized process was employed, which included developing rapport, introducing the project, providing opportunities to ask questions, and scheduling the interview to maximize convenience. A flexible interview guide was used. To develop rapport and make the participant feel at ease, interviews began by focusing upon background information such as major career highlights and motives for climbing. Asked to recall circumstances where MT was required, participants were also invited to identify moments when key decisions were made, such as to turn back or continue and encouraged to provide insights about cognitive and emotional responses to such decision-making. Probes such as "Can you tell me a little more about that?" and "Can you describe what that was like?" were utilised to facilitate deeper understanding and provide elaboration. Further contributions were encouraged by researchers asking, "Is there anything more you can add to help us understand mental toughness in mountaineering?"

Procedure

Ethical approval was obtained from the first author's University Research Ethics Committee. Purposive sampling (Patton, 2002) was used for the initial trawl of participants.

A multi-stage assessment procedure was used to establish that participants had high levels of MT. (1) Initially, email contact was made with three mountaineers who were identified as being high achievers (attaining multiple 8000m summits) but who had also endured and overcome significant challenges and setbacks in the mountains (e.g., death of friends, climbing accidents, high-altitude bivouacs, equipment failures) and continued to thrive and achieve despite adversity. (2) Participants' understanding of the term MT was checked through initial questioning and in all cases was found to be closely aligned with current conceptualisations. (3) Participants were asked whether or not they considered themselves to be mentally tough. (4) A process of "snowball" sampling (Patton, 2002) was used to recruit additional participants whom the initial sample identified to epitomise MT in mountaineering. (5) Research team members used their own knowledge and critical awareness to assess whether or not participants were mentally tough. Interviews were recorded using a digital data-recorder and transcribed verbatim by a professional transcription company.

Data Analysis

A flexible, content analysis (Silverman, 2001) was used to generate themes. In accordance with phenomenological principles, the research team employed an iterative process of data analysis, with members independently analysing transcripts to identify raw themes. Following Giorgi's (1985) guidelines for undertaking psychological-phenomenological research, the following data-analysis process was adopted: engagement with the phenomenological attitude (efforts to suspend as far as possible preconceptions surrounding the phenomenon); initial impressionistic readings of transcripts to gain a feel for the overall account; in-depth re-reading as part of a lengthy process of data-immersion, to identify themes and sub-themes (see also, Allen-Collinson, 2011). The researchers separately produced initial discovery sheets of key words, concepts and themes, before provisionally classifying common concepts into categories. Subsequently, team-members discussed and

agreed upon salient higher-order themes and general dimensions. Transcripts were revisited and coding decisions were discussed *intra* team to reconcile any analytic divergences. Individual transcripts were analysed to examine the appropriateness of the classification of meaning segments into established theme categories, to enhance the accuracy of the coding and inductive analysis. Consistent with qualitative approaches in general, data segments could have been interpreted and coded in myriad different ways. In making explicit our paradigmatic grounding, and having sought detailed feedback from our participants *vis-à-vis* our initial interpretations, we seek to engender confidence that our findings are firmly grounded in contextual understandings of our participants' life-worlds.

Trustworthiness

To enhance the authenticity and trustworthiness of data analysis (Sparkes & Smith, 2013), a series of procedures was undertaken. A key element of phenomenological research is engagement in *epochē* or *bracketing* (see Allen-Collinson, 2011). In undertaking the epochē, the researcher aims, as far as is possible, temporarily to bracket her or his tacit assumptions about what is claimed to be "known" about a phenomenon, or at least to critique these assumptions, in order to approach the phenomenon with "fresh eyes" (Allen-Collinson, 2011). In the present study, a bracketing interview was conducted between two research team members in order to identify and challenge potential interviewer bias. After four interviews were complete, the first two authors listened back to a recording, to provide self-reflection, critique, and to aid the process of bracketing. For example, this process led to greater agreement about areas to probe in subsequent interviews – the content of which was reflected upon in weekly meetings during data collection.

As Tracy (2012) notes, member-checking is considered good practice in seeking to generate credible, authentic and plausible interpretations. Participants were provided with a summary of the analysis and the manuscript, and were encouraged to question the team's

interpretations and offer alternative accounts. Participants did not report any issues and did not request any changes to the analysis or manuscript.

Results and Discussion

All participants reinforced the importance of MT in mountaineering due to the specific demands of the sport and environmental conditions. The data are organised within three general dimensions that represent key findings (see supplementary material); these being (i) interactions with risk, (ii) DM processes, and (iii) dangers of MT. While presenting these themes separately we acknowledge that inter-relations exist; for example, perceptions of risk influenced decision-making. To illustrate the key themes direct quotations are used to "give voice" to participant experiences. Figures in parentheses identify our participants.

Interactions with Risk

This general dimension reflected participant interactions with and interpretations of risk. Risk was described as the potential for gaining or losing something important (e.g. goals / life). In particular, awareness and appreciation of the risks of high-altitude mountaineering were evident but offset by risk-management strategies, the enjoyment of mountaineering challenges and the environment. Participants planned ahead to reduce risk and remained vigilant when in the mountains.

Enjoying the challenge / accepting the risk. The passion for and enjoyment of mountaineering was expressed by all participants. This theme reflected the beauty of the natural environment, teamwork, the sense of freedom gained from climbing, and the hard physical work, even suffering, needed to achieve goals. Mentally tough participants reported understanding and accepting the risks involved in mountaineering. "I'm a realist...I know that if you're going for a summit push on an 8000m peak there's a chance you might not come back [but] I love the risk factor; I love the isolation; I love the tranquillity of it all; I love the adrenaline surge you get" (12). Those interviewed had witnessed death in various forms in

the mountains and were able to cope effectively and continue climbing, even immediately following traumatic events. Participants reported seeing climbers fall to their death, losing team members in avalanches, passing bodies of deceased mountaineers near the summit of 8000m peaks, and recovering bodies following accidents. Despite this, these mentally tough participants consistently reported that the risk and challenge of testing their skills in the harshest conditions was the very thing that attracted them to the sport. The enjoyment of mountaineering outweighed the risk. "Despite watching somebody die, that creates the jeopardy that actually makes what we do interesting" (4). Similar to previous findings (e.g., Ewart, 1994), several mentally tough participants reported that their perception of risk was somewhat different to low MT individuals or non-climbers: "Whilst I might put myself in physical environments which others might think are risky or might consider as high-risk environments, I don't" (4). Similarly, it was noted that "less mentally tough [climbers]…are often worrying about how they are dong, how they feel" (6), and that "they're sort of like scared of what they took on, it's more than they thought" (11).

Managing (minimising) the risk. Participants reported the perceived ability to manage some risks through experience, planning, preparation, and logical DM. This was not seemingly born from a sense that it could never happen to them, rather an acceptance that things *could* go wrong but it was possible to reduce the risk through careful risk-management; for example, "by making the right decisions regarding the weather, the route, my health, and my team mates, using the right safety gear, going in the right season, those risks I know that I can minimise" (2). While previous work has highlighted small, yet significant positive relations between MT and attitudes to physical risk-taking (Crust & Keegan, 2010), it was evident that these mountaineers were acutely aware of the risks and were very logical risk-managers:

> I think a lot of that is about appreciation of risk rather than trying to ignore risk. Ignoring risk is dangerous. Appreciating it, working round it, seeing it as a challenge to be overcome, not as something that must be ignored, I think is key to being mentally tough (4).

This management of mountaineering risk has parallels with work by Hardy et al. (2014) that found mentally tough cricketers were sensitive to punishment, were vigilant, and planned ahead to avoid negative consequences.

Monitoring of conditions (situational awareness). Experienced and mentally tough participants reported being vigilant and closely monitoring environmental conditions during ascent and descent in order to off-set risk. "I think tougher people often are much more withdrawn, and analyse situations…looking at all your possibilities all the time" (8). During the ascent phase, such mountaineers paid close attention to rock formations or other features of the terrain that could aid route-finding if conditions deteriorated or light faded. During the descent, they were in a high state of focused concentration with acute awareness of the dangers of mistakes due to fatigue or lapses of attention. "I'm always looking over my shoulder. Kind of going 'how do I get down this part?' or to try to remember this section so if it gets dark I can figure it out" (1). Similar to Wickens et al. (2015), mentally tough participants were attuned to a range of external (i.e., snow conditions, weather, number of people on the route, etc.) and internal (i.e., bodily sensations such as fatigue, effects of altitude) information that was integrated into the complex process of DM. Furthermore, the MT and experienced mountaineers in this study perceived that climbers with low MT and less experience were not as vigilant, and did not employ such risk-management strategies to the same extent.

Calculated risks versus reward. Participants reported taking calculated risks but clearly distinguished MT from machismo or foolhardiness. One mountaineer who turned

around following poor snow conditions on K2 reported a brief conversation with another climber who evaluated the risks somewhat differently: “Before he went he said ‘summit or die, either way I win’ and he got both. Now to me no summit is worth even the tip of my little finger.” (4). Unless based upon catastrophic events (such as avalanche), the approach of the climbers interviewed was to continue while constantly monitoring, until a point where the risk of continuing outweighed the potential rewards. Another mountaineer (5) emphasised the risk versus reward continuum when evaluating conditions on K2:

> But also about deciding what's worth it. I turned around on K2 because the snow conditions were poor. I could have kept on going a little bit further but I got to the point where I thought...in theory I can say “one more step, one more step,” but my recognition of risk versus reward is that it's now better, now it's time to turn around.

Decision-Making Processes

This general dimension concerned how participants approached and managed key decisions at crucial points within the climb, highlighting as important the awareness of self, the environment, situational factors and the complex interactions that led to effective DM under pressure. Emotions were set aside in favour of realistic evaluations and rational analysis. Nevertheless, the experience of these participants meant they also reported an intuitive sense of danger and were generally able to show restraint when necessary, even when involving sacrificing personal ambitions.

Logical and rational decisions. Decisions were described as logical and rational rather than emotive, with mountaineers usually able to separate their own personal goals and ambitions from the perceived realities of the situation. One described the logical analysis preceding an important decision to turn back on a Mount Everest summit bid. While waiting around due to large numbers en route, he became aware of cold sensations in his toes and the early signs of frostbite. “I think it was a good decision that I made over maybe one hour and

analysing the conditions and it was not an impulsive decision... I've seen a lot of people get in trouble by being emotional" (2). The following year, he returned to set a climbing record on Mount Everest. Another participant reported that: "you've got to be very honest with yourself. You've got to look within...to be able to double-check. The only way to do that is to step back and say 'is this the right course of action?'" (4). In contrast, participants reported that less mentally tough mountaineers seemed influenced more by emotions when the challenge was high, and were likely to turn around sooner. Participants repeatedly used the word "calculated" to emphasise the logical analysis that underpinned DM. This reflected evaluating the likelihood of success against the potential for accidents. The mentally toughest climbers were seen as those who would seek advice but ultimately make their own decisions without relying on others. An expedition leader noted the less mentally tough "want that safety net around them, people to make decisions for them" (8). Furthermore, those who were high-altitude guides for less experienced climbers provided several examples of turning back clients on Mount Everest and refusing to let anything other than the logical analysis of the situation / conditions influence their decision: "I don't want to have to make that call to their mum [or spouse]...I will grab their collar and pull them back if they're about to take that one step too far" (1).

Pushing hard but sensing danger. Some mentally tough participants reported beginning to internally question whether it was prudent to continue before reaching a point of rest such as a snow-shelf that allowed time to reflect and take decisive action: "there's a difference between bravery and a lack of appreciation of danger" (4). Similar to previous reports of MT (Cook et al., 2014; Gucciardi et al., 2016) participants were prepared to push hard and keep going in adverse conditions, but there was a point where the interaction of internal and external factors was perceived to indicate a worsening of the risk and reward balance and the potential for disaster. Mentally tough mountaineers also reported visualising

and projecting forward to the likely consequences of one course of action or another. One such participant described a decision to turn around on K2:

> We climbed for hours and it was exhausting work but again that sense of "I can get to the next camp, I can rest and then we'll go to the top and it will be worth it". But the snow conditions were very bad, the climbing was very steep, I was getting exhausted...I started to go down a path where things might not be possible to come back from. I realised that yes, I could keep putting one foot in front of the other and I was, but now the image of me summiting was actually rapidly disappearing and it was being replaced by almost an image of me not being able to make it either to the next camp or back to the previous camp. (5)

Highly experienced participants reported the importance of intuitively sensing danger and trusting their instincts. One expedition leader explained this as:

> A gut feeling is, I dare say, all those little subconscious things that you recognise... danger points that you recognise but subconsciously and you then start, the body then starts or the mind then starts recognising this and then gives you a warning sign so er I dare say good decision-making comes from acting on the subconscious reactions that you have during the course of the day. (9)

For mentally tough mountaineers this often emerged during a form of pre-reflective, intuitive processing of information when attention was primarily directed to simple tasks such as coordinating steps and breathing on the summit push. This subconscious process gradually shifted to a more conscious awareness of external conditions and situational factors that signalled danger. One such climber recalled the decision-making process made on K2 when he turned around while his climbing partner and many other mountaineers continued:

> You start looking around and your mind registers stuff that you might not consciously recognise all the time. So when I started looking at all those factors I'm like the

> avalanche danger is high; the chance of serac collapse is high; we're not moving fast enough; we're not gonna be able to get through the Bottleneck before it's dark, and then I also wasn't feeling 100%. So all of those things combined made it the right decision for me to turn around. (8)

Several mountaineers died on K2 that day and his climbing partner endured a bivouac high up the mountain, eventually losing toes due to frostbite. Also on K2 an experienced and mentally tough expedition leader (9) recalled making a life or death decision to turn his clients around after an avalanche, before quickly *sensing* a better option was to stay where they were.

> I realised that I made a mistake...I realised that they were in a safe area, but it was better that they stayed in that safe area than to try and pull them back immediately, and if I had pulled them back immediately they would have been killed in one of the avalanches.

Sacrificing personal goals to help others. Not all decisions to turn around were based upon environmental conditions or personal health. One participant highlighted the personal sacrifice and abandonment of goals displayed by an elite mountaineer to help a climber who had collapsed within sight of the summit of K2. This involved maintaining a sense of reality and not losing sight of what was most important. Decisions to set aside personal ambitions to help others in need were highlighted as indicative of MT.

> He'd attempted to climb K2 [before] and had got within 200 metres of the summit and stopped to help someone who'd been left for dead by another team. Now many might see that as just a moral imperative, I see that as mental toughness. He was faced with a decision of "do I continue?" You know this guy for all intents and purposes is dead, do I continue to the summit which you know is almost a given at that point or do I stop to try and see if this guy is still alive and try and help him and as a result of that

> then to throw away my own dreams, desires to get to the summit? He saved that guy's life but I think that's a great example of mental toughness.

Several participants reported involvement in rescue attempts following many hours of physically- and mentally-demanding climbing. While other mountaineers reportedly focused upon personal goals and continued past stricken climbers, or were focused upon self-preservation, those perceived as the mentally and physically toughest mountaineers were the ones who risked their own lives to attempt rescue.

Understanding limits and demonstrating restraint. Participants accepted that sometimes circumstances were beyond their personal control and that understanding one's own limits was crucial to survival. Essentially, MT was about giving maximal effort to achieve goals, but also knowing when enough was enough and practising restraint when the goal of staying alive became more important. One participant (7) reported waiting high on K2 for conditions to improve before realising the route had become too dangerous. "The right decision was then to turn back and go down. So there are points where you sort of try to push, push the limit but then at the same time you do know where the limit is." This mountaineer described turning around on Makalu within sight of the summit, after having the self-awareness to understand his body was not functioning effectively.

> At that point you could literally see the summit but I decided not to go for it even though, even to this day I'm sure I could have made it to the summit but I'm almost positive I would not have come back down. (7)

One participant commented, "So it's a fine line, and I think a lot of mental strength depends on also being prepared to give up" (13). The decision to turn around was never taken lightly, especially with the substantial investment (financial, emotional, etc) involved. Often the decision to descend *without* summiting was regarded as more difficult, requiring much greater MT.

> To have the mental strength to turn around, that's often much more difficult than carrying on. I mean if you can already see the summit of Everest; you've just spent seven weeks, you've spent 60,000 US dollars, but your expedition leader tells you that you're getting into trouble if you carry on, turning around then takes huge mental strength. Carrying on is much easier. (3)

Participants reported an acute awareness of self, situation, and what they were, or were not capable of. Self-knowledge and honesty were previously reported as important components of MT in mountaineering (Fawcett, 2011). That was not an acceptance of failure but more a pragmatic, realistic perspective; sometimes the circumstances/conditions were too dangerous and it was better to return, to try again another time.

Reframing success and failure. One interesting comparison that emerged from the data concerned perceptions of success and failure for high MT mountaineers. These mentally tough – and high-achieving – mountaineers all set out on expedition with the goal of summiting, but the summit itself was often reframed as a "bonus". "One might assume that getting off a mountain is failure. Now I believe that that's where you need to be mentally tough to go OK, well we didn't quite achieve what we set out to, but we've had an amazing experience" (4). Significant rewards were gained from the attempt itself with the realisation that sometimes things beyond one's personal control meant the summit remained out-of-reach. While not summiting was disappointing, it was not framed as failure for mentally tough participants as long as every effort had been made in the prevailing circumstances. "Failure means something different to me, if I summit a mountain but two people die on the way home [or] we're not talking when we get back that's not a success, that's a failure. Reframing what [we've] achieved, so despite not getting to the actual summit...we got as far as [we could]" (1). Building on *calculated risks versus reward (above)*, mentally tough

participants viewed the loss of fingers and toes to frostbite as a sign of failure to manage risk and poor DM rather than a badge of honour even if the summit had been gained.

The Dangers of MT

Participants all endorsed the importance of MT in mountaineering, highlighting numerous examples of when MT was necessary (e.g., continuing when in pain, decisions to turn around, turning clients around, assisting rescue of injured climbers). Despite this there was a consensus that in some situations MT could also be dangerous. The most common example reported was that some mountaineers with high levels of MT persist too long, enduring conditions that endangered not only themselves but other climbers who were then required to provide rescue. High-altitude doctors also reported that mentally tough mountaineers would often down-play symptoms (e.g., coughing) that could indicate acute mountain sickness or early stages of pulmonary oedema. In some circumstances the toughest mountaineers would appear to avoid the doctors or hide their symptoms for fear of being told to descend. "They're very determined and the hard part about treating them is slowing them down…it's hard to force these people to go down…they're there to climb, they're not there to go back down…They have strong characters" (11). Participants provided several examples of highly-experienced and mentally tough mountaineers pushing their bodies too far in a quest to summit and then suffering exhaustion on the descent. Several explanations were offered for making poor decisions, such as oxygen deprivation, external pressures, and human error. One explanation concerned the competitive nature of mentally tough individuals and the desire to achieve personal goals.

Competitiveness. Participants noted the need to restrain their competitive nature and the potential consequences of not doing so. One participant reported the conflict between her rational/logical self and her competitiveness when experiencing difficulties but being within

sight of an 8000m summit. The temptation to continue was internally vocalised as the "devil on her shoulder".

> The devil's saying, "Do it; you've just spent your lifesavings and you're not gonna get another chance for two years; you don't wanna go back." You hate to fail; we all hate to fail; we want the success story. It's just a battle with reason for me. Yet the little devil on your shoulder is saying, "Don't be a wimp; this is ridiculous; you're right here." That's where I think some people don't come back though. (12)

This appears similar to the "ego control" reported as a central feature of MT in previous case-study research concerning an elite mountaineer (Fawcett, 2011). As such, survival is given higher priority than personal ambitions or goals. While most research posits high commitment as a central feature of mentally tough individuals, there is evidence that for some, this can develop into over-commitment (even obsession) resulting in negative consequences such as burnout or injury (Crust et al., 2014). In mountaineering the dangers of obsessive focus upon the summit have previously been reported (Burke et al., 2010). One mountaineer described making the decision to carry on to the summit of Shishapangma despite being three hours behind schedule and aware of worsening weather conditions.

> We felt strong, we were both very, very determined to achieve our goal, the conditions on the mountain were fairly good, fairly stable, so we just kept pushing each other on... a mountain is always there tomorrow, so you can always come back tomorrow but sometimes a timeframe is never there so it has to be now or never. (7)

The decision, primarily based upon supporting his partner to achieve a landmark achievement resulted in both men having to bivouac high on the mountain after weather conditions deteriorated rapidly. Nevertheless, while their competitiveness led them into danger, MT enabled them to make rational decisions that facilitated their survival even when suffering dehydration and the effects of altitude. "We had to sit down and wait until daylight because if

we'd have moved another 100 metres, we'd have made a wrong decision, we'd have fallen down a crevasse." The climbers were fortunate that conditions improved the next morning as both were physically depleted and struggled down to a lower camp.

Mind-body imbalance (persisting too long). There was a feeling that some people had MT that was out-of-balance with physical capabilities. "I think the main drawback is not being able to know when to give up. To keep pushing as far as you can and then being past the point of no return" (2). Another mountaineer (3) reported an example of what she described as "body-shutdown" with feelings of strength and energy suddenly being replaced by a drained sensation after summiting an 8000m peak. Whilst managing to get down safely she acknowledged that her MT had over-ridden her body awareness and placed her in a dangerous situation which she was able to overcome only with the support of her climbing partner. Several participants felt that some deaths of fellow mountaineers were due to their being too mentally tough and warned of the dangers of not tuning in to one's own body and internal sensations of energy reserves. "That comes about from them being mentally tough and overriding their physical [capabilities] and they die from exhaustion. When that happens usually they self-override their body to the point where their body can no longer respond" (8).

Over-estimating personal control. While most mountaineers reported restraint and knowing when to turn around, some examples akin to costly perseverance (Lucus et al., 2015) were noted when describing other mountaineers. One female participant gave an overview based on her experiences of losing friends in the mountains.

> The more you do it [push the limits] and the more you have success with no failure you start to get a little arrogant maybe. You just keep going until you get hurt or something goes wrong and you either get lucky or not in that situation. You see it a lot in mountaineering with sponsorship or...where the guides at some level felt they had to get their clients up and took unnecessary risks. They broke their own rules. I

> think the more you have success without failure, the more you're willing to tempt fate. So your mental toughness leads you down a path that ultimately ends badly (12).

This appeared to represent extremely mentally tough, experienced mountaineers who had overcome challenging and hazardous conditions/situations previously, and who over-estimated their ability to exert personal control in such circumstances. One participant reported oxygen equipment failure when heading to the summit of Everest, acknowledging afterwards he should have turned around. Feeling in control, he pushed on to the summit but later lost several toes to frostbite. "If I knew in hindsight that I was gonna suffer frostbite then would I have gone that extra mile to get to the top or come down and keep my toes? I would've come down; no question about it." For some, "getting away with it" previously led to the belief they would be able to do so again. Wickens et al. (2015) warn that experience gained with an absence of consequences can breed dangerous over-confidence, with evidence that experts are just as susceptible to over-confidence as novices (Kahneman, 2011).

Selective attention / discounting. Some mentally tough participants highlighted the fine line between challenging oneself and pursuing goals, and losing a sense of reality.

> Well it's difficult to make decisions at altitude for many reasons. I believe one of them is high up on the mountain, you're not thinking clearly and all the time I think the, how do I say this, trying to reach the summit, can make other important factors, not seem as important. (1)

This theme was reported to be dangerous for mountaineers with high levels of MT, reflecting selective attention to information that confirms their belief that the summit is attainable, while discounting other more relevant information (i.e. route conditions, time of day) indicating otherwise: "I saw many strong people that died easily...very, very tough, but just focussed on the summit" (14). Wickens et al. (2015) drew heavily on Nobel Prize-winning work (see Kahneman, 2011) to explain how decisions in mountaineering could be influenced

by susceptibility to a series of well-known heuristics. One of these, known as confirmation bias, occurs when selective attention is paid to cues confirming an initial belief. Present findings indicate the potential for this and other "biased" decision-making in mentally tough mountaineers, although the findings were somewhat nuanced.

The counter-balance of experience. Participants identified interactions between MT and experience that are noteworthy and could benefit from further investigation. There was general agreement that mountaineers with high levels of experience and MT had the optimum combination in regards to DM and risk-management. In effect, this combination was deemed evident in the best climbing partners as experience was generally viewed as a counter-balance to MT, meaning climbers gave maximal effort and remained committed though adversity, but were able to make the toughest decisions to turn around. A number of examples were provided of inexperienced climbers with high levels of MT who had managed to summit 8000m peaks. Nevertheless, there was a general consensus that such achievement usually occurred during ideal conditions and when the climbers were guided by more experienced mountaineers. Examples of mentally tough but inexperienced climbers getting into trouble and needing to be rescued (unable to help themselves) were reported with one participant summing up the general feeling that, "Mental toughness with experience is a very positive thing but mental toughness with inexperience, that's a recipe for disaster" (2). Without experience, MT can lead mountaineers to persevere too long and not recognise the situational dangers that indicate risk outweighs reward. It was felt that few people with low MT were drawn to mountaineering, although some climbers were felt to be tougher mentally than others. Several participants reported that they would not choose to climb with a partner whom they perceived to lack MT.

General Discussion

Through adopting a phenomenological methodology, this study aimed to examine the lived experiences (particular focus upon DM) in mentally tough, high-altitude mountaineers. A central feature of the work was to explore evidence of costly perseverance (Lucus et al., 2015), with findings indicating a complex and nuanced relationship between MT and DM. Mental toughness was generally reported to be beneficial in deciding to persevere or to turn around and particularly important in remaining calm and rational in crisis situations. This was because the mentally toughest mountaineers reported being realistic, analytical, vigilant, and aware of limitations (e.g., self, environmental, situational). Nevertheless these mountaineers seemingly walk the fine line between pushing to the limit and pushing too far in conditions where the brain is depleted of oxygen and temptation is bound-up with personal ambition, investment, or external pressures in the case of guides or expedition leaders (Wickens et al., 2015).

A plausible explanation of our findings is that, analogous to other psychological constructs (e.g., self-confidence), there is an optimal level of MT. Previous MT research has tended to emphasise the benefits and largely overlook potential drawbacks (Andersen, 2011). Mountaineers from our sample mostly reported persevering in challenging situations in order to achieve goals, but recognised limits and applied restraint as necessary when safety was paramount. One potential benefit of MT in highly stressful situations that might partially explain effective DM is the ability to remain calm, flexible in attention, and focused on task-relevant cues (Cook et al., 2014; Coulter et al., 2010). Our participants reported a continual monitoring of conditions and assimilating a wide range of information to support DM – a process requiring flexible attention. In contrast, it is well documented that stress can cause attentional narrowing and therefore restrict the search for potential solutions (Wickens et al., 2015). Given the stress-resisting qualities associated with MT (Hardy et al., 2014), our participants would theoretically be well-placed to function effectively when under pressure.

Despite this, some mountaineers were described as too mentally tough for their own good, persevering towards the summit and ignoring the physical sensations of exhaustion, thus not allowing requisite reserves of energy for the descent. This has parallels with work that found mentally tough exercisers over-ride pain and continue exercising when injured, thus risking more serious injury (Crust et al., 2014). One reason that an optimal level of MT might explain these findings is that for different reasons, climbers with low MT (e.g., highly anxious) and very high MT (e.g., fixated on goals, evidencing stubborn perseverance) may have suboptimal focus. This essentially suggests more rigid, less flexible attention. Thus, while low levels of MT were associated with abandoning goals too quickly, those with extremely high levels of MT may endanger themselves by persisting too long and taking undue risks. While high levels of MT were reported to be essential in mountaineering, it may be that dangers accompany extreme levels. Similar to past research (Burke et al., 2010; Fawcett, 2011) the dangers of competitiveness and obsession with the summit were emphasised, thus the reported examples of costly perseverance might also reflect obsessive passion (Vallerand & Miquelon, 2007) where mentally tough climbers become obsessed with goal attainment. It is important to be mindful that in high-altitude mountaineering, decisions are made in conditions where the brain is starved of oxygen, and this has been identified as a major factor in reported accident rates (Wickens et al., 2015) and can be influential irrespective of experience or MT.

Present findings are also important in context of the conceptual similarities and differences between MT and psychological grit (Credé et al., 2016). While most mountaineers reported high levels of perseverance but applying restraint as necessary, some examples of costly perseverance and near-misses were provided. These were often reflections upon the decisions of other climbers (including climbing partners), but there were examples where participants themselves lost fingers / toes to frostbite following decisions to persist.

Participants also reflected on risky decisions that ended favourably, when the outcome was partly due to good fortune (outside personal control). Disparity between present findings and those of Lucus et al. (2015) might reflect conceptual differences between MT and psychological grit. Both constructs overlap in relation to perseverance but the former is a somewhat broader construct, generally grounded in rational perceptions. One high-altitude doctor observed that the mentally toughest climbers could be sub-divided into those who were more open-minded, flexible thinkers, and those who were more rigid, stubborn and inflexible. It is possible this distinction reflects important conceptual differences between MT and psychological grit, with the latter more likely to adopt stubborn persistence. This might explain why our participants were generally able to retain a sense of perspective and remain realistic even when having to abandon personal goals.

A highly salient finding concerned how participants emphasised the combined importance of MT and experience. A recent review highlighted how experience facilitates effective DM through processes such as problem identification, pattern recognition, intuition, and holistic evaluation of potential courses of action (Cotterill & Discombe, 2016). High levels of experience, as reported by our sample, were identified as key to making effective decisions in mountaineering. Nevertheless, the importance of MT to goal achievement was also emphasised through perseverance and deciding to continue in challenging conditions. Commensurate with previous work on MT (Crust et al., 2014), mountaineers reported an analytical rather than emotional analysis of circumstances that was important in making effective decisions. In combination, MT and experience usually resulted in effective DM (e.g. to persevere in challenging conditions, but abort when risk became too high). Consistent with previous findings (Crust & Keegan, 2010) the mountaineers reported pushing to the limit and taking calculated risks to achieve their goals. Nevertheless, DM in such challenging and changeable natural environments is complex and subject to multiple interacting variables (see

Wickens et al., 2015). While our participants emphasised the combined importance of experience and MT to underpin effective DM, examples were also given where tough and experienced mountaineers perished, sometimes through failure to apply restraint and over-estimating personal control. Indeed, previous research has identified that in some circumstances, where experience is gained with an absence of consequences, expert participants are just as susceptible to making biased (and ineffective) decisions as are novices (Kahneman, 2011). Equally, the drive to persevere and achieve that is evident in mentally tough participants might lead some to become obsessed with goals (Crust et al., 2014) and thus take undue risks.

Consistent with Klein (2008), there was evidence that effective DM reflected both analytical and intuitive processes. One particularly novel finding concerned the importance of the "gut feeling" or pre-conscious processing that develops from experience, and which precipitated conscious analysis of the external environment. Whilst rational and analytical processes were used to make crucial decisions, this subconscious sense of danger often prompted a greater awareness and analysis of prevailing circumstances and environmental factors. This switch from intuitive to more conscious processing of information was reported by the most experienced mountaineers and appears worthy of further investigation, especially given similar processes have recently been reported with experienced adventure sports coaches (Collins, Collins, & Carson, 2016).

Similar to Burke et al. (2010) participants had a highly-tuned self-awareness (sense of energy expenditure, coldness etc.) and used this information alongside environmental factors (route conditions, weather forecast). Similarly, participants drew heavily on knowledge and personal experiences. Nevertheless, the most prominent features characterising DM was monitoring of environment and self, rational analysis, and restraint. Participants were vigilant and constantly evaluating information in the moment, and were thinking through the

consequences of actions several stages in advance. One participant likened mountaineering to a chess match. Emotions and the desire to summit were usually set aside to enable controlled and rational thinking. One previous intervention study found self-awareness to be an important process by which participants enhanced their MT (Gucciardi, Gordon, & Dimmock, 2009). This process appears similar to the ego control noted by Fawcett (2011).

Some scholars have been critical of past MT research in traditional elite sport contexts, which they argue presents an unrealistic, fantasy account based upon "macho" connotations (Andersen, 2011). In particular, Andersen maintained stubborn perseverance or rigidity are rarely considered positive character traits. In contrast to previous accounts of elite athletes, through examining the lived-experiences of elite mountaineers we offer a different, finer-grain perspective on MT, consistent with the contextual differences reported by Fawcett (2011). This perspective may be coloured by the physical dangers involved with mountaineering and the past experiences of the participants. While these mountaineers were prepared to take calculated risks, as one climber reported, that doesn't mean "any risk". These participants were aware of limits and retained a sense of reality, and the good judgement to know when enough was enough. It was accepted that the toughest decisions were actually to turn around (also see Fawcett, 2011) and enduring the disappointment of not achieving the summit despite the investment of time, money, and effort. There was no place for attitudes such as "summit or die", over-competitiveness, or celebrating the rigid, stubborn accounts from other sports (e.g., Cook et al., 2014), which were replaced by narratives of restraint and flexibility.

A further finding was particularly noteworthy given both extant reports of selfish behaviours of mountaineers (Simpson, 1998), and previously reported characteristics of MT (Cook et al., 2014). There were numerous examples of climbers giving up personal goals and ambitions to aid in the rescue of injured climbers, or performing rescues when in exhausted

states following their own summit attempts. The moral decision-making of climbers has been criticised following high profile fatal incidents (Simpson, 1998). It must be acknowledged that rescue attempts at high-altitude are extremely dangerous and place the lives of rescuers at great risk. Rescue is not always possible, but the examples of selfless behaviours reported by mentally tough climbers challenge perceptions of selfishness, and run counter to other evidence that MT individuals are single-minded and focused only upon personal goals (Cook et al., 2014; Jones et al., 2002).

There are some interesting parallels between past and present findings that may be theoretically important. For example, while the mountaineers were prepared to take calculated risks, there was clear evidence of risk-management and taking preventative actions to reduce risk rather than merely ignoring it. Participants were highly attuned to danger, detected threats early and planned their actions accordingly to reduce risk. This coheres with the findings of Hardy et al. (2014) where early threat detection and sensitivity to punishment were found in mentally tough cricketers. Furthermore, Barlow et al. (2015) recently found alexithymia (a trait representing emotional regulation difficulty) significantly related to risk-taking behaviours, fewer precautionary behaviours, and concomitant increased likelihood of accidents and near misses with high-risk sports participants. In contrast, mentally tough mountaineers reported calculated risk-taking, risk-management strategies, with emotions and feeling clearly articulated, expressed and regulated throughout climbing experiences. Through using different research strategies and samples, these studies in combination, are beginning to elucidate important individual differences related to DM, and cautiously explain why some people present greater dangers to themselves and others.

Limitations and Future Research Directions

The present work offers new perspectives on MT and further insights into the complex DM processes in mountaineering, but as with all research, some limitations were

evident. For example, single retrospective interviews were used and generally concerned incidents that occurred over the course of a career and thus some accounts were of actions taken several years previous. It is possible that over time a selective form of recall provides an incomplete picture of events at the time; a limitation of methods requiring participant recall. To address this, it would be profitable to interview climbers immediately post-expedition to obtain near-experience data (see Swann, Keegan, Crust & Piggott, 2016). While the participants were encouraged to provide examples of both perceived good and bad decisions made on expedition, it was noticeable that significantly more personal examples of perceived good, and concomitantly, more examples of perceived poor decisions of other climbers were recounted. This may represent a form of biased recall although given these climbers had extensive experience and had survived in extreme conditions it may simply reflect good judgment. Nevertheless, as one expedition leader highlighted, the labelling of decisions as good or bad is mostly based upon retrospective reflections on consequences. Finally, while we have presented our interpretations of the data, others could have coded them differently and may have arrived at alternative conclusions.

The findings offer several promising lines of enquiry and further research will enable better understanding of these ideas. The relationship between MT and costly perseverance might be examined through extending the work of Lucus et al. (2015) to encompass and compare MT *and* grit to differentiate these constructs. While MT is evidently important to success in mountaineering, it is possible that high MT, alongside other situational factors, might predispose some mountaineers to persist too long and take undue risks. In particular, the relationship between MT and obsessive passion (Vallerand & Miquelon, 2007) should be further examined. While Gucciardi, Jackson, Hanton and Reid (2015) reported obsessive passion was significantly and negatively related to mentally tough behaviours in tennis players, there is existing evidence to suggest that those with very high levels of MT might

become obsessed with goals (Crust et al., 2014). If the present findings are supported elsewhere, future research could aim to develop training and educational interventions to counter risk. Such interventions could help to save lives in the mountains, especially given the high mortality rates in mountaineering. Recent evidence suggests targeted interventions are more effective in promoting effective DM, than is simply accumulating vast experience (Cotterill & Discombe, 2016). Furthermore, these findings suggest that different strategies may be needed for climbers across combinations of MT and experience (e.g., high MT but low experience compared to low MT but high experience). Future researchers might also profitably examine the impact of cultural differences in decision-making. For example, the mountains hold different cultural significance (i.e., spirituality) to Sherpa mountaineers and this is may impact upon DM. Given differences noted between accounts of MT from mountaineers and those of more traditional athletes (Cook et al., 2014; Jones et al., 2002) future research might examine behaviours and coping mechanisms employed by more and less mentally tough mountaineers to compare with previous data. Indeed, interviews with a broad range of mountaineers, augmented with behavioral observations, could yield further insight into the findings reported here.

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