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RELATIONSHIPS BETWEEN RISK TYPES & MENTAL TOUGHNESS

WHITEPAPER
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BACKGROUND

Sporting success at the elite level is judged on the finest of margins.

In most sports, physicality is key. Being stronger, faster, fitter and more coordinated will be a significant advantage. These factors are usually straightforward and can easily be measured using quantifiable metrics like time, distance, speed and weight.

But these metrics only tell part of the story.

On paper, athletes may seem destined for greatness, yet never reach the heights expected of them. In other cases, they greatly exceed all expectations. This demonstrates the limitations of 'traditional' metrics. They can only take you so far in predicting the ultimate metric: success.

Improving prediction has required leading researchers to broaden their horizons in search of a deeper, more accurate and more diverse understanding of success in sports.

Physiology is certainly one key, but further work has served to highlight the importance of psychological and socio-cultural factors.

PSYCHOLOGY IN SPORT

Recognition that athletes and their coaches needed to look beyond physicality coincides with the increasing prominence of psychology in the world of sport. Sports Psychologists use psychological principles, knowledge, strategies and techniques to address a wide range of performance and well-being issues in sport and in life ([Terry et al., 2020](#)). This has made them essential members of the non-playing staff tasked with supporting and developing athletes.

The demand for sports psychologist expertise extends beyond the realm of sport. Their insight is increasingly sought by professionals in high-stress jobs including surgeons, firefighters and performance artists. The organisation employing the largest number of sports psychologists is the US Army ([Weir, 2018](#)). Findings from the realm of sport are being generalised and applied to performance in an increasing range of contexts.



PSYCHOLOGY IN SPORT



The current research study uses personality science in a sport psychology framework to understand potential precursors to high performance. More specifically, this study will explore the interactions between mental toughness, personality and risk taking. Each of these concepts have been identified as important aspects of athletic performance.



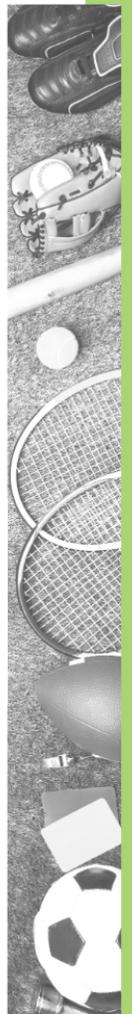
MENTAL TOUGHNESS

One of the most important psychological constructs related to sporting success is 'Mental Toughness' (Crust & Keegan, 2010; Mahoney et al., 2014). Publication and citation metrics indicate its substantial growth in the academic literature over the last two decades (Gucciardi, 2020). Mental toughness is a multidimensional trait that Crust (2007, p. 271) summarises as:

“

Coping effectively with pressure and adversity so that performance remains little affected, recovering or rebounding from setbacks and failures as a result of increased determination to succeed, persisting or refusing to quit, being competitive with self and with others, being insensitive or resilient, having unshakeable self-belief in controlling one's own destiny, thriving on pressure and possessing superior mental skills.”

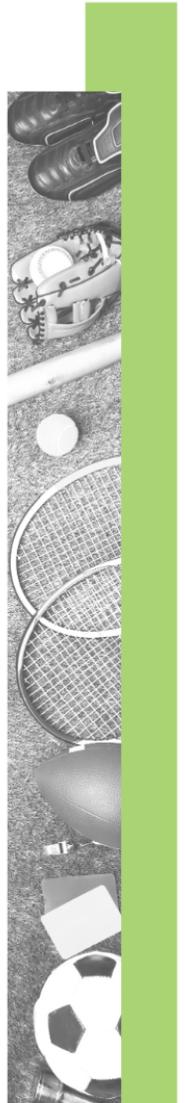
”



MENTAL TOUGHNESS

Athletes, coaches, and sports psychologists have consistently referred to mental toughness as one of the most important psychological characteristics related to sporting success ([Crust, 2007](#)). Greater levels of mental toughness enable athletes to perform effectively and thrive in demanding situations (Weinberg, 2010; [Crust, 2009](#)). Unsurprisingly, it has been reported consistently in elite athletes ([Mahoney et al., 2014](#)). Mentally tough athletes are characteristically described as self-confident, challenge-seeking and low in anxiety (Clough et al., 2002).

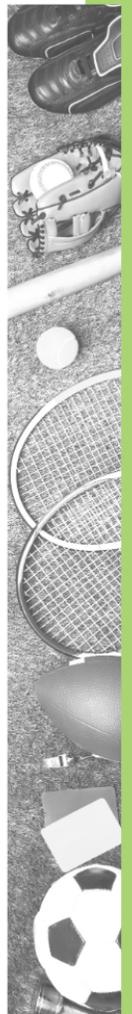
As with personality, levels of mental toughness are regarded as relatively stable throughout adulthood. Psychologists have argued that the construct has a genetic component and is partially heritable ([Horsburgh et al., 2009](#)), with significant evidence emerging from twin studies. Whilst the influence of genetics appears sizeable, research also indicates that mental toughness can be enhanced and developed through training and psychological support ([Beattie et al., 2019](#)).



MENTAL TOUGHNESS

Similar claims have been made about other relevant psychological constructs. Investigating what determines levels of positivity, [Lyubomirsky et al., \(2005\)](#) reported that 50% and 10% of the variance could be ascribed to genetics and circumstances respectively. This suggests that there is room in the remaining 40% for individual development.

Given its significance, its stability and capacity for development, measuring mental toughness has become an important goal of research in the field of sports psychology.



PERSONALITY AND SPORT

Personality is a core topic of psychology that has been defined as “psychological qualities that contribute to an individual’s enduring and distinctive patterns of feeling, thinking and behaving” (Cervone & Pervin, 2010; p. 8). Trait views of personality have become particularly popular. Recent decades of debate have generated a fairly high degree of consensus for broadly structuring personality into five factors (Arnold et al., 2020; p. 47).

The Five Factor Model (FFM) of personality consists of ‘Neuroticism’ (emotional instability vs. stability), ‘Extraversion’ (vs. introversion), ‘Openness’ (curiosity or unconventionality), ‘Agreeableness’ (vs. antagonism), and ‘Conscientiousness’ (constraint vs. disinhibition) (Widiger & Crego, 2019). These factors are said to be the most basic and general dimensions that account for the majority of perceived differences in personality that exist between individuals (Costa & McCrae, 1992; John et al., 2008).

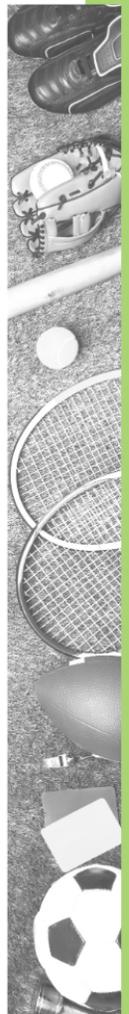


PERSONALITY AND SPORT

There is good evidence that long term athletic success and short-term behaviours can be predicted by personality traits ([Allen et al., 2013](#); [Allen & Laborde, 2014](#); [Vealey, 2002](#)). [Morgan \(1980\)](#) even suggesting that personality may account for up to 45% of the variance in performance.

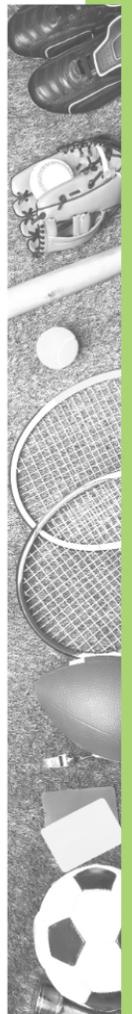
Research in this area includes differences in personality traits between athletes compared to non-athletes ([Allen et al., 2013](#)) and also those who make it to the top as elite athletes ([Kajitna et al., 2004](#)).

Research also supports that there are differences between sports, including individual vs. team sports ([Nia & Besharat, 2010](#); [Sindik, 2011](#)), contact vs. non-contact sport ([Khan et al., 2016](#); [Ahmadi et al., 2011](#)) and safe vs. extreme/high risk sport ([Kajitna et al., 2004](#); [Tok, 2011](#)). Researchers have posited that certain traits can help athletes cope with adversities and interpret anxiety-related symptoms as positive, which is a major contributor to sporting success ([Hanton & Fletcher, 2005](#)).



PERSONALITY AND RISK-TAKING

Personality research indicates that low levels of Neuroticism and Conscientiousness and higher levels of Extraversion and Openness to experience have consistently predicted increased risk taking ([Castanier et al., 2010](#); [Trickey, 2017](#)). Greater Neuroticism predicts participants' experience of negative emotions like anxiety and poor self-confidence, which serve to reduce the resilience required by risk taking ([Hogan & Hogan, 2007](#); [Klein & Kunda, 1994](#)). High Conscientiousness is associated with conformity and control, so low scorers will be more likely to display the hastiness, impulsiveness and impatience that lead to risk-taking behaviours ([Hogan & Ones, 1997](#); [Kowert & Hermann, 1997](#)). Extraversion predicts sensation-seeking ([Eysenck, 1973](#)), which can be an influential motivator of high-risk decisions, and high 'openness to experience' is associated with a personal desire for adventure and interest in new experiences, which can manifest as risk-taking ([Nicholson et al., 2005](#)).



PERSONALITY AND RISK-TAKING

These findings have been reflected in sporting arenas. Sportsmen scoring low on measures of Neuroticism and Conscientiousness demonstrate a greater readiness for, and proclivity towards, reckless risk taking ([Stoyanova et al., 2016](#)). When viewed through the lens of personality, the conceptual association between risk taking and mental toughness emerges. The high-stakes nature of competitive sports ensure that environments are exceedingly stressful and anxiety inducing. Athletes able to overcome these obstacles through greater mental toughness are also likely to possess tolerance of, and possible attraction to, risk taking.

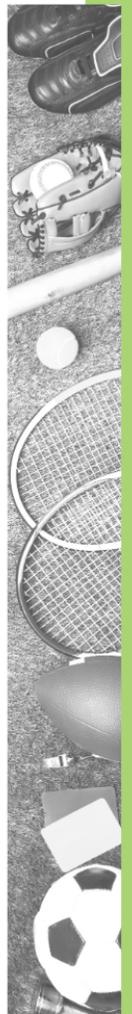
This is supported by evidence suggesting mentally tough athletes have a positive attitude to risk taking ([Crust & Keegan, 2010](#); [Bull et al., 2005](#)). An individual with lower levels of mental toughness will gravitate towards their comfort zone, as this will protect them from anxiety-provoking situations.



PERSONALITY AND RISK-TAKING

This can prevent them from developing strategies that help them maintain control in adverse and challenging situations ([Crust, 2007](#); [Crust & Keegan, 2010](#)). A qualitative study into sporting performance identified taking risks at crucial times during matches as characteristic of mentally tough players ([Coulter, Mallett & Singer, 2016](#)).

Analyses including measures of mental toughness and broader measures of FFM personality have evidenced their relationship. The most notable relationships with mental toughness include Neuroticism, ([Cerin, 2004](#); [Clough et al. 2002](#); [Maddi, 2004](#)), Extraversion ([Campbell-Sills et al., 2006](#)), and Conscientiousness ([Clough et al., 2002](#)). The current study will give greater focus to risk-relevant elements of personality and mental toughness.



PERSONALITY AND RISK-TAKING

The point where personality has its impact on sports performance is in the dynamics of decision making. Faced with a wide range of challenges and threats to successful sporting performance, the athlete has to weigh up the pros and cons; the opportunities and the risks, making strategic and instant ‘in the moment’ decisions in pursuit of their immediate sporting goals. Neuroscience implicates two neurological systems in the decision-making process, emotion and cognition ([Walport, 2014](#)).

The former is a major theme in the literature reviewed above. Cognition has parallels with the personality trait Conscientiousness, also well represented in that discussion. In essence, decisions are made by balancing ‘gut reaction’ (Emotion) with analysis (Cognition). Sports training and coaching feeds into both.



METHODOLOGY

Measuring mental toughness

In the current study, the Sports Mental Toughness Questionnaire (SMTQ; [Sheard et al., 2009](#)) was administered to all participants. This is a 14-item assessment that is structured by three factors: Confidence (vs. self-doubt), Constancy (vs. irresolute), and Control (vs. agitation). These factors have emerged from exploratory analysis and correspond meaningfully to themes encountered frequently in the recent qualitative studies undertaken in the sport domain (e.g. [Crust, 2007](#)).

The current study explored the interaction between the SMTQ and the risk-associated personality characteristics assessed by the Risk Type Compass (RTC).



METHODOLOGY

The two underlying RTC scales also combine to create the ‘Risk Tolerance Index’ (RTi) – essentially the vertical scale which provides a 1-100 score denoting individuals’ overall risk tolerance. A second combination creates the ‘Risk Stability Index’ (RSi) – essentially the horizontal scale, also a 1-100 score denoting the stability of an individuals’ risk decisions.

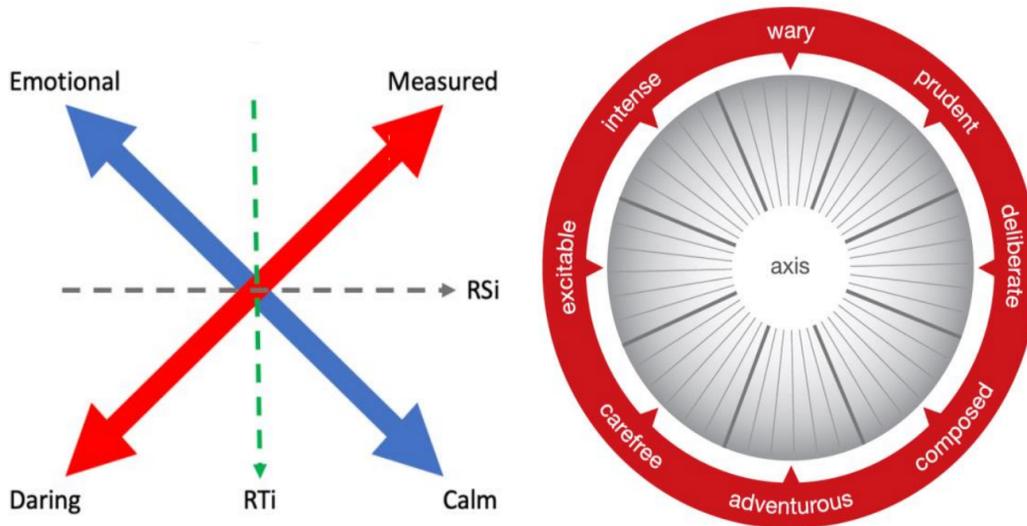
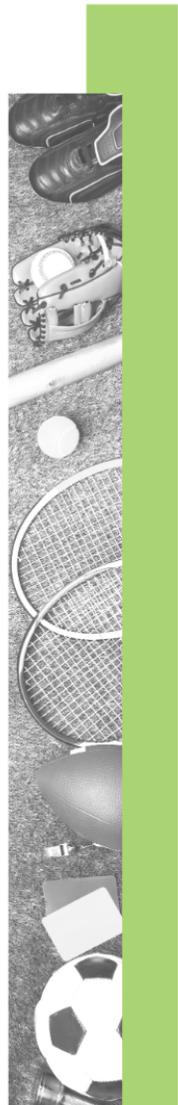


Figure 1. Structure of the Risk Type Compass' underlying scales (left) and resulting 'Compass' (right) that overlays these scales.



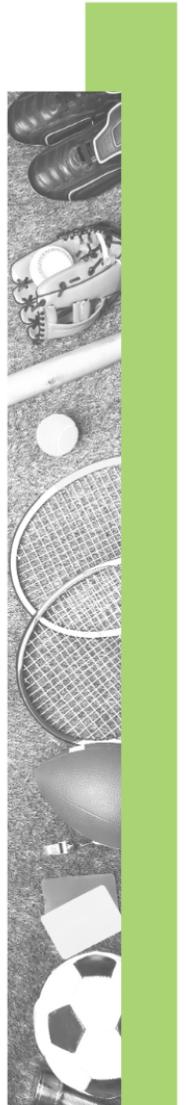
METHODOLOGY

The Emotional:Calm scale plots an individual's tendency to be emotional, apprehensive and anxious at one end of the scale, or calm, confident and resilient at the other. The scale consists of ten 4-item 'subthemes'.

The Daring:Measured scale is concerned with the cognitive elements of risk disposition. It reflects caution, preparedness and need for certainty at one end, and impulsiveness, flexibility and happiness to work with ambiguity and uncertainty at the other. The scale consists of eight 4-item 'subthemes'.

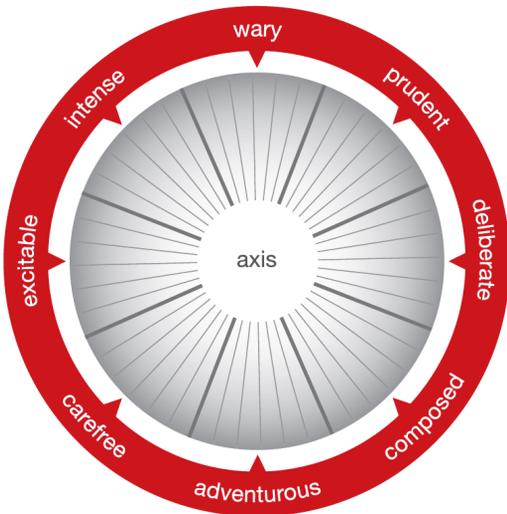
The Emotional:Calm, Daring:Measured, RTi and and RSi scales have test retest reliability coefficients of '.92', '.91' and '.96', '.91' respectively, supporting Trickey's (2017) assertion that the Risk Type Compass assesses stable and deeply-rooted risk dispositions.

A gender-balanced norm group of 10,000 people determine positions on these scales. The Compass has over 200 potential positions, and placement denotes participants' Risk Type. Analysis of over 13,500 individuals indicates that Risk Types are evenly distributed across the general population.



SAMPLE

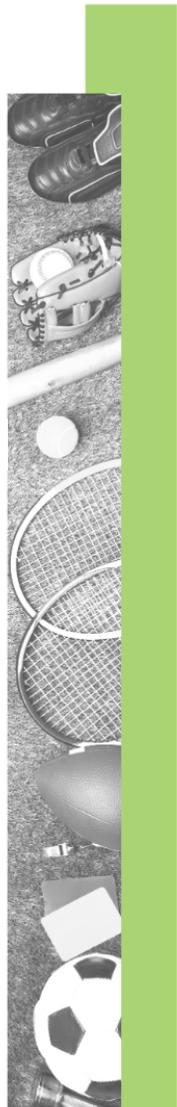
The sample consisted of 70 amateur athletes. It was 65.71% female and had an average age of 28.69 (s.d. = 9.04). The most common sports reflected in the sample were horse riding (17), rugby (10), hockey (7), and football (6).



Risk Type	N	%
Wary	14	20
Prudent	7	10
Deliberate	4	5.7
Composed	7	10
Adventurous	6	8.6
Carefree	5	7.1
Excitable	10	14.3
Intense	12	17.1
Axial	5	7.1

Table 1. and Figure 2. Risk Type Breakdown of sample.

Each participant completed the Risk Type Compass and the Sports Mental Toughness Questionnaire.



RESULTS

Initial analysis dividing participants into Males (n = 24) and Females (n = 46) found a negligible and non-significant difference between the two groups. The next step in the demographic analysis was to explore the impact of age on mental toughness. A correlational analysis indicated that age was significantly related to mental toughness, reporting a positive correlation of 0.313 that was significant at the $p < 0.01$ level. Prior to analysing the role of personality, further analysis was conducted on the different sports represented in the sample. Analysis of variance between sporting groups found no significant differences, indicating that choice of sport did not predict levels of mental toughness in the sample.

Analysis of personality began by exploring differences in Mental Toughness between the eight Risk Types (and Axial group). Sample size prevented direct comparisons between the nine groups, although initial analysis indicated the prominence of the Emotional:Calm scale in predicting the SMTQ. This led researchers to categorise the Risk Type groupings in relation to their position on the 'Emotional:Calm' scale.



RESULTS

This resulting in a ‘high emotional’ group (Wary, Intense and Excitable), a ‘high calm’ group (Deliberate, Composed and Adventurous), and an ‘average’ group (Prudent, Axial and Carefree). The findings of this analysis are presented in **Table 2** below:

Risk Type Grouping	SMTQ Total
High 'Emotional'	36.36
Average	42.59
High 'Calm'	46.12

Table 2. Risk Type Differences in SMTQ Average scores

Findings demonstrated clear differences between Risk Types. An additional ‘Analysis of Variance’ analysis demonstrated that these inter-group differences were significant at the ‘ $p < 0.01$ ’ level.

Given the strength of differences apparently driven by the Emotional:Calm scale, additional analysis was conducted on the two underlying RTC scales and the Mental Toughness variable. The findings are presented in **Table 3**. below.

RTC Scale	SMTQ Total
Emotional:Calm	.673**
Daring:Measured	-0.121

Table 3. RTC Scale Correlations with SMTQ



RESULTS

The initial analysis of the Emotional:Calm and Daring:Measured scales identified two clear findings. The first was the exceedingly strong relationship between the Emotional:Calm scale scores and the total score on the Sports Mental Toughness Questionnaire. This relationship is best illustrated by the graph in **Figure 3** below.

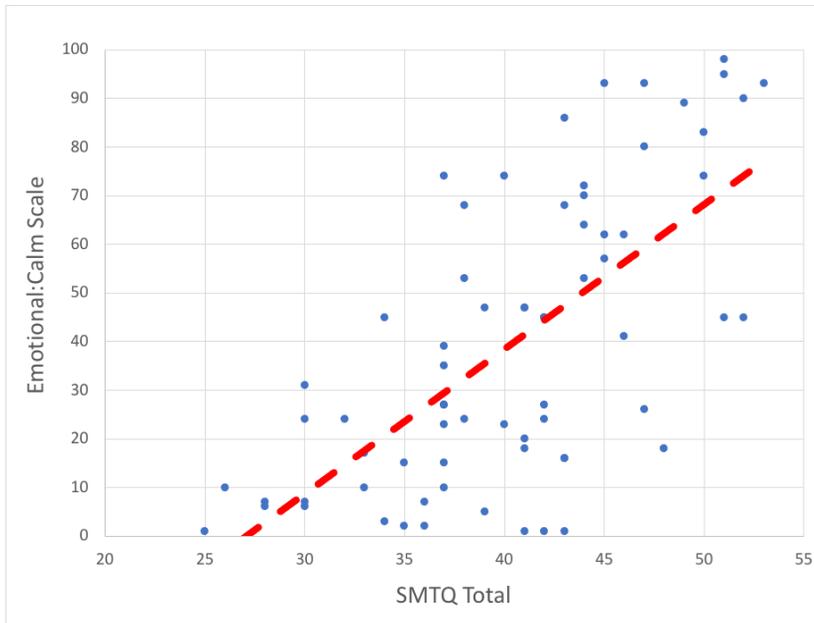
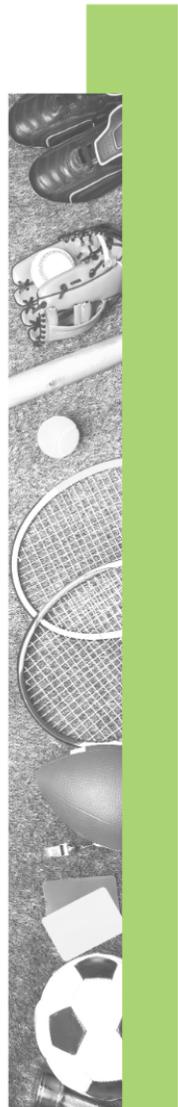


Figure 3. Relationship between the SMTQ Total score and the Emotional:Calm Scale (with line of best fit)

The second clear finding, at scale level, was the low and statistically non-significant relationship between the Daring:Measured scale and the Sports Mental Toughness Questionnaire total score. However, given that the Daring:Measured scale is a composite of eight subthemes, six of which have very significant correlations with SMTQ, it was clear that scale-level analysis was insufficient and that exploration at the subtheme level was required.

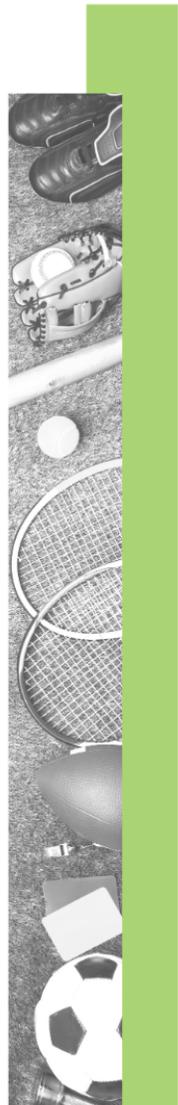


RESULTS

This took the form of a correlational analysis in which relationships between the RTC subthemes and the Mental Toughness dependent variable were assessed (see Table 4. below). The ‘+’ and ‘-’ symbols before each subtheme name denote how they contribute to their scale.

RTC		SMTQ Total
Emotional:Calm Subthemes	(-) Apprehensive	-.470**
	(-) Sensitive	-.643**
	(-) Intuitive	-0.146
	(-) Astute	-0.05
	(-) Eager	-0.084
	(+) Resilient	.310**
	(+) Confident	.544**
	(+) Forgiving	.359**
	(+) Optimistic	.582**
(+) Equable	.408**	
Daring:Measured Subthemes	(-) Audacious	.279*
	(-) Hasty	.378**
	(-) Explorative	.308**
	(-) Spontaneous	.486**
	(+) Methodical	0.109
	(+) Perfectionistic	.322**
	(+) Focused	.510**
	(+) Conforming	0.084

Table 4. RTC Subtheme breakdown of SMTQ correlations



RESULTS

The subtheme breakdown provided some important additional information. When viewing the ten Emotional:Calm subthemes, the relationship they have with the Mental Toughness dependent variable parallels their contribution to the Emotional:Calm scale. This contrasts with the Daring:Measured scale's eight subthemes, where relationships between significantly correlated subthemes of the Daring:Measured scale and Mental Toughness are variable in the direction of those correlations. This not only accounts for the absence of correlation between the Daring:Measured scale and the Mental Toughness variable, but demonstrates that, at subtheme level, both the RTC scales have high levels of relevance.

The next stage of the analysis was to conduct a three-step multiple hierarchical regression to determine how much variance could be predicted in the dependent variable (Mental Toughness) using personality (RTC). The previously reported findings for age meant that this variable was controlled for in the regression equation's first step. The regression equation's second and third steps added the Emotional:Calm scale and the Daring:Measured subthemes respectively.



RESULTS



Unsurprisingly, the Emotional:Calm scale predicted the greatest amount of variance in the Mental Toughness variable with an additional 37% of explained variance on top of the age control's 8.4%. The addition of the eight Daring:Measured subthemes provided a further 13.3% of DV variance prediction.

When combined, age, the Emotional:Calm scale and the Daring:Measured subthemes account for a staggering 58.7% of the variance in the Mental Toughness dependent variable.



INTERPRETATIONS AND IMPLICATIONS

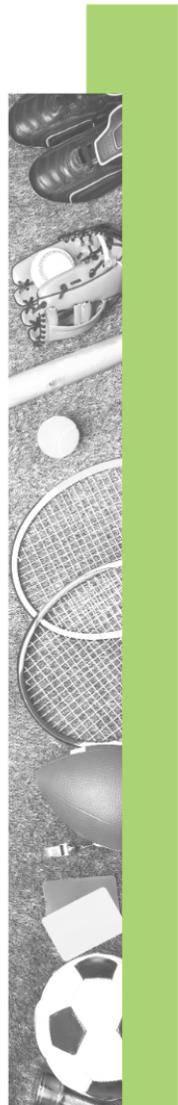
Mental toughness and Risk Type Interpretation

Correlations between the two RTC scales and behaviours on other measures will always have implications for our understanding of the Risk Types and the inferences under consideration during the interpretation of RTC profiles and feeding back to those assessed. To a greater or lesser extent this will involve insight and judgement.

The headline from this research is that strength of the correlation between SMTQ and the **Emotional:Calm** scale of the RTC has obvious implications for the Risk Types at both extremes; the Intense Risk Type (low SMTQ) and the Composed Risk Type (High SMTQ) although, even in this case the pattern of subtheme scores will potentially be influential.

Risk Type	Emotional:Calm Scale	Daring:Measured Scale	Sample N	Sample %	SMTQ Average
Wary	High Emotional	High Measured	14	20.0%	36.21
Intense	High Emotional	Average	12	17.1%	36.17
Excitable	High Emotional	High Daring	10	14.3%	36.80
Prudent	Average	High Measured	7	10.0%	41.14
Axial	Average	Average	5	7.1%	44.00
Carefree	Average	High Daring	5	7.1%	43.20
Deliberate	High Calm	High Measured	4	5.7%	46.00
Composed	High Calm	Average	7	10.0%	46.00
Adventurous	High Calm	High Daring	6	8.6%	46.33

Table 5. Risk Type breakdown of SMTQ Averages



INTERPRETATIONS AND IMPLICATIONS

Note the subthemes of either scale that have a negative but statistically significant association with SMTQ. Taken at face value, the insignificant correlation between the **Daring:Measured** scale and SMTQ seems to question its relevance, yet all correlations are positive and six of them statistically significant; those from the Measured end of the scale often cancelling out subthemes from the Daring end of the scale. So, interpretation of individual profiles warrants detailed scrutiny of the subthemes because, whether positive or negatively correlated, most of them are clearly capable of influencing profile interpretation in some way.

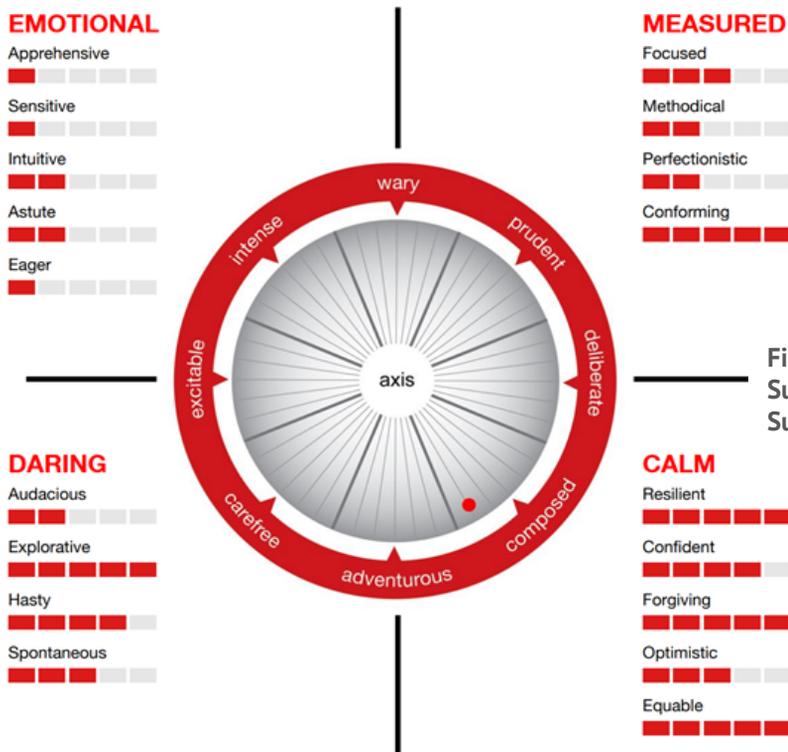
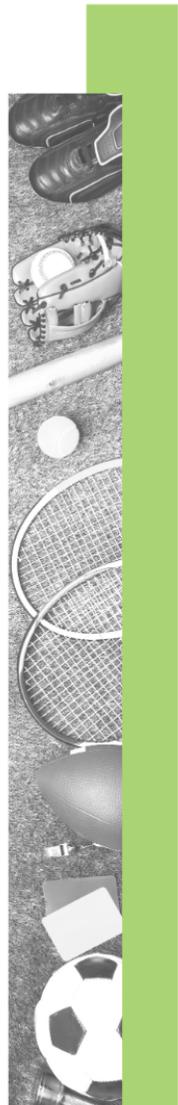


Figure 4. RTC with Subthemes (see Table 4 for Subtheme Correlations)



SUMMARY OF RISK TYPE IMPLICATIONS

Wary Risk Type: Shrewd/ vigilant/ controlling Low MT due to Intense Risk Type being at the extreme end of the Emotional:Calm Scale (i.e. emotional and low resilience). But check Daring:Measured subthemes for any contraindications.

Prudent Risk Type: Systematic/ orthodox/ detailed Expect average MT because this Risk Type is in mid-range (Axial) for Emotional:Calm. But check Daring:Measured for Cognitive subthemes tapping into MT from Measured (Lower MT) and from Daring (Higher MT).

Deliberate Risk Type: Confident/ purposeful/ thorough Average MT due to high Emotional:Calm score, combined with low Daring:Measured score. So emotionally resilient but cognitively averse to uncertainty – but check subthemes for any contra-indications.

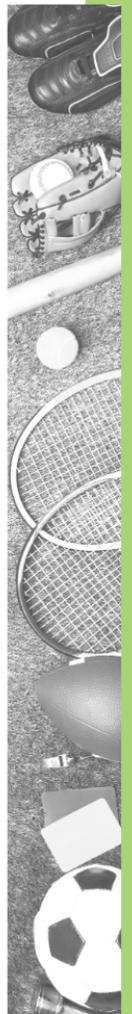
Composed Risk Type: Calm/ resilient/ optimistic High MT based on emotional strength, but mid-range (Axial) on Daring:Measured so subthemes investigation essential. Higher Daring sub-scale scores could increase MT, lower scores decrease MT.



DISCUSSION

The most significant finding of the current research is the extremely powerful predictive capability the Risk Type Compass dimensions possess when determining levels of mental toughness. The influence of age was also notable, as it reported a significant positive correlation with mental toughness. This may, to an extent, reflect the part played by experience in reducing situational uncertainty and anxiety. Familiarity makes decision making processes more comfortable as the degree of uncertainty surrounding those decisions is reduced. The athletes master situations and develop effective strategies, understand the strategy (cognition), and the repetitive nature of training builds and refines 'gut feeling' (emotion); beliefs and feelings combine to build mental toughness.

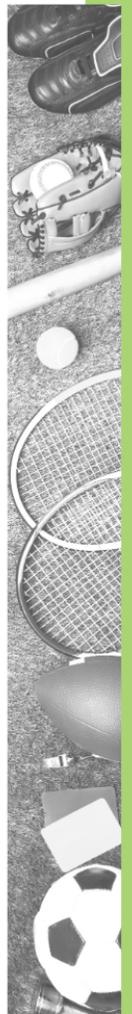
This is immediately apparent at Risk Type level. Risk Types placed towards the 'calm' end of the Emotional:Calm scale (i.e. Deliberate, Composed and Adventurous) are significantly more likely to report higher levels of mental toughness relative to Risk Types at the 'emotional' end of the scale (i.e. Wary, Intense and Excitable). This indicates that higher levels of negative emotion serve to reduce risk taking and limit mental toughness.



DISCUSSION

Unsurprisingly, this finding emerges more clearly in analyses at the scale level, as the Emotional:Calm scale was highly predictive of mental toughness. This aligns with previous research assessing the association between the FFM of personality and mental toughness. This is because the Emotional:Calm scale draws from risk-relevant elements of Neuroticism. High scores on the Emotional:Calm scale (i.e. high ‘calm’) result in a greater tolerance of risk, which in turn can enable individuals to engage in behaviours and make decisions that others deem too risky.

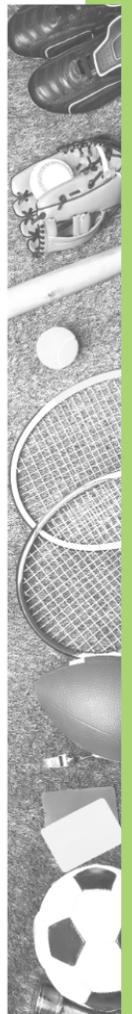
Conversely, lower scores on this scale reflect individuals’ greater likelihood of experiencing unpleasant emotions. This serves to heighten sensitivity to the potential negative consequences of decisions. In addition to greater risk aversion, manifested as gravitation towards ‘safe’ responses, the sensation of negative emotions also acts to reduce levels of mental toughness. At scale level, the predictiveness of the Emotional:Calm scale greatly outweighed that of the Daring:Measured scale, yet subtheme level analyses suggest a significantly different story.



DISCUSSION

Of all RTC subthemes, the most predictive was that of the 'Sensitive' (-.643) subtheme. Forming one tenth of the Emotional:Calm scale, the subtheme assesses how "Emotionally reactive and influenced by the emotions of others" participants are, with lower scorers predicting greater mental toughness. The next strongest predictors of mental toughness were the 'Optimistic' (.582) and 'Confident' (.544) subthemes, which are defined as "displays an upbeat and positive mindset, turning problems into opportunities" and "selfassured, poised and projects an image of competence and positivity" respectively.

The three subthemes above contribute to participant's positions on the Emotional:Calm spectrum, but as Table X above illustrates, Daring:Measured scale subthemes were also important. The strongest subtheme relationship was that of 'Focussed' (.510), which identifies participants who are "Purposeful, goal-driven and not easily deterred from objectives".

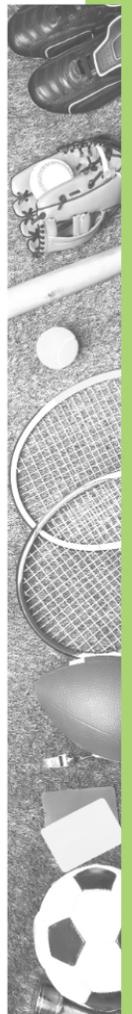


DISCUSSION

This subtheme is a risk-relevant inverse of the 'openness' personality factor, with low scorers on the subtheme more likely to be drawn to imaginative big-picture thinking. The Daring:Measured scale's next strongest predictors of mental toughness were the Spontaneous (.486) and Hasty (.378) subthemes, which identify individuals who are "Quick-witted, instinctive and makes decisions 'on the fly'" and "Push the limits, tries things on impulse, not always thinking them through" respectively.

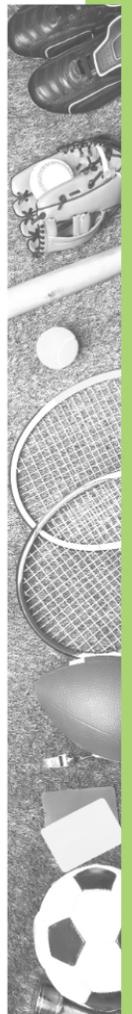
Downsides to Mental Toughness

The current research not only evidences the predictive power of the Risk Type Compass in relation to mental toughness. It also broadens our understanding of what it means to be mentally tough, and the potential consequences it can have on others. Although negative emotions such as fear and anxiety are inversely predictive of mental toughness, they also play a vital role in relation to species survival in terms of threat awareness and avoidance. While emotional sensitivity implies defensive and avoidant responses, mental toughness implies assertive and confrontational reactions to threat, insecurity or uncertainty.



DISCUSSION

The nuance of subtheme analysis helps us understand how this can be a cause for concern. The most notable example came in the form of the sensitivity subtheme, which reported a very strong inverse relationship with mental toughness. This means that exceedingly high scorers on the mental toughness variable are likely to be unaffected by emotions, be it their own or those of others. Whilst this may benefit performance during points of great stress, it may have adverse consequences for team-based relationships and mentoring responsibilities. This suggests that the relentless pursuit of mental toughness could come with a downside, as well as reducing the temperamental diversity that can be extremely important for teams to possess.



CONCLUSION



The relationship between mental toughness and risk-relevant decision making recurs constantly in sporting arenas. Every competitive and non-competitive encounter demands a constant stream of strategic decisions from athletes. Many of those decisions will not be made consciously, so viewing the resulting variance of outcomes entirely in terms of ability and experience is insufficient. Information evaluating risk-relevant personality will add considerable insight into athletes' levels of mental toughness, appetite for risk and decision making. This understanding may potentially be reflected constructively in programmes of development, training and game strategies. Given that sport is judged on the finest of margins, this could represent the difference between success and failure.



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