

Psychological profiles of resilience in extreme environments: Correlating measures of personality and coping and resilience

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Abstract

The presence of psychological resilience is believed to confer positive personal benefits, and may be particularly advantageous for individuals working in isolated, confined, and/or extreme environments. The study reported here aimed to identify contextually adaptive psychological profiles of resilience in such settings. This was done by correlating scores for measures of resilience with scores for measures of personality and coping, using South African Navy specialists who were identified as good adaptors. As resilience profiles may differ across contexts, two highly specific samples were used, namely navy divers and submariners.

This article presents psychometric profiles of contemporary personality and coping styles. Then, using bivariate correlations, resilience-associated, context-specific, diver and submariner personality and coping profiles were identified. Their resilience profiles appeared well suited to their respective environments.

Some differences were observed between the typical personality descriptions and the resilience profiles identified, with a number of possible reasons forwarded to understand this. Firstly, there were some concerns regarding the validity of the measures in the local cultural context; secondly, context-specific resilience may be expressed differently from resilience in general society; and thirdly, contemporary profiles of specialists may reflect current organisational processes in addition to psychological factors.

In terms of practical application, while the identification of resilience profiles may also have value for selection purposes, it could be particularly useful for mission preparation, through the training of context-relevant coping skills.

Introduction

The study on which this article is based aimed to identify contextually adaptive personality and coping profiles associated with resilience, to guide deployment in isolated, confined and extreme (ICE) environments. Resilience refers to the process of adapting well to challenging psychological demands.² The concept has been researched extensively in ICE environments, particularly in military settings, and established scales are available to measure resilience. Similarly, personality profiling, as well as coping profiling, have also been researched extensively in ICE contexts, with established scales also available to measure these two constructs.

'ICE environments' refer to settings characterised by hostile external conditions, exposure to a range of often unique context-specific physical, mental and social stressors. These require engineering technology to maintain human survival.³ Examples of ICE settings include underwater habitats, spacecraft, remote weather stations, and polar outposts. Within the military, navy diving and submarine service are both considered extreme environments, because of their unusual demands, the use of technologies to support life, and the advanced training required to operate safely underwater.

The demands imposed by specific ICE environments are well described, as well as the idea that a specific kind of psychological profile is required to cope well in such contexts.^{4,5,6} There is a long history of personality profiling in specialised military settings, often involving the selection of military personnel for special duty assignments, such as aviation, submarines, or naval diver training.⁷ In the context of maritime ICE environments, personality descriptions have been developed for both navy divers and submariners.^{8,9,10} Context-specific coping profiles have also been reported for these two groups.^{11,12} For example, navy divers display a propensity for adventurousness, a strong sense of self-agency, and low trait anxiety, and rely on active coping while rejecting avoidance coping.^{4,7} Submariners display a strong sense of self-efficacy, meticulousness and constructive group orientation (i.e. can get along with others), and also rely on active coping while rejecting avoidance coping.⁴

To illustrate how context influences coping, divers typically use acceptance as a coping strategy. This is often associated with the generally short-term nature of diving operations, where acceptance only needs to facilitate coping for a short period, and can thus be maintained successfully. During typically longer submarine operations, crew members often use positive reframing and religion as coping strategies, rather than acceptance.⁴ These strategies are associated with more inward-focused coping, and appear suited to long-duration missions, where acceptance-as-coping might be difficult to sustain.

Historically, studies developing profiles have generally sampled experienced personnel, who have spent some time in their particular domain, and then used the identified personality traits to describe the *typical* profile for that domain. As participants were generally thought of as successful in their respective domains (e.g. successfully managed exposure to ICE conditions), their typical profiles have traditionally been considered as adaptive-in-context. Using this reasoning, it is often believed that the typical profile is also the *ideal* or *desired* profile, as these individuals have been operating in their ICE environments for some time (thus making it an 'adaptive' profile). Such psychological profiles have then been used to guide selection of new recruits into the field, in turn risking perpetuating the profile in any subsequent samples.

It could be argued that a *typical* profile is not necessarily an *ideal* or *desired* profile. For example, Suedfeld and Steel describe the personality paradox in capsule habitats, namely that most volunteers applying for anything as challenging and unusual as space or undersea habitats tend to score toward the upper end of any scale of thrill-seeking, adventurousness, and similar dimensions.¹ Paradoxically, life in capsule environments (e.g. submarines) is characterised by stimulus invariance (monotonous

routine, boring tasks, being cooped up with the same unvarying group) interspersed with only occasional excitement. Thus, volunteers most likely to end up in specifically ICE capsule environments may potentially not be suited optimally to such environments. The same may apply to other high-risk ICE activities, for example long-term deployment to an international space station or polar outposts. Volunteers would have personality traits supportive of risk-taking and adventurousness, but the actual demands of the environment may require great technical proficiency and corresponding meticulousness, or particularly good interpersonal skills, or the patience to tolerate confinement.

Further, all ICE environments place high demands on long-term psychological adaptation, which then raises the question of whether any *typical* profile would necessarily also be the profile reflecting optimal *resilience*.¹³ In other words, would profiles developed by traditional means inevitably yield traits that would reflect high resilience to the demands of ICE environments? The relevance of this question is supported by previous studies with navy specialists, which suggest that the typical personality profile was not always associated with the profile reflecting optimal resilience.¹⁴

Psychological resilience is defined as the process of adapting well in the face of adversity, trauma, tragedy, threats or significant sources of stress.¹ Dispositional resilience, referring to that personal quality that allows people to overcome hardships and even thrive in the face of it, have been operationalised in constructs such as sense of coherence, hardiness, mental toughness and locus of control, reside in the positive psychology domain, and have previously also been applied to ICE environments.^{15,16,17,18,19,20,21}

Psychological hardiness is a widely researched construct within resilience literature. It is defined as a personal worldview, which is fairly stable over time, and comprising the following interrelated components:

- commitment (vs. alienation) – referring to the ability to feel deeply involved in the activities of life;
- control (vs. powerlessness) – the belief that one can control or influence events of one’s experiences; and
- challenge (vs. threat) – the sense of anticipation of change as an opportunity to foster personal development.¹⁷

Hardiness is a psychological orientation associated with people who remain healthy and continue to perform well under a range of stressful conditions.^{22,23} Hardy individuals – that is, persons with a strong sense of commitment, control and challenge – appear to be more resistant to the adverse effects of personal and environmental stress than less hardy individuals. As a personality variable, hardiness appears to be largely distinct from the Big Five personality dimensions.^{24,25}

An extensive body of research supports the notion that hardiness protects against the ill effects of stress on health and performance among a wide variety of civilian and military occupations and contexts.^{26,27,28,29,30,31,32,33,34} Hardiness has been implicated as a resilience factor across cultures.^{35,36} It is thought to decrease the negative effect of stress through

a combination of underlying cognitive, physiological and behavioural factors, which include very specific coping strategies (e.g. active coping rather than avoidant coping responses).^{24,37,38}

A related construct, termed mental toughness (MT), was partially derived from the theoretical foundations of hardiness, and extended the theory by adding a fourth component to the three dimensions of hardiness, namely confidence.¹⁸ MT is moderately associated with other psychological constructs associated with mental health, and is strongly associated with behavioural perseverance.^{18,39,40,41,42,43} Scores on MT scales have been related to both coping strategies and performance in military contexts (e.g. problem-focused rather than avoidance-coping responses).^{40,44,45} MT correlates significantly with the Big Five personality dimensions, with the exception of openness to experience, although there are concerns whether MT can be regarded as a truly dispositional trait.^{41,44,46}

Many of the constructs in the resilience literature have their own associated measuring tools. The Dispositional Resilience Scale (DRS) has been used extensively in military and non-military samples,^{25,29,47} with the 15-item self-report version (DRS-15) tapping into attitudes regarding commitment, control and challenge.⁴⁸

The Mental Toughness Questionnaire (MTQ) items are aggregated to six dimensions, with the 18-item self-report version (MTQ-18) providing an overall score for mental toughness.^{18,49,50} The application of the DRS-15 and MTQ-18 in the South African (SA) military context has recently been reported.⁴⁹

Rationale and aims

If psychological hardiness confers positive personal benefits in the face of potentially adverse physical, social and mental demands, then its presence may be particularly advantageous for naval specialists working in ICE environments. This returns to the question of whether a particular psychological profile could be considered resilient in a particular environment, i.e. whether it would be possible to identify ideal or desired personality and coping profiles associated with resilience in specific contexts.

As mentioned, earlier research with navy specialists suggested that the typical personality profile may not necessarily be associated with profiles reflecting optimal resilience.¹³ Previous studies reported general correlations between both the DRS-15 and MTQ-18 and the Big Five personality factors (see Table 1), suggesting that personality factors may be associated with resilience. However, it is not clear how this association would be expressed in terms of the requirements of specific potentially demanding contexts. In other words, would the nature or degree of association between personality factors and resilience be influenced by specific ICE settings? The previously reported correlations appear to suggest that a personality profile reflecting optimal resilience – contingent on environmental context – could be described.

Table 1: Published correlations between the DRS-15 and MTQ-18, and the Big Five personality traits

Scale		<i>E</i>	<i>A</i>	<i>C</i>	<i>N</i>	<i>O</i>	<i>Source</i>
DRS-15	Total scale	.11*	n.s.	.18*	-.25*	n.s.	Bartone et al. (2009) ²³
DRS-15	Total score	.41*	.24*	.28*	-.38*	.40*	Kardum et al. (2012) ⁵⁷
DRS-15	Total score	.61*	.41*	.50*	n.s.	.39*	Loche (2017) ⁶⁰
MTQ-18	Total score	.37*	.32*	.41*	-.74*	.14	Delaney et al. (2015) ⁴⁵
MTQ-18	Total score	.49*			-.61*		Curran (2017) ⁵⁹

* $p < .01$

Note: E=extraversion; A=agreeableness; C=conscientiousness; N=neuroticism; O=openness to experience; n.s.=not significant

The study on which this article is based therefore aimed to identify contextually adaptive psychological profiles associated with resilience for deployment in ICE environments. Psychological profiles here refer to the dual domains of personality and coping. The study explored associations between resilience and other psychometric descriptions of specialist groups by correlating scores for measures of hardiness and MT with scores for measures of personality and coping. As resilience profiles may differ across contexts, the study used two highly specific samples, namely navy divers and submariners, for whom good resilience has traditionally been reported.¹³

Methods

Participants

The sample consisted of South African Navy (SAN) divers and submariners on active duty, who were recruited during their annual occupational health assessment. The study was conducted according to the principles set out in the Declaration of Helsinki (2013). Written informed consent was obtained; the study was also part of a larger project with Institutional Review Board approval. In accordance with study parameters, all data were anonymised prior to analysis. The data were collected over a period of three years, and sample sizes are indicated for each analysis.

All participants included in the final sample were considered good adaptors, based on a number of criteria:

- all participants had to have completed at least two years of operational experience after qualification – indicating adaptation in their respective extreme environment;
- participants were required to have no organisational record of poor psychological adaptation in their respective specialist environments;
- participants had to submit positive supervisors' reports, including a recommendation for continued use in their field; and

- participants had to provide positive self-reports of good coping (obtained during their annual medical examinations).

The 125 divers (6.4% female) had a mean age of 27.7 years (\pm 5.7, range 20–48), while the 213 submariners (25.4% female) had a mean age of 31.6 years (\pm 6.7, range 23–51). The divers all had 12 years of formal schooling, while the submariners had a further one to eight years of additional vocational training.

Measures

Hardiness was measured with the DRS-15, which was used in its standard format.⁴⁶ The DRS-15 is scored on a four-point Likert-type scale, with higher scores reflecting greater hardiness. Good psychometric properties and criterion-related validity across multiple samples have been reported, including a Cronbach's α reliability coefficient of .82 for the total scale, and .71 for a general SA Navy sample.^{26,46,49}

Mental toughness was measured with the MTQ-18.¹⁸ It is scored on a five-point Likert-type scale, with higher scores reflecting greater MT. High test–retest reliability, high internal consistency, and good validity have been reported, including a Cronbach's α reliability coefficient of .70 for the total scale, and .88 for a general SA Navy sample.^{18,38,49}

Personality was described with the State-Trait Personality Inventory, Trait version (STPI-T) and Big Five Inventory (BFI-44), while coping styles were described with the Brief COPE (BC) scale. The STPI-T measures personality traits according to the emotional disposition model, and consists of 40 self-report items – scored on a four-point scale – that measure dispositional anxiety, curiosity, anger and depression in adults.⁵¹ Hardiness has previously been (negatively) correlated to dispositional anxiety and anger.²⁴

The BFI-44 measures personality traits according to the five-factor model.^{52,53} The scale was constructed to allow quick and efficient assessment of five personality dimensions when there is no need for differentiated measures of particular facets. It consists of 44 self-report items with short phrases and relatively accessible vocabulary, rated on a five-point scale.^{51,52} Hardiness has previously been positively correlated to extraversion and negatively correlated to neuroticism.²⁴

The BC is a 28-item self-report inventory designed to assess coping responses across 14 coping domains.⁵⁴ Ratings for each item are made on a four-point scale, and higher scores represent greater endorsement of coping strategies. Hardiness has previously been positively correlated to active coping and negatively correlated to avoidance coping.²⁴

Data analysis

The personality and coping profiles of the sample were reported using descriptive statistics. Internal consistency of the resilience scales was examined using Cronbach's α coefficients. There were no significant gender differences on either the DRS-15 or MTQ-18, and the rest of the analysis combined the scores of women and men in each

speciality. The association between resilience and specific personality and/or coping profiles were thereafter explored using correlational statistics. Due to a technical error, correlations between the MTQ-18 and BC were not available.

Results

The combined sample DRS-15 produced a marginally acceptable Cronbach α of .66, while the MTQ-18 produced a more acceptable Cronbach α of .87. The psychometric profiles of the SAN specialists are presented in Table 2. Both groups – divers and submariners – scored high on the DRS-15 and MTQ-18 compared to norms, suggesting good psychological resilience.^{38,39,47}

Table 2: Personality and coping profiles of navy divers and submariners

	Divers			Submariners		
	N	M	SD	N	M	SD
STPI-T						
Anxiety	125	14.01	3.0	212	13.20	2.9
Curiosity	125	29.93	4.1	212	31.54	4.7
Anger	125	16.14	3.6	212	15.05	3.6
Depression	125	13.56	3.0	212	13.35	2.9
BFI-44						
Extraversion	125	3.63	0.5	212	3.78	0.6
Agreeableness	125	4.32	0.5	212	4.45	0.5
Conscientiousness	125	4.33	0.5	212	4.43	0.5
Neuroticism	125	1.86	0.6	212	1.67	0.5
Open to experience	125	3.67	0.4	212	3.76	0.4
Brief COPE						
Self-distraction	125	3.14	1.7	194	3.19	1.7
Active coping	125	4.89	1.3	194	5.01	1.2
Denial	125	1.04	1.4	194	0.88	1.3
Substance use	125	0.13	0.5	194	0.10	0.5
Use emotional support	125	3.46	1.6	194	3.93	1.6
Use instrumental support	125	4.25	1.6	194	4.60	1.4
Behavioural disengagement	125	0.38	0.9	194	0.33	0.8
Venting	125	1.96	1.5	194	1.97	1.3

Positive reframing	125	4.42	1.4	194	4.48	1.4
Planning	125	4.65	1.4	194	4.97	1.2
Humour	125	2.85	1.9	194	2.45	1.9
Acceptance	125	4.26	1.4	194	4.46	1.4
Religion	125	3.91	1.9	194	4.27	2.0
Self-blame	125	0.64	0.9	194	0.56	0.7
DRS-15						
Total score	125	35.26	4.6	213	36.72	4.3
Cronbach's α	125	.65		213	.66	
MTQ-18						
Total score	123	70.41	9.3	189	71.98	8.2
Cronbach's α	123	.87		189	.86	

Note. Means in bold identify the contemporary typical profile, of this sample, for each specialty.

The SAN specialists displayed very similar contemporary personality profiles, scoring in the direction of healthy emotional disposition across the four STPI-T subscales, and with Big Five personality profiles characterised by average scores for extraversion and openness to experience, higher scores for agreeableness and conscientiousness, and lower scores for neuroticism.

The coping profiles of divers was characterised by the use of seven specific coping strategies, and those of the submariners by the use of nine specific coping strategies. Unsurprisingly, in both groups there was a reliance on engagement – in other words, active coping – as an endorsed strategy, and a clear non-endorsement of avoidant coping strategies.

Bivariate correlations between the DRS-15 and measures of personality and coping are presented in Table 3. The hardy profile was associated with the typical STPI-T profile reported in Table 2. Further, all five BFI-44 factors were associated with hardiness, which differed somewhat from the typical profile reported in Table 2. Seven of the nine markers of the typical submariner coping profile (see Table 2), as well as an additional two markers (namely use of emotional support and religion), were associated with hardiness among submariners, suggesting that these coping styles work to the benefit of these individuals. In contrast, only a limited number of markers from the typical diver coping profile (see Table 2) were associated with hardiness among the navy diver sample, with acceptance showing the strongest correlation. Across both samples, correlations with coping domains were, while significant, generally very modest.

Table 3: Bivariate correlations between DRS-15 total score and measures of personality and coping

	Divers			Submariners		
	N	<i>r</i>	<i>p</i>	N	<i>r</i>	<i>p</i>
STPI-T						
Anxiety	125	-.437	<.001	212	-.455	<.001
Curiosity	125	.404	<.001	212	.333	<.001
Anger	125	-.212	.017	212	-.333	<.001
Depression	125	-.498	<.001	212	-.388	<.001
BFI-44						
Extraversion	125	.295	.001	212	.402	<.001
Agreeableness	125	.408	<.001	212	.440	<.001
Conscientiousness	125	.581	<.001	212	.515	<.001
Neuroticism	125	-.551	<.001	212	-.521	<.001
Open to experience	125	.453	<.001	212	.414	<.001
BC						
Self-distraction	125	-.099	.270	194	.093	.196
Active coping	125	.202	.024	194	.303	<.001
Denial	125	-.117	.194	194	-.147	.051
Substance use	125	-.054	.553	194	-.181	.012
Use emotional support	125	.068	.448	194	.243	.001
Use instrumental support	125	.138	.125	194	.340	<.001
Behavioural disengagement	125	-.230	.010	194	-.184	.010
Venting	125	-.124	.170	194	.161	.052
Positive reframing	125	.144	.110	194	.222	.002
Planning	125	.080	.373	194	.305	<.001
Humour	125	.008	.929	194	.100	.164
Acceptance	125	.305	.001	194	.398	<.001
Religion	125	.141	.116	194	.162	.024
Self-blame	125	-.193	.031	194	-.130	.072

Bivariate correlations between the MTQ-18 and measures of personality are presented in Table 4. Like the DRS-15 profile, the MTQ-18 was associated with the typical STPI-T profile reported in Table 2, and with all five BFI-44 factors, which again differed from the typical profile reported in Table 2.

Table 4: Bivariate correlations between MTQ-18 total score and measures of personality

	Divers			Submariners		
	<i>N</i>	<i>r</i>	<i>p</i>	<i>N</i>	<i>r</i>	<i>p</i>
STPI-T						
Anxiety	123	-.684	<.001	188	-.678	<.001
Curiosity	123	.613	<.001	188	.577	<.001
Anger	123	-.379	<.001	188	-.563	<.001
Depression	123	-.687	<.001	188	-.653	<.001
BFI-44						
Extraversion	123	.145	.110	176	.337	<.001
Agreeableness	123	.175	.052	176	.367	<.001
Conscientiousness	123	.297	.001	176	.490	<.001
Neuroticism	123	-.369	<.001	176	-.503	<.001
Open to experience	123	.247	.006	176	.180	.016

The SAN submarine personality profile that best reflected resilience was characterised by low scores for dispositional anxiety, anger and depression, and high scores for dispositional curiosity, as well as high scores for the extraversion, agreeableness, conscientiousness, and openness to experience factors, and low scores for the neuroticism factor. Their coping profile best reflecting resilience was characterised by the use of active coping, emotional and instrumental support, positive reframing, planning, acceptance and religion, and the non-endorsement of substance use and behavioural disengagement.

The SAN diver personality profile that best reflected resilience was also characterised by low scores for dispositional anxiety, anger, and depression, and high scores for dispositional curiosity. However, their Big Five resilience profile was not unanimous. DRS-15 correlations suggested that high scores for the extraversion, agreeableness, conscientiousness, and openness to experience factors, and low scores for the neuroticism factor were associated with resilience. MTQ-18 correlations suggested that only high scores for the conscientiousness and openness to experience factors, and low scores for the neuroticism factor were associated with resilience. Their coping profile best reflecting resilience was characterised by the use of active coping and acceptance, and the non-endorsement of behavioural disengagement and self-blame.

Discussion

This study aimed to identify contextually adaptive psychological profiles associated with optimal resilience for deployment in ICE environments. In this regard, personality and coping profiles associated with resilience were identified for both submariners and navy divers.

The resilience-associated profile in this sample of maritime specialists was characterised by low dispositional anxiety, anger, and depression, and high dispositional curiosity, as well as high degrees of extraversion, agreeableness, conscientiousness, and openness to experience, and a low degree of neuroticism. This description follows previous reports of comparable correlations of resilience measures of dispositional anxiety and anger, and extraversion and neuroticism.²⁴ A similar emotional disposition has previously been shown to support wellbeing and was considered protective of mental health.^{55,56} Given the isolated, confined and/or extreme environment into which these maritime specialists may deploy, healthy emotional disposition and low neuroticism would be positive resources for emotional self-management (i.e. protect mental health). Furthermore, the strong association with conscientiousness could be expected in a safety critical environment with reliance on life-support technology. This trait is closely related to the reported meticulousness of submariners, who work in an environment where mistakes cost lives.^{4,8,13} The association with agreeableness would facilitate good interpersonal management in confined spaces, where the constructive management of relations is critical for psychological adaptation.^{2,3,5,57}

The SAN specialists showed much stronger correlations between resilience scores and the Big Five factors compared to those reported for both West Point students and general population samples (see Table 1),^{23,58} which may suggest an inherent personality requirement in the ICE context. This supports previous findings implying that very specific personality profiles appear particularly adaptive in these relatively unique environments.^{9,11,13,56,58}

Although the personality profiles associated with resilience for divers and submariners were generally similar, it was noteworthy that they reported different coping styles associated with resilience, which could possibly be attributed to their different deployment and work environment demands.⁴ For example, the presence of active coping and the absence of behavioural disengagement (i.e. withdrawal) were prominently correlated to resilience across both specialities. This association has previously been reported in related groups,^{24,37} and has also been observed among international diver and submariner samples.^{11,59}

Furthermore, resilient submariners additionally endorsed positive reframing, acceptance and religion as coping strategies, reflecting internal or 'cognitive' approaches to coping. These strategies may be particularly useful to facilitate resilience in the context of submarine operations where practical measures of coping with chronic stressors may not always be available (i.e. when on extended patrol). The requirement of sustaining coping across longer missions in demanding contexts may thus activate the use of internal mechanisms to cope.⁴ Submarine patrols of longer duration are often associated with an increasing sense of social isolation, making internal strategies particularly appropriate.⁴ The association of hardiness and use of emotional support among submariners can also be understood in terms of their deployed environment. The physical context of close personal interaction in a submarine, together with an acknowledged reliance on each other to meet the demands of a hostile external environment, facilitates opportunities to draw on the emotional support of the group.⁴

Resilient divers additionally endorsed acceptance, and disregarded self-blame, as coping strategies. As mentioned earlier, divers' use of acceptance may be particularly suitable to the typically short-term nature of stressful diving operations, while their previously reported high confidence and self-esteem could explain their non-use of self-blame as a coping strategy.⁴

Some differences were observed between the known group or typical profile of the divers and submariners – as described by the BFI-44 and the BC – and the identified resilience profile. This apparent contrast between the actual and resilience personality and coping profiles could be hypothesised to be influenced by a number of factors.

Firstly, although the SAN currently applies no occupational-specific psychological selection, at least some of the older participants may originally have been selected into their respective occupational groups based on typical profiles (a practice that the SAN employed in the past). The actual profiles may thus reflect previous selection biases.

Secondly, in spite of their earlier use in South Africa, neither the DRS-15 nor the MTQ-18 might be an accurate measure of resilience in the SA cultural context (the same argument could also apply to the BFI-44). Although it has been translated into a number of languages and is used successfully across the global north, the underlying components of the DRS and/or MTQ may not translate easily into the cultural context of a developing country, such as South Africa.^{28,34,57,60,61,62} Support for this concern was found in three indicators in the findings:

- the DRS-15, as a scale, displayed poor internal consistency, and may not be a useful measure of resilience locally;
- the unusually high scores of the DRS-15 and MTQ-18 found here (see Table 2) are not unexpected for a specialist group, but a recent study reported that a general SAN sample also scored much higher than comparable international norm groups,⁴⁹ and this unexpected finding raises doubts about the validity of these scales; and
- the two instruments are also brief scales, which provide a limited assessment of resilience, whereas extended measures may provide more accurate reflections of actual resilience.

Thirdly, the ICE context of these specialists may pose unique demands that require specific traits or behaviours that are not necessarily associated with resilience in general society or even in the general military. Earlier studies described very specific personality profiles for divers and submariners and others in ICE environments. Very specific coping styles and strategies have also been described in specific ICE contexts.^{8,10,11,56,58,63} These strategies are, for example, an over-reliance on active problem-solving skills and a rejection of behavioural disengagement (i.e. avoiding, withdrawing or giving up). Such strategies may be very important when living and working in settings requiring life-support technology to maintain survival, but may not always be equally important in other circumstances. Resilience profiles in ICE contexts may thus look different from resilience profiles in other, everyday contexts. Support for the concept of context-

specific resilience could also be inferred from the observation that associations (and the strength of correlations) between personality factors and resilience differed between the maritime specialities reported here and other samples outside ICE environments.^{23,57} Resilience traits, it appears, are contingent on context.

Lastly, various organisational processes involved in the recruitment and/or retention of naval personnel in the SA context may create opportunity for individuals with different-from-expected general resilience profiles to enter and remain in military specialities. For example, recent research suggests that socio-economic factors, additional to psychological factors such as interest or aptitude, might be significant contributors to employment choices of navy divers.⁶⁴

Typical, contemporary, psychological profiles – in the context of ICE environments – are often considered ideal profiles, and are thus used to guide recruitment and selection of personnel. However, the findings reported here suggest that such profiles may not necessarily be the most optimal resilience profiles in each respective context. This brings a challenge to the extent to which traditional or known group profiles should be used to guide recruitment or selection of personnel for missions in ICE environments. For example, one implication of this study is that following the typical profile, attention would traditionally be placed on three of the Big Five factors, while their association with hardiness suggests that attention should be paid to an individual's score across all five factors. The DRS-15 and BFI-44 are brief scales, and generally not considered comprehensive enough for selection purposes. However, the principle remains, namely that reliance on known group or typical profiles – in this case of navy specialists – may neglect other equally important factors, such as dispositional resilience or specific coping repertoires.

A limitation of the study was the lack of a control group consisting of designated 'poor adaptors' to allow comparison between the traits of those who successfully adapt to their contexts, and those who do not. Furthermore, successful adaptation was inferred, and although a number of criteria were used to make this inference, more specific indicators may be required to describe successful adaptation more accurately.

Future studies could explore the extent to which *resilience* profiles, whichever way they are determined, should be considered *desirable* profiles and used to guide entry into any ICE mission. This could be done by, among others, extending the analysis by correlating personality and resilience scores with actual behavioural outcomes during and after ICE missions. Such behavioural outcomes could include markers of general or mental health, and/or indicators of coping (whether according to a subjective self-report or possibly a more objective peer report), and/or measures of performance (work or social functioning), and/or other indicators of personal experience. Such a wide range of markers may facilitate a more nuanced understanding of the interplay between personality and coping profiles, and personal resilience and psychological adaptation in ICE contexts, than previous limited-focus analyses.

With research on-going, two practical applications, with demonstrated success to enhance resilience, could continue to be implemented.^{65,66} Firstly, in the current context

where limited resources impact on operational deployments, it remains imperative to foster sense of purpose and belonging. Having a sense of purpose is associated with greater endorsement of preventive health behaviours and improved morbidity and mortality. Likewise, a sense of belonging (to military unit or other social groups) protects military service members from developing adverse psychological reactions following deployments. Secondly, it is worth to consider extending the practice to embed resilience resources within high-stress work places to include ICE environments. There is widespread evidence that embedding mental health providers and behavioural health technicians – who have operational and cultural competence specific to the military context – enhances psychological health among service members and leaders. Of particular interest is that many embedded military resilience/mental fitness programs are effectively implemented by trained “lay” personnel rather than highly educated mental health professionals, making program implementation more flexible and less costly.

Conclusion

The study on which article reported set out to explore contextually adaptive psychological profiles of resilience in unusual settings. It did so by correlating scores for measures of resilience with scores for measures of personality and coping, and identified psychological profiles reflecting resilience, for both SAN diving and submarine settings as examples of ICE environments.

The researcher concluded that the expected, typical profiles were not wholly associated with resilience profiles. This has a number of implications. Firstly, resilience may need to be understood contextually, where optimal resilience profiles may differ across settings with divergent psychological demands. Secondly, traditional profiling of groups operating in ICE environments – for purposes of developing reference profiles for use in recruitment or selection – may not necessarily be successful in identifying the most resilient individuals for such applications.

These findings might have value for mission selection purposes, in guiding the assessment of candidates to enhance mission success, as well as individual wellbeing. More importantly, the context-dependent nature of resilience might be a particularly useful consideration for mission preparation, by guiding the training of context-relevant coping skills.

ENDNOTES

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- ² American Psychological Association. “The road to resilience”. 2022. <<http://www.apa.org/helpcenter/road-resilience.aspx>> Accessed on 28 May 2022.
- ³ P Suedfeld & GD Steel. “The environmental psychology of capsule habitats”. *Annual Review of Psychology* 51. 2000. 227–253. doi: 10.1146/annurev.psych.51.1.227
- ⁴ GM Sandal, GR Leon & L Palinkas. “Human challenges in polar and space environments”. *Review of Environmental and Scientific Biotechnology* 5. 2006. 281–296. doi: 10.1007/s11157-006-9000-8
- ⁵ CH van Wijk. “Coping in context: Dispositional and situational coping of navy divers and submariners”. *Journal of Human Performance in Extreme Environments* 13/1. 2017. Article 7. doi: 10.7771/2327-2937.1091
- ⁶ LA Palinkas, KE Keeton, C Shea & LB Leveton. *Psychosocial characteristics of optimum performance in isolated and confined environments*. Report NASA/TM-2011-216149. Hanover, MD: NASA Center for AeroSpace Information, 2011.
- ⁷ JN Butcher, T Jeffrey, TG Cayton, S Colligan, JR DeVore & R Minegawa. “A study of active duty military personnel with the MMPI-2”. *Military Psychology* 2/1. 1990. 47–61.
- ⁸ CH van Wijk. “Personality profiles of divers: Integrating results across studies”. *International Maritime Health* 69/4. 2018. 297–303. doi: 10.5603/IMH.2018.0046
- ⁹ GS Moes, R Lall & B Johnson. “Personality characteristics of successful navy submarine personnel”. *Military Medicine* 161/4. 1996. 239–242.
- ¹⁰ CH van Wijk & WAJ Meintjes. “Mental health and personality functioning of naval specialists working in extreme environments”. *Military Psychology* 29/6. 2017. 601–614. doi: 10.1037/mil0000185
- ¹¹ S Kimhi. “Understanding good coping: A submarine crew coping with extreme environmental conditions”. *Psychology* 2/9. 2011. 961–967. doi: 10.4236/psych.2011.29145
- ¹² GM Sandal, IM Endresen, R Vaernes & H Ursin. “Personality and coping strategies during submarine missions”. *Human Performance in Extreme Environments* 7/1. 2003. 29–42. doi: 10.7771/2327-2937.1025
- ¹³ LA Palinkas. “Going to extremes: The cultural context of stress, illness and coping in Antarctica”. *Social Science and Medicine* 35/5. 1992. 651–664.
- ¹⁴ CH van Wijk. “The resilience of naval specialists: Their sense of coherence and its relationship with measures of personality”. *South African Journal of Psychology* 38/4. 2008. 737–751.
- ¹⁵ GE Richardson. “The meta-theory of resilience and resiliency”. *Journal of Clinical Psychology* 58/3. 2002. 307–321. doi: 10.1002/jclp.10020
- ¹⁶ A Antonovsky. *Health, stress and coping*. San Francisco, CA: Jossey-Bass, 1979.
- ¹⁷ A Antonovsky. *Unravelling the mystery of health: How people manage stress and stay well*. San Francisco, CA: Jossey-Bass, 1987.
- ¹⁸ SC Kobasa. “Stressful life events, personality and health: An inquiry into hardiness”. *Journal of Personality and Social Psychology* 37. 1979. 1–11.
- ¹⁹ P Clough, K Earle & D Sewell. “Mental toughness: The concept and its measurement”. In I Cockerill (ed), *Solutions in sport psychology*. London: Thomson Learning, 2002, 32–46.

- ²⁰ JB Rotter. "Generalised expectancies for internal versus external control of reinforcement". *Psychological Monographs* 80. 1966. 1–28. doi: 10.1037/h0092976
- ²¹ P Suedfeld. "Applying positive psychology in the study of extreme environments". *Human Performance in Extreme Environments* 6/1. 2001. 21–25.
- ²² PT Bartone, RR Roland, JJ Picano & TJ Williams. "Psychological hardiness predicts success in US Army Special Forces candidates". *International Journal of Selection and Assessment* 16/1. 2008. 78–81.
- ²³ SC Kobasa, SR Maddi & S Kahn. "Hardiness and health: A prospective study". *Journal of Personality and Social Psychology* 42. 1982. 168–177.
- ²⁴ PT Bartone, J Eid, BH Johnsen, LC Laberg & S Scott. "Big Five personality factors, hardiness, and social judgment as predictors of leader performance". *Leadership & Organization Development Journal* 30/6. 2009. 498–521.
- ²⁵ KJ Eschleman, NA Bowling & GM Alacon. "A meta-analytic examination of hardiness". *International Journal of Stress Management* 17/4. 2010. 277–307. doi: 10.1037/a0020476
- ²⁶ PT Bartone. "Predictors of stress-related illness in city bus drivers". *Journal of Occupational Medicine* 31. 1989. 657–663.
- ²⁷ PT Bartone. "Hardiness protects against war-related stress in army reserve forces". *Consulting Psychology Journal* 51. 1991. 72–82.
- ²⁸ PT Bartone. "Hardiness as a resiliency factor for United States forces in the Gulf War". In JM Violanti, D Paton & C Dunning (eds), *Posttraumatic stress intervention: Challenges, issues, and perspectives*. Springfield, IL: C. Thomas, 2000, 115–133.
- ²⁹ PT Bartone, SW Hystad, J Eid & JI Brevik. "Psychological hardiness and coping style as risk/resilience factors for alcohol abuse". *Military Medicine* 177/5. 2012. 517–524.
- ³⁰ TW Britt, AB Adler & PT Bartone. "Deriving benefits from stressful events: The role of engagement in meaningful work and hardiness". *Journal of Occupational Health Psychology* 6. 2001. 53–63.
- ³¹ SM Escolas, BL Pitts, MA Safer & PT Bartone. "The protective value of hardiness on military posttraumatic stress symptoms". *Military Psychology* 25/2. 2013. 116–123. doi: 10.1037/h0094953
- ³² SR Maddi & M Hess. "Hardiness and success in basketball". *International Journal of Sports Psychology* 23. 1992. 360–368.
- ³³ SR Maddi & SC Kobasa. *The hardy executive: Health under stress*. Homewood, IL: Dow Jones Irwin, 1984.
- ³⁴ M Westman. "The relationship between stress and performance: The moderating effects of hardiness". *Human Performance* 3. 1990. 141–155.
- ³⁵ SW Hystad, J Eid, BH Johnsen, JC Laberg & P Bartone. "Psychometric properties of the revised Norwegian Dispositional Resilience (Hardiness) Scale". *Scandinavian Journal of Psychology* 51. 2010. 237–245.
- ³⁶ SR Maddi & RH Harvey. "Hardiness considered across cultures". In PTP Wong & LCJ Wong (eds), *Handbook of multicultural perspectives on stress and coping*. New York, NJ: Springer, 2006, 409–426.
- ³⁷ AM Sandvik, E Gjevestad, E Aabrekk, P Øhman, P Kjendlie, SW Hystad, PT Bartone, AL Hansen & BH Johnsen. "Physical fitness and psychological hardiness as predictors of parasympathetic control in response to stress: A Norwegian police simulator training study". *Journal of Police and Criminal Psychology* 35(4). 2019. 504–517. doi: 10.1007/s11896-019-09323-8
- ³⁸ PT Bartone & GG Homish. "Influence of hardiness, avoidance coping, and combat exposure on depression in returning war veterans: A moderated-mediation study". *Journal of Affective Disorders* 265. 2020. 511–518. doi: 10.1016/j.jad.2020.01.127

- ³⁹ M Gerber, S Brand, AK Feldmeth, C Lang, C Elliot, E Holsboer-Trachsler & U Pühse. “Adolescents with high mental toughness adapt better to perceived stress: A longitudinal study with Swiss vocational students”. *Personality and Individual Differences* 54. 2013. 808–814.
- ⁴⁰ M Gerber, AK Feldmeth, C Lang, S Brand, C Elliott, E Holsboer-Trachsler & U Pühse. “The relationship between mental toughness, stress and burnout among adolescents: A longitudinal study with Swiss vocational students”. *Psychological Reports: Employment Psychology & Marketing* 117. 2015. 703–723. doi: 10.2466/14.02.PR0.117c29z6
- ⁴¹ M Kaiseler, RCJ Polman & AR Nicholls. “Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport”. *Personality and Individual Differences* 47. 2009. 728–733. doi: 10.1016/j.paid.2009.06.012
- ⁴² B Giles, PSR Goods, DR Warner, D Quain, P Peeling, KJ Ducker, B Dawson & DF Gucciardi. “Mental toughness and behavioural perseverance: A conceptual replication and extension”. *Journal of Science and Medicine in Sport* 21/6. 2018. 640–645.
- ⁴³ DF Gucciardi, P Peeling, KJ Ducker & B Dawson. “When the going gets tough: Mental toughness and its relationship with behavioural perseverance”. *Journal of Science and Medicine in Sport* 19/1. 2016. 81–86. doi: 10.1016/j.jsams.2014.12.005
- ⁴⁴ J Mutz, PJ Clough & KA Papageorgiou. “Do individual differences in emotion regulation mediate the relationship between mental toughness and symptoms of depression?” *Journal of Individual Differences* 38. 2017. 71–82. doi: 10.1027/1614-0001/a000224
- ⁴⁵ Y Lin, J Mutz, PJ Clough & KA Papageorgiou. “Mental toughness and individual differences in learning, educational and work performance, psychological well-being, and personality: A systematic review”. *Frontiers in Psychology* 8. 2017. Article 1345. doi: 10.3389/fpsyg.2017.01345
- ⁴⁶ PF Delaney, JA Goldman, JS King & RO Nelson-Gray. “Mental toughness, reinforcement sensitivity theory, and the five-factor model: Personality and directed forgetting”. *Personality and Individual Differences* 83. 2015. 180–184. doi: 10.1016/j.paid.2015.04.020
- ⁴⁷ PT Bartone. “A short hardiness scale”. Paper presented at the Seventh Annual Convention of the American Psychological Society, New York, NY, 1995.
- ⁴⁸ PT Bartone. Test-retest reliability of the dispositional resilience scale-15, a brief hardiness scale. *Psychological Reports* 101(3 Pt 1). 2007. 943–944. doi: 10.2466/pr0.101.3.943-944
- ⁴⁹ JL Perry, PJ Clough, L Crust, K Earle & AR Nicholls. “Factorial validity of the Mental Toughness Questionnaire-48”. *Personality and Individual Differences* 54. 2013. 587–592. doi: 10.1016/j.paid.2012.11.020
- ⁵⁰ D Arendse, P Bester & C van Wijk. “Exploring psychological resilience in the South African Navy”. In NM Dodd, PC Bester & J van der Merwe (eds), *Contemporary issues in South African military psychology*. Stellenbosch: African Sun Media, 2020, 137–160. doi: 10.18820/9781928480631/08
- ⁵¹ CD Spielberger. *Preliminary manual for the State-Trait Personality Inventory*. Tampa, FL: University of South Florida, 1995.
- ⁵² OP John, EM Donahue & RL Kentle. *The Big Five Inventory: Versions 4a and 54*. Berkeley, CA: Institute of Personality and Social Research, University of California, 1991.
- ⁵³ OP John, LP Naumann & CJ Soto. “Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues”. In OP John, RW Robins & LA Pervin (eds), *Handbook of personality: Theory and research* (3rd ed). New York, NY: Guilford Press, 2008, 114–158.
- ⁵⁴ CS Carver. “You want to measure coping but your protocol’s too long: Consider the Brief COPE”. *International Journal of Behavioral Medicine* 4. 1997. 92–100.

- ⁵⁵ CD Spielberger & EC Reheiser. "Assessment of emotions: Anxiety, anger, depression, and curiosity". *Applied Psychology: Health and Well-being* 1/3. 2009. 271–302. doi: 10.1111/j.1758-0854.2009.01017.x
- ⁵⁶ CH van Wijk. "Screening mental well-being in high demand occupational settings in South Africa". *European Scientific Journal* 13/14. 2017. 140–157.
- ⁵⁷ GR Leon, C McNally & YS Ben-Porath. "Personality characteristics, mood, and coping patterns in a successful North Pole expedition team". *Journal of Research in Personality* 23. 1989. 162–179.
- ⁵⁸ I Kardum, J Hudke-Knezevic & N Krpic. "The structure of hardiness, its measurement invariance across gender and relationship with personality traits and mental health outcomes". *Psychological Topics* 3. 2012. 457–507.
- ⁵⁹ TJ Beckman, WB Johnson & R Lall. "Salient personality characteristics among navy divers". *Military Medicine* 161/12. 1996. 717–719.
- ⁶⁰ E Curran. "Personality and sport: An investigation into whether personality traits can predict behaviour in people participating in competitive sport". Master's Thesis. Manchester Metropolitan University, 2017. <<https://e-space.mmu.ac.uk/619198/1/Emma%20Curran.pdf>> Accessed on 28 May 2022.
- ⁶¹ BH Johnsen, P Bartone, AM Sandvik, R Gjeldnes, AM Morken, SW Hystad & SV Stormæs. "Psychological hardiness predicts success in a Norwegian armed forces border patrol selection course". *International Journal of Selection and Assessment* 21. 2013. 368–375. doi: 10.1111/ijsa.12046
- ⁶² RW Loche III. "Psychological hardiness, Big Five personality, and demographic factors as predictors of college enrolment among military veterans". Doctoral dissertation. Oklahoma State University, 2017. <<https://core.ac.uk/download/pdf/215292751.pdf>> Accessed on 28 May 2022.
- ⁶³ GM Sandal. "Coping in Antarctica: Is it possible to generalize results across settings?" *Aviation, Space and Environmental Medicine* 71/9. Suppl. 2000. A37–A43.
- ⁶⁴ CH van Wijk & M Fourie. "The appropriateness of using the Self-Directed Search Questionnaire in developing countries: A pilot study with navy divers". *Open Journal of Social Sciences* 5. 2017. 60–69. doi: 10.4236/jss.2017.52007
- ⁶⁵ J Roski, BL Gillingham, J Millegan, DR Zitelman, SV Batten & EM Delaney. "Building resilience for greater health and performance: Learning from the military" *Health Affairs Blog*, August 12, 2019. <https://www.healthaffairs.org/doi/10.1377/forefront.20190807.768196> Accessed on 28 May 2022.
- ⁶⁶ RR Sinclair & TW Britt (eds). *Building psychological resilience in military personnel: Theory and practice*. Washington, DC: American Psychological Association, 2013. doi: 10.1037/14190-001