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Reported growth following mountaineering expeditions: The role of personality and perceived stress

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1 **Reported growth following mountaineering expeditions: The role of personality and**
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Abstract

Results from previous studies suggest that stressful environmental conditions such as those faced on expedition may result in psychological growth. Building on previous research, the present cross-sectional study examined the role of personality and perceived stress in relation to post-expedition growth. Eighty-three participants who had completed a mountaineering expedition responded to measures of stress, personality, growth, well-being and resilience. Findings implicate perceived stress, and personality dimensions of agreeableness and openness, in post-expedition growth. Growth was associated with well-being but distinct from psychological resilience, highlighting the need to consider growth and resilience independently. Present findings support the proposition that stressful expedition-environments may promote positive psychological adjustment and identify factors that may influence this change. Research is needed to delineate the impact of other variables, such as coping, on changes that occurs during the post-expedition phase. Such research holds relevance for maintaining health following immersion in extreme and unusual environments.

Keywords: Personality; Stress; Post-expedition Growth; Mountaineering; Expedition

Introduction

There are a number of inherent stressors associated with extreme environments, such as hostile climates, cramped living spaces, lack of available life support and limited communication with the outside world (Sandal, 2000). Despite these challenges, there is a growing body of literature that suggests exposure to stress as a result of operating in extreme environmental conditions can manifest in adaptive psychological responses and personal growth (Kjaergaard, Venables, Leon, & Fink, 2013; Leon, Sandal, Fink, & Ciofani, 2011). Such findings are consistent with the positive psychology orientation encouraged by Suedfeld (2001, 2005), and based on the presumed ‘salutogenic’ (or health-enhancing) function of challenging experiences (Antonovsky, 1987). Researchers conducting studies with diverse

populations, such as young adult expedition-goers (Stott & Hall, 2003), round-the-world sailors (Kjaergaard, Leon & Venables, 2015), polar adventurers (Atlis, Leon, Sandal & Infante, 2004; Leon et al., 2011), military personnel (Kjaergaard et al., 2013), Antarctic over-winterers (Palinkas, 1986), and astronauts (Ihle, Ritsher & Kanas, 2006; Suedfeld, Brcic, Johnson, & Gushin, 2012), have reported various forms of positive adjustment following exposure to stress-inducing extreme environs. These findings contrast to the more traditional pathogenic view of extreme environments, which focused on psychological and interpersonal dysfunction experienced by personnel in such contexts (Steel, Suedfeld, Peri, & Palinkas, 1997; Suedfeld, 2001).

In an attempt to explain the positive adjustment reported in previous studies, scientists focusing on psychological factors in extreme environment contexts have employed concepts embedded in the post-traumatic growth (PTG) literature (Calhoun & Tedeschi, 2004). While extreme environments are not by nature considered traumatic, they do provide a challenging context that tests the personal resources of an individual and may result in enhanced feelings of personal strength, appreciation of life, and possibilities for the future. It is important to note that Calhoun and Tedeschi (1996; 2004) consider growth as a process of positive adaptation that occurs following stressful and traumatic events, and emphasize a distinction from psychological resilience. In contrast to growth, resilience is more related to avoiding, warding off, and recovering from negative effects (Palinkas & Suedfeld, 2008). Although the relationship between growth and resilience is debated (Lepore & Revenson, 2006) and considered to be complex (Calhoun & Tedeschi, 2006), initial evidence does support the distinction between the two variables (e.g., Levine, Laufer, Stein, Hamama-Raz, & Solomon, 2009). If resilience and growth are found to be independent constructs, this would highlight the need to consider both variables when examining responses to stressful environments such as expeditions.

According to Calhoun and Tedeschi (1996; 2004), there are several distinct changes that characterize PTG. These include, (a) improved perceptions of personal strength; (b) appreciation of life; (c) possibilities for the future; (d) relating to others; and (e) spiritual awareness. Personal strength relates to an enhanced belief in one's capabilities and having the resources needed to overcome challenging situations. Appreciation of life is associated with a positive view of the world and understanding what matters in life. Possibilities for the future refers to new opportunities that may not have presented themselves before encountering the stressful experience. Relating to others is about understanding and connecting with other people and spiritual awareness is being aware of and in touch with religious matters. Despite a number of studies examining growth following immersion in extreme conditions (e.g., Ihle et al., 2006; Kjaergaard et al., 2013), there has been little or no attempt to assess the correlates (i.e., personality, stress, well-being, resilience) of growth after returning from an extreme and unusual environment expedition.

Findings from previous work suggest that the extent to which a person is likely to report growth will be influenced by a variety of factors, which include the level of stress experienced and an individual's personality characteristics (Paton, 2005). Indeed, Shakespeare-Finch, Gow and Smith (2005) reported positive correlations between the Big-5 personality dimensions of extroversion, openness, agreeableness, and reports of PTG. Similar relationships between PTG and personality have also been found in other clinical (Garnefski, Kraaij, Schroevers, & Somsen, 2008) and non-clinical (Tedeschi & Calhoun, 1996) populations, thereby highlighting the importance of considering dimensions of personality when studying PTG.

Within extreme environment research, personality has often been a variable of interest and is an important consideration when screening people to operate in challenging conditions (Cardona & Ritchie, 2007; Palinkas & Suedfeld, 2008; Sandal, Leon & Palinkas, 2006). For

instance, the European and Russian Space Agencies and the National Aeronautics Space Administration (NASA) screen applicants' personality prior to acceptance on to their respective astronaut programs (Kanas & Manzey, 2008; Musson, Sandal & Helmreich, 2004). The aim of this screening process is to remove candidates who are deemed unsuitable for deployments in space.

In teams operating in challenging situations, a combination of high motivation (instrumentality) and positive expressivity (interpersonal sensitivity) have been used to define what is referred to as "the right stuff". The "right stuff" personality profile has been associated with superior coping and performance in teams operating in stressful environments such as aircrews (Chidester, Helmreich, Gregorich, & Geis, 1991), military units (Sandal, et al. 1998), submarine personnel (Sandal, Endresen, Vaernes & Ursin, 1999), and astronauts (McFadden, Helmreich, Rose, & Fogg, 1994). Further evidence also exists to indicate that agreeableness, the extent to which a person is affable and able to work with others, may contribute to performance in demanding situations such as space missions and astronaut training (Rose, Fogg, Helmreich, & McFadden 1994). Instrumentality and agreeableness (closely linked to positive expressivity) are very relevant to the present research, especially given the importance of the study participants working with others to complete their expedition objectives.

Personality profiling has also been popular with polar expedition groups and has been used to assess a variety of individuals and teams operating in Arctic and Antarctic conditions (Bishop, Grobler, Schjoll, 2001; Kjaergaard et al., 2013; Leon & Scheib, 2007; Sandal, Bergan, Warncke, Vaernes, & Ursin, 1996). Findings from previous studies suggest that individual characteristics such as high emotional stability, task ability, and social compatibility predict optimal performance and adaptation during polar expeditions (Biersner & Hogan, 1984; Mocellin, Suedfeld, Bernaldez, & Barbarito, 1991; Palinkas, Gunderson,

Holland, Miller, & Johnson, 2000). Further distinctions can be made between the types of individual characteristics needed for optimum performance during different length expeditions to the Polar Regions. The ideal personal characteristics for short-duration (<3 months) polar excursions are considered to be a high motivation to achieve, sense of adventure, and low susceptibility to anxiety. In contrast, the individual characteristics ideal for longer-duration stays and over-wintering are somewhat different and include amongst others, being emotionally stable, introverted yet socially adept and not needing social interaction (Palinkas & Suedfeld, 2008). The participants in the present study were typically undertaking short-duration expeditions and optimal performance would be expected to fit within the former profile.

Taken together, findings from military, space, and polar expedition research point towards certain personality factors, such as agreeableness, motivation, and low neuroticism (or anxiety susceptibility) that are expected to facilitate performance and adjustment in extreme environments (Musson et al., 2004; Sandal et al., 2006). However, to date there has been a limited attempt to examine the link between personality and adjustment (i.e., growth) specifically during the post-expedition phase. Given the role of personality factors in predicting performance and adjustment (Palinkas et al., 2000), and considering research conducted in trauma-related settings (e.g., Shakespeare-Finch et al., 2005), we might also expect the same personality factors to contribute to reports of growth on return from extreme and stressful environmental conditions.

In summary, the aim of the present study was to build on previous research examining growth following an extreme environment expedition (e.g., Kjaergaard et al., 2013; 2015). Specifically, in the current study we tested the relationship between PTG and correlates, including stress, personality, well-being, and resilience. In line with previous findings, we expected expedition-goers to report perceptions of growth. We expected growth to be

positively related to well-being but not related to the distinct construct of resilience (Levine et al., 2009). Finally, we anticipated that stress and personality would account for changes in reported growth. It was expected that dimensions of personality consistent with the “right stuff” (e.g., agreeableness, conscientiousness, openness) would be predictive of post-expedition growth.

Method

Participants

In total, 83 mountaineering participants (Male = 72; Female = 11) were involved in the present study. On completion of data collection, 93 expedition-goers had fully completed the survey. After screening for expedition-type, 10 non-mountaineers were eventually removed from the analysis resulting in the finally sample of 83 mountaineers. The final sample had a mean age of 42.54 years ($SD = 16.50$ years), had participated in at least 1, and up to as many as 40 expeditions ($M = 7.55$), and on average had completed their most recent expedition 28 months ago ($SD = 48$ months). Of the participants, 31 were single, 42 were married, 2 separated, and 8 co-habiting. In addition, 35 of the participants reported having children. The study was approved by the University ethics committee prior to being undertaken and all participants provided informed consent before taking part.

Measures

Post-expedition growth. To assess reports of post-expedition growth the 21-item Post-traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) was used. The PTGI assesses 5 dimensions of growth, including personal strength, appreciation of life, possibilities for the future, relating to others, and spiritual matters. There were 4 items for personal strength (e.g., “*knowing I can handle difficulties*”), 3 items were used to assess appreciation of life (e.g., “*an appreciation for the value of my own life*”), 5 items used for possibilities (e.g., “*new opportunities are available which wouldn’t have been otherwise*”), 7

items for relating to others (e.g., “a sense of closeness with others”) and 2 items for spiritual matters (e.g., “a better understanding of spiritual matters”). Participants were asked to consider the extent to which they experienced change in relation to their last expedition. Responses were provided on a 6-point scale, ranging from 0 (*I did not experience this change*) to 5 (*I experienced this change to a very great degree as a result of my expedition*). The PTGI has been used in previous expedition research and demonstrated acceptable validity and reliability (Ihle et al., 2006; Kjaergaard et al., 2013). In previous work, alpha coefficients for the PTGI subscales range from .77 to .97 (Ihle et al., 2006). Reliability coefficients for the PTGI and other scales used in the present study are presented in Tables 1 and 3.

Subjective vitality. To examine participant well-being the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997) was administered. The SVS contains 7 items tapping into the extent to which a person feels alive and vital (e.g., I have energy and spirit). To answer each of the questions, participants were provided with the stem “Since returning from my last expedition, in general in everyday life...” and responded using a 7-point scale ranging from 1 (*Not at all true*) to 7 (*Very true*). The SVS has been used extensively in previous research across a variety of domains and has been shown to be a valid and reliable indicator of well-being (Bostic, Rubio & Hood, 2000). Bostic et al. indicate typical alpha coefficients for the SVS range between .80 and .89.

Resilience. The Brief Resilience Scale (BRS; Smith et al., 2008) was used to assess expedition-goers’ reports of resilience. The BRS contains 6 items tapping into one dimension of resilience (e.g., “I tend to bounce back quickly after hard times”). Participants were provided with the stem “Since returning from my last expedition, in general in everyday life...” and asked to respond to each item using a 5-point Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The BRS provides an assessment of resilience as an outcome

and offers information on the ability of a person to bounce-back consistent with the definition with the PTG literature (Windle, Bennett & Noyes, 2011). Smith et al. (2008) reported acceptable levels of internal reliability for the BRS in four independent samples with Cronbach alpha scores ranging from .80 - .91.

Stress. A single item was used to assess participants' perceptions of how stressful their expedition experience was. A scale based on the Borg (1982) system was used to capture perceptions of stress. Participants were given the stem "how stressful was the expedition listed above?" and asked to respond on a scale from 0 (*least it could possibly be*) – 100 (*most it could possibly be*) in terms of how stressful they found the expedition experience. Single item measures of stress have shown good construct, content and predictive validity in previous psychological studies (Elo, Leppanen & Jahkola, 2003; Salminen, Kouvonen, Koskinen, Joensuu, & Vaananen, 2014) and have also been utilized in past extreme environment research (Kahn & Leon, 2000).

Personality. The 44 item Big Five Inventory (BFI; John, Donahue & Kentle, 1991) was used to assess the five personality traits of agreeableness, conscientiousness, extraversion, openness and neuroticism. There were 9 items to assess agreeableness (e.g., "I am someone who likes to cooperate with others), 9 items to assess conscientiousness (e.g., "I am someone who does a thorough job"), 8 items for extraversion (e.g., "I am someone who has an assertive personality"), 10 items for openness (e.g., "I am someone who is original and comes up with new ideas") and finally 8 items for neuroticism (e.g., "I am someone who is depressed, blue"). Participants were given a series of statements and asked to consider the extent to which did or did not apply to them. A 5-point Likert scale ranging from 1 (*Disagree strongly*) to 5 (*Agree strongly*) was used to respond to each item. The BFI has demonstrated reliability and validity in previous research and showed convergence (Soto & John, 2009) with the NEO personality inventory (Costa & McCrae, 1992) used in previous extreme

environment research. In prior work, Soto and John (2009) have reported acceptable internal reliability scores for the BFI with coefficients ranging between .81 - .88.

Procedure

A cross-sectional retrospective design was employed in the study. Data were collected using an online questionnaire that was completed in English and contained items related to demographics, expedition characteristics and the variables under examination. Indices of reliability for each of the study variables can be seen in Tables 1 and 2. Prospective participants were contacted online via a number of mailing lists and pre-existing networks within the mountaineering and expedition community. After reading the information letter and criteria for inclusion, individuals were asked to provide consent. Following consent, participants completed the different sections of the online questionnaire in relation to their most recent expedition. In total, the questionnaire took approximately 20 – 30 minutes to complete.

Initially, the survey was promoted to all forms of expedition (e.g., mountaineering, trekking, polar). However, on completion of data collection the convenience sample collected were mainly mountaineers. Therefore, to be included in the study participants had to have completed an alpine/mountaineering expedition lasting a minimum of 7 days. For the purposes of this study an expedition was defined as a human powered journey between 2 or more locations (i.e., from basecamp to a targeted[s] peak), which is consistent with how an expedition is defined by the Royal Geographical Society in the UK.

Data Analysis

Aggregated scores for each of the questionnaire subscales were computed and descriptive statistics presented alongside background information on the expeditions. To examine the role of group size, expedition duration and expedition experience, variables were dichotomized. For group size, participants were categorized into individual/small group ($N =$

1 – 4) and larger group ($N = 5+$). Expedition duration was considered shorter if the journey lasted between 1 – 4 weeks and longer if the trip was 5 weeks+. If the participants had completed 1 – 4 expeditions they were considered less experienced and those who had completed 5+ trips were coded as more experienced. Coding the variables in such a way resulted in roughly equal group sizes. Parametric assumptions were checked before employing paired samples t-tests to examine differences in growth according to the coded variables. As multiple t-tests were conducted, a Bonferroni adjustment was applied to the probability (i.e., $.05/3 = .017$) value thereby reducing the chance of rejecting the null hypothesis in error. Bivariate correlations were then computed between study variables before running a hierarchical multiple regression analysis. Based on the initial t-tests and correlational analysis, we controlled for expeditions completed and elapsed time since completion in the first step. In Step 2, stress was included as a predictor before adding personality dimensions to the regression model in Step 3. At each stage, the amount of variance was explained and the standardized regression weights assessed for significance.

Results

The location of the expeditions varied and included journeys in 38 different countries, the most common being in Asia particularly in the Himalayas. There were a variety of other locations visited by multiple expedition groups including the Andes, Patagonia, Namibia, the European Alps, Alaska and Antarctica. Out of the 83 participants, 72 reported to have achieved their expedition aims while 11 said they did not complete what they set out to do.

ⁱⁱⁱIn terms of characteristics, there was a similar dispersion of participants between the more than 1 week – less than 2 ($n = 26$), more than 2 weeks – less than 4 ($n = 23$), and more than 4 weeks – less than 8 ($n = 27$). There were fewer participants in the more than 8 weeks – less than 12 ($n = 4$), and more than 12 weeks ($n = 3$) time frames. The size of the expedition groups varied; 3 reported being individuals, 18 as part of a pair, 16 in a group of 3 – 4, 29 in a

group of 5 – 8 people and 17 who completed their trip as part of group of 9 people or more.

In relation to the expedition aims, participants reported wanting to complete first ascents, explore remote environments and gain new experiences.

Reports of post-expedition growth are provided in Table 1. Scores indicate that personal strength and appreciation of life displayed the most prominent perception of change, while spiritual matters changed the least. With the exception of 1 item (i.e., “I have a stronger religious faith”), 44 – 84% of individuals indicated some degree of change and reported feelings of growth following the expedition. Independent samples t tests were used to examine growth according to expedition characteristics (see Table 2). A Bonferroni adjustment was applied due to the repeated t tests and a more conservative estimate of significance was set at $p < .017$. There were no significant differences in reported growth according to group size or duration of expedition. A difference was observed between reported growth according to the level of expedition experience (i.e., more or less experienced). Although this was non-significant according to the adjusted p value ($p = .033$), the effect size ($d = 0.48$) could be interpreted as moderate.

Mean scores, standard deviations and reliability values for the remaining study variables can be seen in Table 3. Reported expedition stress was scored at a moderate level. On average, participants reported higher scores on extraversion, conscientiousness, agreeableness, and openness, and lower scores on neuroticism than when considered in relation to a more general population (see Table 3).

Reports of growth, including future possibilities, appreciation of life, relating to others, and spiritual matters were correlated with subjective vitality but not with resilience. Reports of expedition stress were positively associated with dimensions of growth, including appreciation of life, possibilities for future, personal strength, and relating to others. With respect to personality, there was a significant association between extraversion and spiritual

matters. A series of positive correlations were also found between agreeableness and future possibilities, appreciation of life, relating to others, and spiritual matters. Finally there was a significant positive correlation between openness, and appreciation of life and spirituality. A full correlation matrix with all study variables can be seen in Table 4.

Results from the hierarchical multiple linear regressions are presented in Table 5. Predictors included in Step 1 accounted for only 3% of the variance in participants' reports of growth. Neither the number of expeditions completed or elapsed time was significantly related to growth. Including reports of expedition stress in Step 2 accounted for an additional 11% of the variance in participants' reports of growth and the regression was significant $F(3, 79) = 4.35, p = .007$. At this stage, stress emerged as a significant predictor of overall growth ($B = .35, p = .002$). In Step 3, personality factors were added and this accounted for an additional 22% of the variance in growth and resulted in a significant regression coefficient $F(8, 74) = 4.45, p < .01$. Stress remained a significant positive predictor of growth ($B = .39, p < .01$) and agreeableness also emerged as a significant positive predictor ($B = .34, p = .001$). The relationship between openness and growth was positive and approached significance ($B = .20, p = .07$).

Discussion

The aim of the present work was to examine the expedition characteristics and key psychological factors associated with post-expedition growth. To date, post-expedition responses have received relatively limited empirical attention. This is surprising given that the return stage has been identified as an important phase for individuals following exposure to extreme environmental conditions. While a small number of studies have provided descriptive information on post-expedition growth, there has been no attempt to examine the correlates of growth following expeditions in extreme environment settings. In a unique contribution to the literature, the findings of the present research highlight the role of

perceived stress and personality for ensuing reports of post-expedition growth. Dimensions of growth were also associated with indicators of psychological wellbeing highlighting the potential benefits of facilitating growth experiences.

Consistent with the findings of previous research, the expedition-goers in the present study reported small-to-moderate growth following exposure to an extreme and unusual environment (Ihle et al., 2006; Kjaergaard et al., 2013). Most notably, perceptions of personal strength and appreciation of life were reported as having changed. The perceptions of growth reported suggest that as a result of the expedition, participants felt more capable of overcoming future challenges and had a different perspective of their life. The present findings are in line with the literature on PTG (Tedeschi & Calhoun, 1996), which suggests stressful encounters may lead to a positive readjustment and hold benefits for the individual. In addition, and consistent with previous findings (e.g., Ihle et al., 2006; Suedfeld & Weiszbeck, 2004), changes in spiritual matters were negligible. For such a shift to occur in relation to spirituality, it is possible that a major event or more profound experience would be needed, rather than the environmental stress caused by expedition endeavors.

To better understand the growth response, we examined key expedition characteristics that might account for the positive adjustment (i.e., experience, duration, group size). Although no significant differences emerged, the moderate effect size noted between the more versus less experienced expedition-goers, suggests that the number of expeditions completed could have an impact on growth. The finding related to expedition experience is not surprising given that those who spend more time in stressful environments are likely to become accustomed to such settings and perhaps develop resources to cope with these situations. Consequently, the personal resources of experienced individuals are less likely to be challenged and growth would be unexpected. In Step 3 of the regression model, the link between expeditions completed and growth approached significance. In part, expedition

experience may explain the modest changes in growth reported in the current work, as well as in previous studies that focused on those operating in space (Ihle et al., 2006). This interpretation is consistent with a plateauing effect, which suggests that substantial growth will occur following initial expedition experiences and then become more stable over time. Aligned with theoretical predictions, further growth would only then occur following more demanding (or traumatic) expedition endeavors. Ultimately, events that challenge the resources of an individual will result in a schema change, reformulation of one's self-perception, and reports of growth. In future work, examining how growth is experienced by both novice and more established expedition-goers could provide valuable information on how extreme environments could be used to facilitate positive development. This information could be used to aid the training and preparation of personnel for engagement in more stressful extreme environment endeavors (Kanas et al., 2007).

Within the present sample, participants reported higher scores on conscientiousness, agreeableness, extraversion, and openness, and lower scores on neuroticism than when compared to a general population sample of adults (Nofhle & Robins, 2007). This personality profile is coherent with previous research that has examined individuals operating in extreme and unusual environments (Kjaergaard et al., 2013; Steel et al., 1997). Such a profile is linked to the ideal characteristics needed for short-term polar expeditions as proposed by Palinkas and Suedfeld (2008). Having a high sense of adventure, a desire to achieve, and low susceptibility to anxiety are considered important for performance and adjustment in polar environments and may hold true for other expedition contexts, such as mountaineering (Palinkas & Suedfeld, 2008). In addition, the reports of conscientiousness and agreeableness are suggestive of a profile that is consistent with having the "right stuff", or being high in instrumentality and expressivity, which has been shown to be important for teams operating in challenging contexts such as aircrews (Chidester et al., 1991), astronauts (McFadden et al.,

1994), and military personnel (Sandal et al., 1998). In the present study, the sample of alpinists and mountaineers were self-selecting and responsible for the selection of themselves and other team members. Therefore, ensuring individual members possess the attributes (e.g., conscientiousness, agreeableness) that would allow them to function optimally in extreme environments is critical for the safe and successful completion of different expedition activities.

Not surprisingly, reports of expedition stress were positively correlated with indicators of growth, including future possibilities, appreciation for life, and personal strength. These findings are consonant with the literature on PTG that suggest when a person's resources are challenged they may experience a positive reaction, especially if they are able to overcome the difficulties faced (Calhoun & Tedeschi, 1996; 2006). Interestingly and consistent with the view that growth and resilience should be considered as distinct constructs (Levine et al., 2009; Palinkas & Suedfeld, 2008), there were no significant correlations between the dimensions of growth as measured by the PTGI and resilience. The present results are in line with findings by Levine et al. (2009) and highlight the independence of resilience and growth in this extreme environment context. One possible explanation is that growth is more likely a positive reformulation, rather than simply a tendency to withstand or bounce back from a stressful encounter. Consequently, this finding is in line with the recommendations made by Suedfeld (2001) and highlights the need to consider the complementary variables of growth and resilience in future extreme environment research.

Further positive correlations were found between dimensions of growth and subjective vitality, an indicator of well-being linked to optimal functioning within the eudaimonic perspective (Waterman, 1993). Interestingly, there was no correlation between stress and subjective vitality. This finding is encouraging and suggests that growth

experienced as a result of stress may have subsequent implications for promoting psychological health (i.e., subjective vitality), but that stress in and of itself is not well-being promoting. It is important to highlight that these data are correlational and causal pathways cannot be assumed. Nevertheless, such findings provide impetus for future research in this area and data from prospective studies would allow for a stress-growth-well-being model to be tested further.

After controlling for number of expeditions completed and time since completion (elapsed time), stress remained a positive predictor of growth. This might suggest that regardless of expedition experience or the elapsed time since completion, if the expedition experience was stressful enough to challenge an individual's resources they would be more likely to report growth (also consistent with our earlier interpretation). In addition to stress, a positive association between the personality dimension of agreeableness and growth emerged, suggesting that those who are more affable and able to work with others are likely to report more positive adaption following exposure to extreme and stressful environments. The link between openness and growth was approaching significance and might suggest that those individuals who are interested in new experiences and opportunities are likely to report more growth. Such findings are line with previous research on PTG in disaster and emergency settings (Paton, 2006). In relation to previous extreme environment work, high agreeableness and to some extent openness (similar to a sense of adventure) have been identified as important for individual and team performance in challenging conditions (Biersner & Hogan, 1984; Mocellin, Suedfeld, Bernaldez & Barbarito, 1991; Palinkas et al., 2000; Palinkas & Suedfeld, 2008; Sandal et al., 1999). The present findings suggest that the characteristics of agreeableness, and to some degree openness, may be important for adjustment, and more specifically reports of growth during the post-expedition phase. When included within the same model, the remaining dimensions of personality were not associated

with growth. This suggests that factors other than personality may account for the unexplained variance in the growth response. In upcoming work researchers may consider variables such as personal values, which relates to a person's motivation and may also impact upon adjustment after exposure to stress (Sandal & Bye, 2015; Sandal, Bye, & van de Vijver, 2011). Understanding the motives of expedition-goers is important, especially given that such a group choose to participate in these activities. Examining the quality of motivation (i.e., Intrinsic or Extrinsic; Deci & Ryan, 2000) and/or individuals' goal orientation, or conception of success (Dweck & Leggett, 1988; Nicholls, 1989), may explain how individuals respond to self-imposed stress and account for variability in growth. Motivation has been well-studied in other self-initiated contexts, such as sport, and may help explain how individuals respond and adjust following exposure to extreme environmental conditions.

Limitations

It is important to acknowledge the limitations of the present study. First and foremost, the study utilized cross-sectional data that relied on a retrospective account of the most recent expedition. As such, we were lacking pre-measurement reports of personality, resilience and vitality, which would have allowed us to control for changes in these variables following individuals' most recent expedition experience. However, despite the retrospective nature of the research, the present findings are consistent with previous work on personality predictors for adaptation in extreme environment and provide validity to our results. This approach also overcomes some of the constraints of previous extreme environments research that relies on small sample sizes. Secondly, there are a number of factors that were not considered within the study. In previous work in extreme environments, the coping strategies used by expedition-goers have been shown to be important for adaptation and performance in the face of stress (Nicolas, Sandal, Weiss, & Yusupova, 2013). It is also likely that coping strategies, such as problem- and emotion-focused approaches, would hold relevance for reports of

growth following stressful experiences (Paton, 2006) and should be considered in future work. Linked to the coping response, it is possible there is a stress threshold after which no further growth would be reported and maladaptive responses may emerge. Although beyond the scope of the present study, more work needs to be done to examine the threshold of stress likely to result in growth whilst minimizing potentially adverse effects. Collecting temporal assessments of growth (as well as challenges faced) during the post-expedition phase may elucidate the link between stress and adjustment after exposure to extreme environments. Thirdly, in the current work we employed a single item indicator of perceived stress. This approach has been used in previous studies (Elo et al., 2003) and aimed to provide a global indicator of perceived stress to aid the recall of participants. However, we acknowledge there are a variety of stressors likely to emerge before, during and after exposure to extreme settings. In future work, a more detailed description of stress could be taken to examine whether certain types of stressor (e.g., danger, monotony, psychosocial, weather etc.) account for reports of growth. Fourthly, the present research adopted a largely positive psychological viewpoint consistent with the recommendation of Suedfeld (2001). The expedition-goers may have experienced challenges on return from their experience that were not captured in the present study. In future, considering both the benefits and challenges faced by individuals during the post-expedition phase would be beneficial.

Conclusions

To our knowledge, this is the first study to examine the relationship between personality, stress and growth after completing an extreme environment expedition. The findings of the work are encouraging and highlight the potential ensuing benefits associated with engagement in pursuits in stressful environmental conditions. It is important to caution that although stress and growth are related, more work needs to be done to examine this relationship, particularly as excessive levels of stress are likely to be marked by both adaptive

and maladaptive responses. We also re-emphasize the importance of the personality factors of agreeableness and openness, not only for optimal performance in stressful environments, but also for adjustment in the post-expedition phase. A particular strength of the present work was the considerable sample size, which is often acknowledged as a constraint to studying groups in extreme conditions (Palinkas et al., 2004). In the future, studying mountaineering groups may allow extreme environment researchers to recruit larger samples and aid understanding of optimal performance and psychological adjustment both during and following exposure to extreme environments. Knowledge from such studies could then be applied to the selection, preparation and training of individuals that are due to operate in stressful environments (Kanas et al., 2007).

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Table 1

Reports of Post-expedition Growth by Item

Subscale (and items)	Alpha	Subscale (Mean +/- SD)	Item (Mean +/- SD)	% reporting any change
New Possibilities	.86	1.65 +/- 1.35		
New opportunities are available which wouldn't have been otherwise			1.81 +/- 1.70	64
I am able to do better things with my life			1.71 +/- 1.74	59
I developed new interests			1.80 +/- 1.59	71
I'm more likely to try to change things which need changing			1.60 +/- 1.70	58
I established a new path for my life			1.18 +/- 1.63	44
Appreciation of Life	.85	2.26 +/- 1.47		
I can better appreciate each day			2.04 +/- 1.77	68
I have a greater appreciation for the value of my own life			2.19 +/- 1.73	71
I changed my priorities about what is important in life			2.45 +/- 1.56	84
Personal Strength	.83	2.27 +/- 1.45		
A feeling of self-reliance			2.49 +/- 1.68	79
Knowing I can handle difficulties			2.47 +/- 1.82	78
Being able to accept the way things work out			2.16 +/- 1.66	74
I discovered that I am stronger than I thought I was			1.86 +/- 1.84	61
Relating to Others	.90	1.69 +/- 1.26		
Knowing that I can count on people in times of trouble			1.87 +/- 1.63	71

Having compassion for others			1.62 +/- 1.57	62
A sense of closeness with others			1.96 +/- 1.67	72
A willingness to express my emotions			1.21 +/- 1.47	51
Putting effort into my relationships			1.82 +/- 1.64	68
I learned a great deal about how wonderful people are			1.66 +/- 1.76	58
I accept needing others			1.39 +/- 1.51	55
Spiritual Matters	.61	.75 +/- 1.07		
A better understanding of spiritual matters			1.20 +/- 1.53	49
I have a stronger religious faith			0.28 +/- 0.87	13
TOTAL	0.95	1.73 +/- 1.12		

Note: Growth items range on scale from 0 – 5

Table 2

Differences in Reported Growth Based on Expedition Characteristics

Variables	N	Mean (SD)	<i>t</i>	Sig.
Less Experienced	38	2.01 (1.13)	2.17	.033
More Experienced	45	1.48 (1.07)		
Small group	37	1.80 (0.95)	0.69	.491
Large group	46	1.62 (1.34)		
Shorter duration	49	1.72 (1.08)	0.01	.998
Longer duration	34	1.72 (1.17)		

Note: Less experienced = 1 – 4 expeditions, More experienced = 5+ expeditions; Small group = 1 – 4 people, Large group = 5+ people; Shorter duration = 1 – 4 weeks, Longer duration = 5+ weeks

Table 3

Means, Standard Deviations and Reliability of Growth Correlates

	Mean	Std. Deviation	α	General Population Mean (SD)
Stress	46.83	23.14	N/A	-
Time elapsed (months)	28.30	48.21	N/A	-
Expeditions completed	7.55	7.68	N/A	-
Extraversion	3.50	.85	.88	3.26 (.75)
Agreeableness	3.89	.58	.75	3.71 (.60)
Conscientiousness	4.01	.54	.74	3.49 (.62)
Neuroticism	2.20	.77	.85	2.95 (.72)
Openness	3.89	.43	.57	3.55 (.59)
Subjective Vitality	4.84	1.11	.87	-
Resilience	3.91	.78	.90	-

Note: Range for Stress = 0 – 100; Personality = 1 – 5; Subjective vitality = 1 – 7; Resilience = 1 – 5; Comparative general population sample of 10,497, 18 – 30 year old students from Nofle & Robins (2007)

Table 4

Correlations Between Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Extraversion	1												
2. Agreeableness	.37**	1											
3. Conscientiousness	.11	.31**	1										
4. Neuroticism	-.40**	-.42**	-.22*	1									
5. Openness	.32**	.20	.27*	-.09	1								
6. Stress	-.08	-.14	-.15	.12	-.11	1							
7. Time elapsed	-.14	-.17	-.01	.11	-.03	.26*	1						
8. Possibility	.09	.25*	.04	-.02	.16	.25*	-.05	1					
9. Appreciate Life	.13	.24*	.02	.07	.23*	.33**	-.03	.78**	1				
10. Strength	.14	.20	-.04	.07	.03	.30**	-.01	.76**	.76**	1			
11. Relating	.12	.32**	-.11	.08	.02	.24**	-.04	.72**	.69**	.69**	1		
12. Spiritual	.27*	.23*	.01	-.05	.31**	.19	-.23*	.56**	.57**	.45**	.46**	1	
13. Subjective Vitality	.33**	.40**	.16	-.45**	.32**	.01	-.19	.42**	.29*	.19	.24*	.32**	1
14. Resilience	.38**	.26*	.08	-.61**	.35**	.07	-.05	.20	.20	.11	.10	.16	.59**

Note: * $p < .05$; ** $p < .01$

1 Table 5

2 *Hierarchical Multiple Linear Regression Predicting Post-expedition Growth*

		Beta	Sig.
Step 1	Elapsed time	-.08	.459
	Expeditions completed	-.16	.159
Step 2	Stress	.35**	.002
	Elapsed time	-.17	.115
	Expeditions completed	-.13	.222
Step 3	Stress	.39**	.000
	Elapsed time	-.11	.273
	Expeditions completed	-.19+	.080
	Extraversion	.08	.458
	Agreeableness	.39**	.000
	Conscientiousness	-.12	.299
	Neuroticism	.12	.296
	Openness	.20+	.070

3 *Note:* Growth is computed as an aggregation of its 5 subscales; ** $p < .01$, + $p < .10$

4

ⁱ Separate hierarchical multiple linear regressions were conducted with each of the submissions of growth. The findings were consistent across dimensions with stress and agreeableness predictive the growth response. For parsimony, the results for overall growth are presented. Further information can be provided by the first author upon request.

ⁱⁱ On request from one of the reviewers, we examined the difference in stress and growth scores for completers (72) versus non completers (11). Those who completed the expedition reported perceived stress to be 43.72, whereas non-completers indicated perceived stress to be 59.09. Differences in growth scores between completers and non-completers were relatively small.