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Centrality of Positive and Negative Deployment Memories Predicts Posttraumatic Growth in Danish Veterans

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Abstract

Objectives: The purpose of the present study was to examine theoretically motivated predictors for the development of positive changes following potentially traumatic experiences (i.e., posttraumatic growth). Specifically, we wanted to examine the prediction that memories of highly negative and positive deployment events predict subsequent posttraumatic growth. Method: 251 Danish soldiers (7 % female, mean age 26.4) deployed to forward operating bases in Afghanistan filled out questionnaires before, during and after deployment. This allowed us to perform prospective as well as cross sectional analyses of the data. Results: The main findings were that the centrality of highly emotional memories from deployment predicted growth alongside openness to experience, combat exposure, and social support. Importantly, the centrality of both positive and negative memories predicted growth equally well. Conclusions: The perceived importance of both negative and positive events may play an important part in the development of posttraumatic growth.

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For soldiers deployed to a war zone, life-threatening episodes of extreme danger either to oneself or to others are often part of the experience. Such episodes pose a serious risk for developing posttraumatic stress disorder (PTSD). A recent synthesis of epidemiological surveys found that on average 13.2 % of combat troops developed PTSD upon returning home (Kok, Herrell, Thomas, & Hoge, 2012). However, estimates vary considerably, and some studies find a very low prevalence of PTSD (Smith et al., 2009; see Magruder & Yeager, 2009, for a review). Still, war experiences remain a considerable risk factor for negative mental health outcomes. While the study of adverse outcomes has dominated the field of military psychology, a growing body of literature has focused on a different aspect, namely positive psychological change following war experiences. Knowledge of the factors leading not only to adverse outcomes, but also to positive growth experiences, could potentially be utilized in the treatment of PTSD (Tedeschi & McNally, 2011).

Posttraumatic growth has a long history with different definitions, but in modern psychology one operationalization in particular has risen to prominence. In 1996, Tedeschi and Calhoun described the Posttraumatic Growth Inventory (PTGI) based on their theory of how intense, traumatic events pose unique challenges to survivors, yet may also offer unique opportunities. The questionnaire asks the responder to compare his or her present situation with the pre-trauma situation and evaluate whether positive change has occurred as a result of the traumatic event within five dimensions of growth (relationships, possibilities in life, personal strength, spiritual change, and appreciation of life).

The theoretical foundation of Tedeschi and Calhoun's concept of growth is the idea of a "seismic event" challenging an individual's core assumptions about the self and the world (Tedeschi & Calhoun, 1996, 2004). When rebuilding these assumptions through disclosing the event to oneself through rumination or to others through conversation, the opportunity for growth arises. Whether this will actually happen depends on factors such as social support, management of emotional distress, development of a coherent life narrative, and personality characteristics such as extraversion and openness to experience. For instance, individuals with a greater openness to emotional experiences might notice positive emotions even when dealing with the aftermath of trauma, thus enabling them to acknowledge that good may

come from bad (Tedeschi & Calhoun, 2004). The process of rebuilding can be seen to depend in part on how the traumatic event is represented in the individual's autobiographical memory. According to Tedeschi and Calhoun (2004), if the trauma becomes a turning point in the individual's life story, it may also designate a new beginning which could be a catalyst for positive change. The model predicts that social support plays an important role in this process of incorporating the traumatic event into the life narrative through rehearsing the event with sympathetic others.

The integration of emotionally important events into the life story of an individual has been studied using of the Centrality of Events Scale (CES, Berntsen & Rubin, 2006). This measure includes a series of questions about how central the event has become to the responder's sense of identity and as a turning point in his or her life story. As such, the CES seems ideally suited for investigating the hypothesis that the perceived importance of a traumatic event predicts posttraumatic growth. Indeed, Groleau, Calhoun, Cann, and Tedeschi (2013) found that the CES predicted posttraumatic growth in a sample of university students, explaining unique variance when controlling for other known predictors such as challenges to core beliefs, rumination, and meaning making. In this study, Groleau et al. called for an investigation of both positive and negative aspects of traumatic events, suggesting that some trauma survivors may see positive aspects of trauma. A shortcoming of the study was that it was correlational rather than prospective and the causal relation in Tedeschi and Calhoun's (2004) model was therefore not directly examined.

In summary, Tedeschi and Calhoun's model of posttraumatic growth predicts that the integration of traumatic events into an individual's life story through rehearsal can lead to positive outcomes. This integration in turn is influenced by social support and certain personality characteristics such as extraversion and openness to experience. These predictions have not yet been investigated in a prospective, longitudinal study. The purpose of the present research is to begin to fill this gap. The study will focus on combat related growth, since combat deployment is a potentially traumatic experience that accommodates a prospective, longitudinal design. The next sections will review the literature on war-related growth in relation to the predictors in Tedeschi and Calhoun's model.

Posttraumatic growth and war-related trauma

A growing literature has shown that war-related trauma can lead to positive as well as negative outcomes. Studies on veterans from some of the major 20th century wars (World

War II, Korea, and Vietnam) have documented positive psychological changes in both prisoners of war (Feder et al., 2008; Sledge, Boydstun, & Rabe, 1980) and combat troops (Aldwin, Levenson, & Spiro, 1994; Elder & Clipp, 1989; Fontana & Rosenheck, 1998; Schnurr, Rosenberg, & Friedman, 1993). In general, these studies find that stressful events such as combat exposure and length of captivity increase self-reported growth (but see Maguen, Vogt, King, King, & Litz, 2006, for a negative result).

In addition, a number of studies have found that posttraumatic growth correlates positively with adverse reactions to war-related trauma (i.e. symptoms of PTSD) in both veterans (Dekel, Ein-Dor, & Solomon, 2012; Kaler, Erbes, Tedeschi, Arbisi, & Polusny, 2011; Karlsen, Dybdahl, & Vittersø, 2006; Levine, Laufer, Stein, Hamama-Raz, & Solomon, 2009; Pietrzak et al., 2010) and civilians (e.g. refugees; Dekel & Nuttman-Shwartz, 2009; Hall et al., 2010; Hobfoll et al., 2008). However, other studies have found no relationship between positive change and PTSD symptoms in civilians (Ai, Tice, Whitsett, Ishisaka, & Chim, 2007; Powell, Rosner, Butollo, Tedeschi, & Calhoun, 2003) and combat veterans (Gallaway, Millikan, & Bell, 2011), while two studies have even found negative correlations in both civilians (Kimhi, Eshel, Zysberg, & Hantman, 2010) and air force chaplains (Levy, Conoscenti, Tillery, Dickstein, & Litz, 2011). One possible explanation is that these discrepancies derive from variations in measures of growth as well as differences between the populations under study. For example, while most studies cited above used the PTGI – or a measure highly correlated with the PTGI (Hall et al., 2010; Hobfoll et al., 2008) - some used other measures of growth (Ai et al., 2007; Kimhi et al., 2010) and it is unclear whether these other measures cover the same domains of positive change as the PTGI. Another issue is that posttraumatic growth is considered to be part of the outcome of recovering from trauma. If posttraumatic distress and growth are assessed too close to the traumatic event (e.g. during deployment), the narrative development implicated in growth may not have had sufficient time to enact change. On the other hand, if distress and growth are assessed many months following the traumatic event, distress could have subsided due to outside intervention or simply the passage of time. When investigating the impact of traumatic distress on posttraumatic growth it is important to acknowledge that both of these psychological reactions may not be active at the same point in time.

Personality factors

A number of personality factors that all seem to be related to an ability to commit and persevere in the face of adversity have been found to predict growth in veterans. These include self-controllability (Dekel, Mandl, & Solomon, 2011), effort/perseverance (Pietrzak et al. 2010), "hardiness" (Waysman, Schwarzwald, & Solomon, 2001), and optimism (Feder et al., 2008). However, one common issue with this research is that personality was not assessed prior to the traumatic event, and the predictors themselves therefore also might be outcomes. To the best of our knowledge, only two studies on war-related growth have measured pre-trauma personality characteristics of the participants (Elder & Clipp, 1989; Schnurr et al., 1993). These studies demonstrated that pre-war personality characteristics may interact with the level of combat exposure to create post-war growth. However, the measures used to determine growth were isolated questions generated for the purpose of the studies, and not standardized scales with well-established psychometric properties. Finally, the personality measures used did not test Tedeschi and Calhoun's (2004) prediction regarding extraversion and openness to experience.

Social support

Social support has been shown to both predict growth in combat veterans (Maguen et al., 2006) and to have no effect (Dekel et al. 2011). Although a measure of social support during deployment called "unit member support" predicted growth in one study (Pietrzak et al., 2010), this finding was not replicated in another study (Kaler et al., 2011). It is therefore not entirely clear whether social support is important in relation to posttraumatic growth in veterans. One issue with the research cited could be that social support is measured retrospectively and could therefore be influenced by the responder's current life situation. A measure of current support *during* deployment might be a more valid indication of the amount of support received under the stressful circumstances.

The role of memory

As mentioned, a central prediction in Tedeschi and Calhoun's (2004) model is that memory for the traumatic event is integral in promoting positive change. More specifically, the way the traumatic event is integrated into the trauma survivor's personal life story is important. It is well-known that memory also plays an important role in the development and maintenance of PTSD (e.g, Berntsen & Rubin, 2006; Brewin & Holmes, 2003; Dalgleish,

2004; Ehlers & Clark, 2000; McNally, 2003; Rubin, Berntsen, & Bohni, 2008), but only a few studies have examined effects of memory on war-related growth. Elder and Clipp (1989) asked a group of Korean War veterans to write memories of wartime experiences and found that positive and negative memories about combat did not have an effect on post-war adjustment. They explained the lack of an effect as the result of the voluntary nature of the memories, making them less distressing than involuntary "reliving episodes" (p. 337). Aldwin et al. (1994) found that combat veterans were much more likely to report positive than negative memories of military experiences. It is unclear whether these memories were trauma-related, and there was no indication of their relationship with growth (rather, they were considered an aspect of growth in this study). However, it is also possible that avoidance strategies or stoicism could lead to underreporting of negative events, meaning that direct comparison of frequencies of positive and negative memories might be biased.

Going outside war-related growth, we identified two studies that directly investigated the effect of memory on posttraumatic growth. One was the study by Groleau et al. (2013) reviewed above. The other was a study by Schuettler and Boals (2011), who examined a variety of possible predictors in two samples of university students. In one sample, they used the Autobiographical Memory Questionnaire (AMQ; Rubin, Feldman, & Beckham, 2003), which measures a broad range of characteristics of autobiographical memories, such as reliving, sensory details, talking and thinking about the event, and emotional aspects. Comparing the predictive value of the AMQ in relation to growth and PTSD symptoms, Schuettler and Boals (2011) found that while some items on the AMQ predicted PTSD, none of them predicted growth. However, the CES significantly predicted growth. Like the study by Groleau et al. (2013), the study by Schuettler and Boals (2011) was also correlational, which means that it is not possible to make claims about causality based on their findings.

In summary, many aspects of Tedeschi and Calhoun's model of posttraumatic growth in relation to combat experiences warrant further examination. The relationship between PTSD, personality factors, and social support is inconsistent and the influence of positive and negative memories of deployment has received only minimal attention, with positive memories being largely ignored.

The present study

The present study examined posttraumatic growth in a team of Danish soldiers two to four months after their return from deployment in Afghanistan. Growth was predicted by

measures obtained before deployment, during deployment and concurrently with the dependent variable. We included predictors described in the literature review. Of particular interest was whether the centrality of both negative and positive events from the time of deployment predicted growth after deployment.

Following Tedeschi and Calhoun's (2004) model, we investigated the relationship between posttraumatic growth and pre-deployment personality traits, social support during deployment, trauma exposure, traumatic distress, and the centrality of both negative and positive memories of the deployment. Specifically, we hypothesized that post-deployment posttraumatic growth is predicted by: 1) Extraversion and openness to experience measured before deployment; 2) the self-reported exposure to combat during deployment; 3) self-reported symptoms of posttraumatic stress during deployment; 4) social support measured during deployment; and 5) the centrality of emotionally intense deployment events to the veterans' own life stories and identity also measured during deployment. We did not have specific predictions regarding the valence of the emotionally intense events, but it is possible that viewing both positive and negative events as central and important increases the chance of positive outcomes. We therefore conducted our analyses for both a self-nominated negative and positive event from the time of the deployment.

Finally, since all questionnaires in this study were administered both before and concurrently with our measure of posttraumatic growth, we were able to compare a purely prospective design with a cross sectional design to examine whether the predictors from different assessment times would show different effects. To this end, we conducted the same regression analyses with all predictor variables derived from the same post-deployment measurement time as the measure of posttraumatic growth.

Method

A total of 251 veterans (7 % female, mean age 26.4, range 18-55) belonging to the Danish Contingent of the International Security Assistance Force 7 (ISAF 7) in Afghanistan filled out the Post Traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) 2 to 4 months after return from deployment. The veterans were part of a larger team of 746 Danish soldiers involved in a survey of health and risk factors related to PTSD. The soldiers were deployed for six months in Afghanistan in 2009 and completed the questionnaires five times: before deployment (before), during deployment (during), 1 to 3 weeks after return from

deployment, 2 to 4 months after return (+3 months) and 7 to 8 months after return. A previous study by Berntsen et al., (2012) investigated the trajectories of PTSD symptoms in this larger team.

In the present study, we analysed only those veterans who had filled out the PTGI, which was answered 2 to 4 months after return (see Table 1, for an overview). Furthermore, we limited our analyses to those veterans, who had also filled out a version of the NEO-Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1989) before deployment and the Centrality of Events Scale during deployment. Finally, the veterans filled out measures that were excluded from the present analyses (see Berntsen et al., 2012), since we had no hypotheses for them. For example, we did not include a measure of PTSD symptomatology prior to deployment, since our predictions focus on PTSD symptoms during and after deployment events, following the conception of Post Traumatic Growth. Missing data left us with different sample sizes for the prospective and cross-sectional analyses, and for the CES as answered for a positive versus a negative event in the prospective and cross sectional analyses. Thus, a total of four regression analyses were conducted: Prospective with negative CES (N = 152), prospective with positive CES (N = 133), cross sectional with negative CES (N = 195) and cross sectional with positive CES (N = 186). Figure 1 provides an overview of the four subsamples. Since the drop out in some analyses was substantial, we compared the analysis sample with the drop outs on all included measures (see Table 1). There was only one significant difference at the $p < .05$ level between these groups: completers reported higher openness to experience after returning home compared with drop outs (completers: M = 37.31, SD = 5.20; drop outs: M = 35.80, SD = 5.11; $F(1,241) = 4.84$, $p = .029$).
[Figure 1 about here]

Procedure and materials

Data for the pre-deployment measures were collected 5 to 6 weeks before deployment during group sessions at a military camp in Denmark. Military psychologists instructed and informed the soldiers about the study including the fact that there would be subsequent data collections during and after deployment. The soldiers were informed that their responses were confidential and anonymous, would not be accessed by their leaders in the military, and would be used for research purposes only. During the deployment, data were collected in Afghanistan. All respondents had been deployed between two and five months, when they answered this second set of questionnaires. The questionnaires were handed out by military

personnel at Camp Bastion, Kabul International Airport, or Kandahar Airfield before the soldier went home on leave. The soldiers submitted their answers in closed envelopes in secured (locked) mail boxes. The locked mail boxes were then transported to the research team in Denmark. Finally, data for the final assessment in the present study were collected at different military camps in Denmark, or through mail for those who had returned to civilian life, roughly 2 to 4 months after return from deployment. All respondents contacted by mail received two cinema tickets for their participation.

In order to track the soldiers across the three sets of data collections (Before, During, and +3 Months), they entered their Central Population Register (CPR) number on the front page of the questionnaires. At each data collection they were informed that this page would be separated from their responses, not entered in the database, not stored together with their responses, and that their responses would be accessed only by the research team (who did not have access to the CPR numbers). Anonymity was ensured by converting each CPR number to an ID code. This meant that researchers would not be able to identify individual responses during data handling and analysis, while it would still be possible to link responses given at different time points to an individual respondent.

Means, standard deviations, analyses of internal consistencies (Cronbach's alpha) and assessment time for all measures can be seen in Table 1. For each of our hypotheses, we included the following measures: 1) *Extraversion and openness to experience* were measured using the NEO-FFI. The NEO-FFI is a short version of the Revised NEO Personality Inventory (Costa & McCrae, 2008) consisting of 60 items divided into five domains of personality: Extraversion, Conscientiousness, Agreeableness, Openness to Experience, and Neuroticism. Each item is scored on a 5-point Likert scale ranging from 0 = "Strongly disagree" to 4 = "Strongly agree". In the present study, soldiers completed the NEO-FFI before and 2 to 4 months after deployment. 2) *The self-reported exposure to combat* was measured with the Combat Exposure Scale (Keane et al., 1989). The scale measures different aspects of combat such as firing at the enemy or being fired upon, or seeing others getting shot. The seven items are scored on 5-point scales. Soldiers completed the scale during deployment, 1 to 3 weeks after deployment, and 2 to 4 months after deployment. 3) *Self-reported symptoms of posttraumatic stress* were measured with the Posttraumatic Checklist-Civilian version (PCL; Blanchard, Jones-Alezander, Buckley, & Forneris, 1996). This 17-item scale measures different reactions to traumatic experiences based on DSM-IV (American Psychiatric Association, 1994) criteria, and answers are given on 5-point Likert

scales ranging from 1 = "Not at all" to 5 = "Extremely". Soldiers completed the scale at all measurement points. We opted to use the civilian version since some soldiers would complete the scale before experiencing any combat. 4) *Social support* was measured with the Perceived Social Support Scale (Blumenthal et al., 1987). The scale consists of 12 items belonging to three different domains of support: Family, friends, and significant others. Each item is scored on a 7-point Likert scale from 1 = "Very strongly disagree" to 7 = "Very strongly agree". Soldiers completed the scale at all measurement points. 5) *The centrality of deployment events to the veterans' life stories and identity* was measured with the short 7-item version of the CES. The CES measures the extent to which a person considers an event to be important and central to his/her life story and identity. Items are scored on a 5-point Likert scale from 1 = "Totally disagree" to 5 = "Totally agree". Soldiers completed the CES during and 2 to 4 months after deployment in response to the most negative and the most positive deployment event. An example of a most negative deployment memory read: "Witnessing two improvised explosive devices with 4 wounded. Lots of blood, wreckage, metal pieces. Feeling helpless, because I could not help, since I'm not trained as a medic. There was plenty of help, but I would have liked to treat as well. Instead, I helped secure the area a few meters away." One example of a most positive deployment memory read: "Visiting ARM for an extended period of time and being accepted by one of the platoons there to the extent where I felt that I was 'one of them'."

Finally, the PTGI was used as the dependent variable in our analyses. As mentioned in the Introduction, the PTGI measures self-perceived positive changes (such as greater appreciation of life or close others) following a traumatic experience across 21 items. Each item is scored on a 5-point Likert scale from 1 = "I did not experience this change as a result of my crisis" to 5 "I experienced this change to a very great degree as a result of my crisis". Veterans were instructed to "think about the stressful events you experienced during your participation in the ISAF 7 mission in Afghanistan" and then rate each item in relation to these stressful events.

Data preparation and analysis

Missing responses in the dataset were replaced using the expectation maximization algorithm in SPSS when less than 20 % of a questionnaire's items were randomly missing. If more than 20 % were randomly missing, the measure was excluded for that respondent. Data points not missing at random were not replaced. We conducted four separate hierarchical

linear regression analyses. The PTGI measured 2 to 4 months after deployment was the outcome variable in all four analyses. One analysis included the prospective predictors measured before or during deployment including the centrality of the most *positive* deployment event, measured during deployment. The second analysis included the prospective predictors including the centrality of the most *negative* deployment event measured during deployment. The third and fourth analyses included the concurrent predictors and centrality of the most positive and most negative deployment event respectively.

In the prospective analyses, all measures of personality factors were obtained before deployment, whereas measures of posttraumatic stress, combat exposure, social support and event centrality all were obtained during deployment in accordance with our hypotheses. Finally, the dependent measure was obtained 2-4 months after deployment. The prospective analyses included openness to experience, extraversion, and conscientiousness from the NEO-FFI measured before deployment in the first step. Social support and combat exposure measured during deployment were in the second step. Finally, the CES for either the most negative or the most positive deployment event measured during deployment was in the third step.

For the two final regression analyses (using a cross sectional design) the predictor variables derived from the same measurement time as our dependent measure of posttraumatic growth, that is 2 to 4 months after deployment. As predictors, we chose those variables that showed a significant correlation with the PTGI while also having at least a small effect size according to convention (r = .10, Cohen, 1992; see Table 1). The reliance on both effect size and significance level to select predictors was used in order to reduce the risk of type-1 error as a result of multiple comparisons.

[Table 1 about here]

In the cross sectional analyses, all measures were obtained 2 to 4 months after deployment and therefore at the same time as the dependent measure of posttraumatic growth. The cross sectional analyses included Openness to Experience and Extraversion in the first step. Social support, combat exposure, and the PCL were in the second step. The CES for the most positive or the most negative deployment event was in the third step.

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Results

Many of the measures showed small to medium sized correlations with posttraumatic growth according to effect size conventions (Cohen, 1992; see Table 1). Here, we consider only the correlations that also showed a statistically significant relation. From before deployment, the personality factors extraversion, openness to experience, and conscientiousness correlated with growth. During deployment, combat exposure, social support, and centrality of the most negative and positive event from deployment correlated with growth. After deployment, extraversion, openness to experience, combat exposure, social support, posttraumatic stress symptoms, and centrality of the most negative and most positive deployment event correlated with growth (see Table 1). In the following, we first present the results from the two prospective analyses and then the findings from the cross sectional analyses.

Prospective analyses

The results for the two linear regression analyses predicting posttraumatic growth prospectively can be seen in Tables 2 to 3. The first analysis included centrality of the most negative memory from deployment along with the other predictor variables presented in Table 2. As can be seen in Table 2, personality factors entered in step 1 explained 11 % of the variance in posttraumatic growth, while combat exposure and social support during deployment, entered in step 2, accounted for an additional 5 % of variance. Finally, centrality of the most negative experience from deployment, entered in step 3, explained 3 % of the variance when controlling for the other predictors. The final model included 152 participants and explained 19 % of the variance in posttraumatic growth. In order of importance, the statistically significant predictors were openness to experience (measured before deployment), the centrality of most negative event (measured during deployment), and social support (measured during deployment). Combat exposure measured during deployment formed a trend in the final model (see Table 2).

[Table 2 about here]

In the second prospective analysis, the centrality of the most positive event during deployment was included as a predictor instead of centrality for the most negative event. The final model included 133 participants and explained 23 % of the total variance. Again, centrality of the most positive deployment event accounted for an additional 3 % of the

variance after controlling for the other predictors. In order of importance, the statistically significant predictors were openness to experience (measured before deployment), combat exposure (during deployment), and centrality of the positive event (during deployment). Social support during deployment formed a trend in the final model (see Table 3).
[Table 3 about here]

Cross sectional analyses

The results for the two linear regression analyses predicting posttraumatic growth using measures obtained concurrently with the dependent variable can be seen in Tables 4 and 5. The first analysis included the centrality for most negative event from deployment as a predictor together with other measures obtained concurrently as presented in Table 4. Personality factors accounted for 11 % of the variance in posttraumatic growth, while combat exposure and social support accounted for 7 %. When controlling for the other predictors, centrality of the most negative event explained an additional 7 % of the variance. The final model included 195 participants and explained 25 % of the variance in posttraumatic growth. In order of importance, the statistically significant predictors were the centrality of the negative event, openness to experience, combat exposure, and social support (see Table 4).
[Table 4 about here]

The second analysis included the centrality for most positive memory from deployment as a predictor together with other measures obtained as part of the same data collection as the PTGI. The final model included 186 participants and explained 24 % of the total variance. Centrality of the most positive event accounted for 5 % of the variance after controlling for personality, combat exposure, and social support. In order of importance, the statistically significant predictors were centrality of the positive event, openness to experience, combat exposure, and social support (see Table 5).
[Table 5 about here]

Summary

A consistent pattern of results emerged from both the prospective and cross sectional analyses. Across both strategies of analysis, openness to experience, event centrality and - less consistently - combat exposure and social support predicted posttraumatic growth after deployment. Centrality of positive and negative events explained unique variance in all models.

Discussion

In a prospective longitudinal study of combat veterans, who answered questionnaires before, during, and 2 to 4 months after deployment, we found that the centrality of a highly positive and a highly negative memory from deployment, combat exposure, social support, and openness to experience were predictive of posttraumatic growth. We conducted two prospective analyses and two cross sectional analyses, which showed the same overall pattern of findings with a few minor exceptions. This overlap supports the robustness of our models. The regression analyses supported three of our initial predictions with partial support for the fourth one and no support for a fifth prediction. Each hypothesis will be discussed in relation to the findings below.

First, we found only partial evidence that the personality characteristics extraversion and openness to experience predicted growth. Although both characteristics were significantly correlated with growth, only openness to experience predicted growth in our models. Openness to experience is associated with curiosity, creativity, and emotional responsiveness (McCrae, 1987). As suggested by Zoellner and Maercker (2006), openness may be important in terms of cognitively managing the uncertainty and change that can accompany traumatic experiences. Another explanation for the relationship is Tedeschi and Calhoun's (2004) hypothesis that openness to emotional experiences in particular allows the individual to appreciate positive emotions in the aftermath of trauma. The finding that growth was predicted by the centrality of both a highly negative and a highly positive memory from deployment supports this latter hypothesis. In addition, we think it is possible that openness could facilitate the integration of emotional experiences – both positive and negative – into a person's life story. For example, if a person is particularly curious and open to emotional experiences, he or she might also reflect more on such experiences and possibly rehearse them more (e.g., Rasmussen & Berntsen, 2010). This in turn could promote their integration into the life story. Extraversion did not predict growth in any of our models, but it is also usually associated with low neuroticism and higher subjective well-being (DeNeve, 1999). This could suggest that high extraversion actually is a predictor of resilience, and a recent study has shown that resilience has an inverse relationship with posttraumatic growth (Levine et al., 2009).

Second, we found evidence that the intensity of the traumatic experience measured in terms of combat exposure predicted growth in three out of four analyses while it was a

statistical trend in the fourth (see Table 2). That combat exposure plays a role in posttraumatic growth is not surprising given that it is the cornerstone of Tedeschi and Calhoun's theory (e.g. 1996; 2004) that an event must be sufficiently traumatic to "shatter" a person's basic assumptions about the world or himself in order to lead to growth. The combat experience of the present group of veterans was representative of large-scale war in general. The 245 participants, who completed the combat exposure scale following their return from deployment, reported a mean of 12.5 (SD = 10.4) on the Combat Exposure Scale corresponding to a light to moderate intensity of exposure according to the cut-offs proposed by Spiro, Schnurr, and Aldwin (1994). This score places them slightly higher than Korean War veterans (M = 10.8, SD = 8.9; Spiro et al., 1994), and lower than World War II veterans (M = 15.0, SD = 10.2; Spiro et al., 1994) and Vietnam War veterans (M = 19.5, SD = 12.0; Fontana & Rosenheck, 1998) with standard deviations in the same range.

Third, symptoms of PTSD did not predict growth, which adds to the inconsistency in the literature surrounding this relationship (e.g. Gallaway et al., 2011). In a review of the relationship between PTSD and growth in civilian survivors of trauma, Zoellner and Marcker (2006) did not find an association in most cross sectional studies, and concluded that the literature reveals a "rather irritating and inconclusive picture" (p. 635). One possible explanation for this inconsistency has recently received a lot of attention. This hypothesis states that the relationship between growth and distress conforms to an inverted U-shaped distribution, where intermediate levels of PTSD symptoms are correlated with higher growth, while both more and less severe PTSD would not show this relationship (or possibly a negative one). There is some recent empirical support for this hypothesis (Levine, Laufer, Hamama-Raz, Stein, & Solomon, 2008; McCaslin et al. 2009; Moore, Varra, Michael, & Simpson, 2010; Solomon & Dekel, 2007).

Fourth, social support correlated positively with growth both during and after deployment. It was also a significant predictor in the cross sectional regression analyses, but was only significant in one of the prospective analyses and formed a statistical trend in the other. Indeed, previous findings with combat veterans have been inconsistent (Maguen et al., 2006; Dekel et al., 2011), which may be due to a relatively small contribution of social support in relation to growth. While sharing both positive and negative experiences with others does appear to promote growth, the other predictors in the analyses show stronger and more reliable effects. Following Tedeschi and Calhoun's (2004) model, social support may be important for growth only if it actually leads to a greater integration of the emotionally

intense events. Similarly, rehearsing the traumatic event in one's own mind is related to growth only when the rehearsal is deliberate rather than intrusive (Cann et al., 2011). For example, some soldiers may have experienced strong social support from significant others or family at home during deployment, but may not have shared all their negative experiences with them until after they returned.

Fifth, we found that the centrality of both positive and negative memories from deployment predicted growth. This is a novel finding with potential theoretical implications. It suggests that it may not be only the nature of the event itself (i.e. that it is traumatic) that promotes growth, but rather growth might be related to a psychological propensity to assign centrality to highly emotional events regardless of their valence. This could lead to an emotionally balanced, realistic view of the period of deployment with both good and bad memories being considered important in the aftermath. While not in opposition to prevalent theories of posttraumatic growth (e.g. Tedeschi & Calhoun, 2004) this finding does offer a new route to growth. We propose here that both traumatic and positive events are equally important in promoting growth. A central mechanism in translating these experiences into positive outcomes is the centrality assigned to the events.

Conclusion

A number of limitations should be taken into account when evaluating the present findings. There was quite a high number of missing items in the dataset, which meant that only the responses of 195-133 soldiers out of 251 were available for the regression analyses. While there can be many reasons for drop out, some of the important ones were the amount of questionnaires handed out to soldiers, the longitudinal nature of the study, as well as the fact that many of the soldiers were no longer in the military during the latest follow-up. However, drop out analyses indicated that there was only one significant difference between completers and drop outs on openness to experience with completers scoring slightly higher on this measure after returning home compared with drop outs. This difference might have affected the correlation between openness to experience and posttraumatic growth compared with what would have been found in a more complete sample of veterans. However, this potential problem was present only for the cross sectional analyses – in the prospective analyses there were no differences between completers and drop outs on scores on openness. Since the results from the two types of analyses were largely the same, the attrition is

unlikely to have affected the findings. Another important limitation is the relatively low correlations between the different predictors and the PTGI, which also meant that the regression models explained less than a third of the total variance. This means that there still is a lot of unexplained variance and even with our range of theoretically driven measures we may have missed some important predictors yet to be uncovered. Furthermore, the inclusion of other potentially more powerful predictor variables might reduce or even obviate some of the present effects. Finally, in order to be able to be able to compare pre-deployment measures of PTSD symptoms with measures obtained during and after deployment (Berntsen et al., 2012) the instructions for the PCL did not specify that the symptoms reported should refer to a deployment event, and therefore PTSD symptoms in any individual soldier might have referred to earlier experiences. This limitation was partly mitigated by the inclusion of the Combat Exposure Scale, documenting that the soldiers as a group did experience combat comparable to major wars.

In conclusion, we found that the perceived centrality of both positive and negative events from deployment predicted posttraumatic growth in combat veterans alongside openness to experience, social support, and combat exposure. We propose that highly positive memories are as important as highly negative memories in facilitating growth and that it is the balanced integration of such memories that ultimately may lead to growth. If this understanding is correct, it may have practical implications for the promotion of growth in veterans and possibly also in other populations faced with stressful conditions.

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