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Centrality of Traumatic Events: Double Edged Sword or Matter of Valence?

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Abstract
Event centrality, as measured by the Centrality of Event Scale (CES), refers to the degree to which a salient traumatic memory becomes central to individual identity. The current investigation modified the CES to capture valence (positive vs. negative) of event centrality (i.e., CES-V) and determine whether the valence of event centrality for traumatic events differentially relates to trauma responses (i.e., posttraumatic stress disorder [PTSD], posttraumatic growth [PTG]). Trauma-exposed community members ($n = 512$) completed measures of trauma experiences, PTSD, PTG, and the CES-V. Exploratory factor analysis supported the use of the CES-V. Trauma outcome response profiles were compared between event centrality valence group (i.e., central-positive, not central, central-negative) and factors influencing event centrality valence were explored. Most participants appraised their trauma as central and positive (54.7%), while others appraised their trauma as central and negative (32.8%) or not central (12.5%). Central-positive event centrality ratings were positively related to PTG and inversely related to PTSD, whereas central-negative event centrality ratings were positively related to PTSD and inversely related to PTG. The central-positive group reported the most PTG, and the central-negative group reported the most PTSD. Future research should explore the clinical utility of using event centrality valence to predict trauma responses and track treatment progress.

Keywords Event centrality · Event centrality valence · Posttraumatic stress disorder · Posttraumatic growth · Post-trauma outcomes

Introduction

Most people will experience a potentially traumatic event during their lifetime, with estimates ranging as high as 76% in Canadian populations (Van Ameringen et al. 2008) and 90% in American populations (Breslau 2002). Some individuals experience minimal lasting mental health consequences as a result of their trauma exposure, while others can experience mood disorders, anxiety disorders, substance use disorders, or trauma-specific mental disorders, including acute stress disorder and posttraumatic stress disorder (PTSD;

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American Psychiatric Association [APA] 2013; Substance Abuse and Mental Health Services Administration 2014). A subset of trauma-exposed individuals also report experiencing positive changes due to their trauma exposure, a phenomenon called posttraumatic growth (PTG; Tedeschi and Calhoun 1996). Given the wide range of possible post-trauma responses, researchers have become interested in what factors influence a person to develop PTSD and PTG.

The salience of a trauma memory may have a critical influence on post-trauma responses. Salient autobiographic memories—referring to individually-identified vivid and noteworthy memories—serve as *anchor events* in cognition, or reference points for interpreting new information and events and generating expectations for the future (Berntsen and Rubin 2006; Berntsen et al. 2011). Memories of positive life events (including key life transitions as determined by culturally-shared life scripts, such as graduation, marriage, birth of children, etc.) are typically more frequent and more easily accessible in autobiographical memory than negative life events (e.g., getting fired; Berntsen and Rubin

2006; Berntsen et al. 2011). Salient positive memories often become anchor events that create thematic meaning and temporal structure in our lives (Berntsen and Rubin 2006; Berntsen et al. 2011); however, traumatic memories (i.e., memories of life-threatening events as outlined in diagnostic criteria for PTSD; APA 2013) can become more salient than positive autobiographical memories (Rubin et al. 2004). Event centrality (Berntsen and Rubin 2006) refers to when a salient traumatic memory becomes central to individual identity, or becomes a key reference point for understanding oneself and other life experiences.

Event centrality for traumatic events has evidenced a robust relationship with post-trauma outcomes. Event centrality positively relates to PTSD symptoms while controlling for various factors, including symptoms of depression, anxiety, dissociation, self-consciousness, self-esteem, memory properties, trauma properties, cognitive processing styles, extent of disruption to core beliefs, post-trauma cognitions, different types of rumination, coping styles, perspectives on addressing trauma symptoms, personality traits, violence exposure, demographic risk, and relationship attachment to lost loved ones in diverse samples, such as undergraduate students (Berntsen and Rubin 2007; Boals 2010; Boals and Schuettler 2011; Groleau et al. 2013; Schuettler and Boals 2011), women reporting a history of childhood sexual abuse (Robinaugh and McNally 2011), combat veterans (Brown et al. 2010), treatment-seeking samples (Barton et al. 2013), elder samples (Berntsen et al. 2011), and individuals frequently exposed to violence (i.e., teachers in El Salvador; Roland et al. 2014). Event centrality related to the loss of a loved one has prospectively predicted prolonged grief, depression severity, and bereavement-related PTSD symptoms one year later (Boelen 2012). Event centrality has also been positively associated with PTG while controlling for depression, trauma properties and exposure, cognitive processing styles, extent of disruption to core beliefs, post-trauma cognitions, different types of rumination, coping styles, and perspectives on addressing trauma symptoms in undergraduate (Barton et al. 2013; Bernard et al. 2015; Boals and Schuettler 2011; Groleau et al. 2013; Lancaster et al. 2013; Schuettler and Boals 2011) and community samples (Roland et al. 2014). Accordingly, event centrality appears important for both positive and negative post-trauma experiences (e.g., Boals and Schuettler 2011; Groleau et al. 2013).

Some researchers (e.g., Berntsen et al. 2011; Boals 2010) have investigated the possibility of what they termed *positive* event centrality, or the extent to which a positive life experience becomes central to one's identity, rather than a traumatic event as detailed in the original definition (Berntsen and Rubin 2006). Event centrality of positive life events appears positively related to adaptive psychological functioning (including PTG following other traumatic events in an individual's life) and unrelated to maladaptive psychological functioning (i.e., PTSD, depression, anxiety symptoms; Bernard et al. 2015; Berntsen et al. 2011; Boals 2010). A positive relationship between event centrality of positive life experiences and resilience led Bernard et al. (2015) to conclude that identifying a positive event as central to one's identity may be adaptive and a possible area for clinical intervention (i.e., through identification of central positive experiences and their meaning to use as coping strategies). Alternatively, understanding the valence of event centrality (i.e., positive vs. negative) with which individuals identify traumatic life events may further inform post-trauma experiences and guide clinical intervention. Theoretical models of PTSD (e.g., Ehlers and Clark 2000; Foa and McLean 2016) detail the role of trauma appraisals in the development and maintenance of the disorder, which may implicate event centrality in psychopathology. Similarly, how an individual reflects on a trauma may also contribute to PTG. If an individual can reflect on a trauma as a stimulus for positive change, despite the experience being negative, the cognitive reframing may allow for PTG.

Some researchers refer to event centrality as "a double-edged sword" (e.g., Boals and Schuettler 2011, p. 817; Groleau et al. 2013, p. 482), because evidence to date indicates event centrality for traumatic events correlates positively with both PTSD and PTG (Barton et al. 2013; Boals and Schuettler 2011; Groleau et al. 2013; Roland et al. 2014). Conversely, other factors known to contribute to both PTSD and PTG often share inverse relationships (e.g., post-trauma cognitions, negative affect, certain coping styles, social support; Schuettler and Boals 2011). Groleau et al. (2013) recommended future researchers explore whether the valence of centrality appraisals for traumatic events differentially predicts post-trauma responses—that is, how perceptions of a traumatic event as a positive or negative turning point in life (i.e., central-positive vs. central-negative event) may contribute to subsequent growth or distress. The Centrality of Events Scale (CES; Berntsen and Rubin 2006) is the only measure developed to assess how central an event is to an individual's identity and understanding of other life events, but does not assess whether a traumatic event is viewed as centrally positive or centrally negative. As such, the current investigation was designed to develop a self-report measure of event centrality valence to determine the influence of event centrality valance on post-trauma responses.

Development of a self-report measure that captures the valence of event centrality would permit exploration of whether the valence of event centrality influences post-trauma responses and what factors influence event centrality valence. If event centrality valence is related to post-trauma outcomes, a self-report measure of event centrality valence might also prove helpful in screening for maladaptive trauma responses and serve as a measure of progress

in trauma treatment. For example, trauma type may influence perceptions of negative or positive event centrality, which may in turn help explain the demonstrated influence of trauma type on the severity of PTSD symptoms and the extent of PTG (e.g., Kılıç et al. 2016; Lancaster et al. 2014). Identifying traumas that consistently contribute to negative event centrality could help identify individuals who might benefit from preventative intervention. Time since trauma may also influence the valence of event centrality, based on related PTG theories indicating that growth first requires distress and then takes time (e.g., Joseph et al. 2012). Similarly, an individual might be unlikely to reflect on a trauma as centrally positive to their identity in the immediate aftermath of a trauma, but may grow to over time through cognitive processing. A measure of event centrality valence could track this change in clinical practice.

The overall goal of the current investigation was to explore the influence on event centrality valence on post-trauma outcomes by (a) developing a modified version of the CES to measure the valance of centrality appraisals for traumatic events; (b) assessing whether the valence of centrality appraisals (central-positive vs. central-negative) differentially relates to symptoms of PTSD and PTG; (c) comparing PTSD symptom and PTG profiles between those appraising an index trauma as centrally positive, not central, or centrally negative; and (d) exploring the influence of trauma type and time since trauma on the valence of centrality appraisals. Consistent with theoretical models of trauma outcomes (e.g., Ehlers and Clark 2000; Foa and McLean 2016; Joseph et al. 2012), construing a traumatic event as centrally positive was expected to be positively correlated with PTG and negatively correlated with PTSD. Conversely, perceiving a traumatic event as centrally negative was expected to be inversely correlated with PTG and positively correlated with PTSD. No other specific hypotheses were made given the exploratory nature of the study.

Method

Procedure

The current study was approved by the University of Regina Research Ethics Board. Participants were recruited as part of a larger data collection project on PTSD through Qualtrics Online Survey Software (Provo, UT). Qualtrics provides online notifications of opportunities to participate in survey-based research to previously registered users who match study eligibility criteria gathered from expressed interests and demographic information in system profiles. Participants were not able to participate in the current study if they did not meet study criteria and Internet protocol (IP) addresses were tracked to prevent repeat responses. Participants were

required to be at least 18 years of age and had to have experienced at least one traumatic event in their lifetime (see Measures section) for the current study. If eligible, participants completed self-report measures of trauma exposure, post-trauma outcomes, and a modified CES. Participants were compensated with points worth an approximate value of $1.50 for their participation; points accumulated through participation are redeemable for gift cards through Qualtrics.

Participants

A total of 512 community members (52.1% men; Mage = 48.01, SD = 11.76) from across the United States of America completed all the self-report measures. All participants reported experiencing at least one traumatic event in their life time, but 33 (6.4%) did not identify one experience as an index trauma (i.e., the worst trauma experienced if reporting multiple traumas). Of the 479 that specified an index trauma, four participants (0.8%) reported events (i.e., illness/injury) that did not qualify as traumatic events according to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5; APA 2013) PTSD Criterion A. The average time since experiencing the index trauma was 14.37 years (SD = 13.50), with a range between less than 6 months prior and 55 years prior. The type and frequency of index traumas experienced by the current sample, as well as descriptive statistics for post-trauma outcome measures, are presented in Table 1. Most participants had completed a 2- or 4-year degree program (38.7%), or had completed a partial college education (24.4%). The remaining participants had graduated high school (22.3%), had completed graduate or professional-level education (9.0%), had completed a partial graduate or professional-level education (3.1%), or had not completed a high school degree (2.5%). Most participants were employed full-time (41.4%) or part-time (13.3%), and the rest were retired (12.7%), homemakers (10.7%), on disability (10.4%), unemployed (8.2%), or students (3.1%). Participants identified as predominantly White (80.7%). Other self-reported ethnicities included Black (9.0%), Hispanic (4.9%), First Nations (1.0%), Asian (2.5%), and South Asian (0.6%). The majority of participants were married or cohabitating (56.6%). Other participants were either single (23.6%), separated or divorced (16.0%), or widowed (2.9%).

Self-Report Measures

PTSD Checklist for DSM-5 (PCL-5)

The 20 items of the PCL-5 (Weathers et al. 2013b) measure PTSD symptoms according to the DSM-5 (APA 2013) symptom clusters (i.e., intrusions, avoidance, negative alterations in cognitions and mood, and alterations in

Table 1 Index traumas identified by participants and descriptive statistics for post-trauma outcome measures

Index trauma type	n	%
1. Natural disaster	44	8.6
2. Fire/explosion	23	4.5
3. Transportation accident	75	14.6
4. Work, home, or recreational accident	18	3.5
5. Toxic substance exposure	2	0.4
6. Physical assault	36	7.0
7. Assault with a weapon	17	3.3
8. Sexual assault	38	7.4
9. Other unwanted sexual experience	16	3.1
10. Combat or war exposure	6	1.2
11. Captivity	4	0.8
12. Illness or injury	80	15.6
13. Severe human suffering	20	3.9
14. Sudden accidental death	45	8.8
15. Sudden violent death	26	5.1
16. Injury, harm, or death you caused	5	1.0
17. Other	24	4.7
18. Experienced a traumatic event in lifetime, but did not specify type of index trauma	33	6.4
Post-trauma outcomes	M	SD
PTSD Checklist for DSM-5	20.13	18.38
Posttraumatic Growth Inventory	46.91	28.64

N = 512

arousal and reactivity). The Life Events Checklist for DSM-5 (Weathers et al. 2013a) was administered with the PCL-5 to help respondents first identify all Criterion A traumas they ever experienced and whether respondents experienced the events directly, witnessed the events, learned about such events happening to close family members or friends, or were repeatedly exposed to the events through their work (consistent with DSM-5 criteria). Preliminary questions on the PCL-5 helped respondents identify an index trauma to refer to when indicating how much symptoms from the experience bothered them in the past month. PCL-5 items are rated on a 5-point Likert scale ranging from 0 (*Not at all*) to 4 (*Extremely*). Additional follow-up questions required respondents to estimate how long ago the index trauma happened, to identify whether the event involved actual or threatened death, serious injury, or sexual violence, and to indicate if the event was accidental, violent, due to natural causes, or none of these options when death was involved. These additional questions were included to further establish the extent to which individual experiences would meet Criterion A in the DSM-5 PTSD diagnostic criteria. PCL-5 scores range from 0 to 80 and a total symptom severity score greater than 32 is often indicative of a diagnosis of PTSD (Weathers et al. 2013b). Psychometric analyses of the PCL-5 have demonstrated excellent reliability (Cronbach's $\alpha = 0.92$–0.95; Demirchyan et al. 2014; Liu et al. 2014; Pietrzak et al. 2015). The internal consistency in the current sample was excellent (Cronbach's $\alpha = 0.96$).

Posttraumatic Growth Inventory (PTGI)

The 21 items of the PTGI (Tedeschi and Calhoun 1996) measure positive life changes following a traumatic event. A total score represents changes across five domains (i.e., new possibilities, personal strength, relating to others, appreciation of life, and spiritual change). Items are rated in response to a trauma on a 6-point Likert scale ranging from 0 (*I did not experience this change as a result of the event*) to 5 (*I experienced this change to a very great degree as a result of the event*). Respondents in the current study were instructed to respond to the PTGI while referencing the index trauma they had previously identified to respond to the PCL-5 with. PTGI scores range from 0 to 105, with higher scores indicating more growth (no cut-off score has been established to signify clinically significant PTG). The PTGI has demonstrated good internal consistency and test–retest reliability (Tedeschi and Calhoun 1996). The internal consistency in the current sample was excellent (Cronbach's $\alpha = 0.97$).

Centrality of Event Scale—Valence Version (CES-V)

The items of the original CES (Berntsen and Rubin 2006) measure the extent to which a traumatic experience becomes viewed as a turning point in one's life story and how central it becomes to personal identity and making everyday conclusions. Items are typically rated on a 5-point Likert scale ranging from 1 (*Totally disagree*) to 5 (*Totally agree*) in response to an index trauma. The long (20 items) and short (7 items) versions of the CES have both demonstrated a unitary factor structure and good internal consistency (e.g., Berntsen and Rubin 2006). In order to assess the valence with which individuals encoded traumatic events as central to their identity and life story, the scale of the CES was modified to include a bivalent Likert scale that captured valence (CES-V). Item response options were as follows: − 4 (*Totally agree, for the worse*), − 3 (*Agree, for the worse*), − 2 (*Agree somewhat, for the worse*), − 1 (*Agree a little, for the worse*), 0 (*Disagree or Don't know*), + 1 (*Agree a little, for the better*), + 2 (*Agree somewhat, for the better*), + 3 (*Agree, for the better*), + 4 (*Totally agree, for the better*). Modifying the scale allowed for respondents to identify a traumatic event as centrally negative, not central, or centrally positive to their identity. Participants were instructed to respond to the items in reference to their previously identified index trauma. All 20 of the original CES items were administered in the current sample. Total scores for both the 20-item and 7-item versions were calculated by summing the respective items. The internal consistency in the current sample was excellent for both the long (20-item) CES-V (Cronbach's $\alpha = 0.96$) and the short (7-item) CES-V (Cronbach's $\alpha = 0.92$).

Statistical Analyses

Scale descriptive statistics, reliability analyses, and exploratory factor analyses following guidelines by Costello and Osborne (2005) and Field (2013) were conducted to assess the psychometric properties of the CES-V and the suitability of using the modified bivalent Likert scale. Simple linear regression analyses were used to determine whether valence of event centrality (i.e., CES-V) differentially predicted measures of PTSD (i.e., PCL-5) and PTG (i.e., PTGI). Profile analyses were conducted following the recommendations of Tabachnick and Fidell (2013) to compare subscale response patterns on measures of PTSD and PTG between those appraising their index trauma as centrally positive, not central, or centrally negative. All subscales of both the PCL-5 (i.e., intrusions, avoidance, negative alterations in cognitions and mood, alterations in arousal and reactivity) and the PTGI (i.e., new possibilities, personal strength, relating to others, appreciation of life, spiritual change) were transformed into z-scores to conduct the profile analyses. Profile analysis includes three tests, namely the tests of

levels (i.e., test of main effect for group differences), flatness (i.e., test of within-subjects differences between subscales), and parallelism (i.e., test of group by within-subjects interaction). Significant differences were further analyzed with post-hoc analyses in the form of a one-way analysis of variance (ANOVA) and Tukey's honestly significant differences (HSD) tests. One-way ANOVAs were conducted to determine whether valence of event centrality (i.e., the CES-V) differed based on type of index trauma, and Pearson correlations were conducted to determine if time since trauma was related to valence of event centrality. Bootstrapping using 1000 samples was used to provide confidence intervals for all relevant analyses and to address non-normality for significance testing (i.e., skew values > 2, kurtosis values > 7; Field 2013).

Results

CES-V Scale Statistics and Exploratory Factor Analyses

The overall scale mean for the CES-V was positive with a large standard deviation (20-item CES-V: $M = 9.12$, $SD = 33.04$, 95% CI [6.25, 11.98]; 7-item CES-V: $M = 2.21$, $SD = 12.88$, 95% CI [1.09, 3.33]). Of the total sample, 280 participants (54.7%) had a positive score, 168 participants (32.8%) had a negative score, and 64 participants (12.5%) had a score of 0, suggesting that most participants reflected on past traumatic events as central and positive to their identity, with fewer participants reflecting on past traumas as central and negative or not central to their identity. Table 2 summarizes the scale statistics for the CES-V. Calculation of Cronbach's alpha suggested that the CES-V had excellent consistency for both the 20-item and 7-item versions (see above). Examination of the corrected item-total correlations in the 20-item measure suggested that all the individual items were highly correlated with the overall total score (rs ranging from 0.67 to 0.81), except for Item 19 ($r = 0.48$). The squared multiple correlations of all the items ranged from 0.56 to 0.75, except Item 19 (0.28). Despite Item 19 having a lower corrected item-total correlation and squared multiple correlation, Cronbach's alpha did not increase in the long version if Item 19 was deleted (all adjusted $\alpha s = 0.96$). Corrected item-total correlations for the 7-item version of the CES-V ranged from 0.72 to 0.82, the squared multiple correlations ranged from 0.53 to 0.69, and Cronbach's alpha remained 0.91 when excluding each item one at a time, supporting the inclusion of all seven items in the short version.

Exploratory factor analyses were conducted on both the long and short versions of the CES-V using principal axis factoring extraction and direct oblimin rotation (Costello and Osborne 2005; Field 2013). The Kaiser–Meyer–Olkin

Table 2 Scale descriptive statistics for the CES-V

Scale	N	Min.	Max.	M	Std. error	SD	LLCI	ULCI
CES-V 20 items	512	−80.00	80.00	9.12	1.46	33.04	6.26	11.98
CES-V 19 items	512	−76.00	76.00	8.12	1.41	31.90	5.36	10.88
CES-V 7 items	512	−28.00	28.00	2.21	0.57	12.88	1.09	3.33

CES-V Centrality of Event Scale-Valence Version, *LLCI* lower limit 95% confidence interval, *ULCI* upper limit 95% confidence interval

Measure of Sampling adequacy (KMO = 0.97) suggested that the sample size was adequate for performing a factor analysis with all 20 items. There were two factors with eigenvalues over Kaiser's criterion of 1.00 that together explained 60.38% of the variance when using all 20 items. The second factor had an eigenvalue of 1.003, which barely met the recommended criterion and only accounted for 3.12% of the variance. Examination of the scree plot showed a sharp inflexion following the first factor. Only three items loaded on the second factor (i.e., Items 7, 11, 19). Items 7 and 11 start with "I believe that people who haven't experienced this type of event…" which is unlike the structure of the rest of the items on the measure. Berntsen and Rubin (2006) also found that these items cross-loaded onto a separate factor, suggesting that the cross-loadings may be a result of the item structure rather than a separate factor. In the rotated structure, Item 19 ("If this event had not happened to me, I would be a different person today") had a communality of 0.27, which is less than the criterion of 0.40 recommended by Costello and Osborne (2005). Therefore, a second factor analysis was run with 19 of the original items, excluding Item 19. Excluding Item 19 resulted in only one factor with an eigenvalue greater than 1 (11.59), which accounted for 58.88% of the variance. Examination of the scree plot justified retention of one factor, which all 19 items loaded onto (ranging from 0.67 to 0.83). A parallel analysis also supported a unitary factor structure. The superior unitary factor structure of the CES-V excluding Item 19 suggests that when administered as a bivalent scale for the better or for the worse, Item 19 may not be appropriate for inclusion in the total score.

The exploratory factor analysis for the 7-item CES-V (using principal axis factoring extraction and direct oblimin rotation) suggested that the short version also has a unitary factor structure. Only one eigenvalue was greater than 1.00 (4.74) and accounted for 62.51% of the variance. Examination of the scree plot showed distinct inflexion at factor two, suggesting that only one factor be retained. A parallel analysis also supported a unitary factor structure. All seven items loaded (ranging from 0.71 to 0.86) on the unitary factor representing event centrality. Results of the exploratory factor analyses suggested that both the long and short versions of the CES-V had a unitary factor structure comparable to the factor structures of the original long and short versions of CES (while excluding Item 19 in the long version of the CES-V).

Based on the comparable results of the factor analyses and measures of internal consistency, all subsequent analyses were conducted with both 7-item and 19-item versions of the CES-V. Given the prevalent use of the 7-item version and good practice recommendations to use brief measures when possible to alleviate assessment burden, results from analyses using the 7-item version are presented in text, and replicated tables with results from analyses using the 19-item version are available as supplementary material. No discrepancies were observed between analyses using the two different versions.

Does Event Centrality Valence Differentially Relate Post-trauma Outcomes?

Results from both simple linear regressions predicting PTSD and PTG, respectively, are presented in Table 3 (and Table 3a in supplementary material). The regression model predicting PTSD symptoms was statistically significant; the CES-V inversely predicted and accounted for a small proportion of variance (2%) in PCL-5 scores. The regression model predicting PTG was also statistically significant; the CES-V positively predicted and accounted for a greater proportion of variance (17%) in PTGI scores. Overall, the regression results supported the hypotheses that (a) positive and central appraisals of traumatic events would relate negatively to PTSD symptoms and positively to PTG, and that (b) negative and central appraisals of traumatic events would relate positively to PTSD and negatively to PTG.

Do Post-trauma Outcomes Differ Based on Event Centrality Valence Group?

PCL-5 subscale means and standard deviations are presented for each group of event centrality valence (i.e., centrally positive, not central, or centrally negative) in Table 4 (and Table 4a in supplementary material). Figure 1 (and Fig. 1a in supplementary material) displays the PCL-5 subscale profile

Table 3 Linear regressions predicting post-trauma outcomes

Dependent variable	Independent variable	Coefficients						Model Statistics		
		b	$SE\ b$	β	p	LLCI	ULCI	Adj. R^2	F	p
PCL-5	Constant	20.56	0.82			19.03	22.02			
	CES-V 7	−0.19	0.06	−0.14	0.002	−0.33	−0.06	0.02	9.50	0.002
PTGI	Constant	44.87	1.17			42.43	47.33			
	CES-V 7	0.92	0.09	0.41	<0.001	0.76	1.06	0.17	105.78	<0.001

Confidence intervals are 95% bias corrected and accelerated confidence intervals based on 1000 bootstrapped samples

PCL-5 PTSD Checklist for DSM-5, *PTGI* Posttraumatic Growth Inventory, *CES-V 7* 7-Item Centrality of Event Scale-Valence Version, *LLCI* lower limit confidence interval, *ULCI* upper limit confidence interval

Table 4 Mean post-trauma outcome scores by subscale, total score, and centrality of events valence group based on 7-item CES-V

Outcome measure	Centrality of events valence group						F	Partial η^2
	Negative		Not Central		Positive			
	M	SD	M	SD	M	SD		
PCL-5 intrusions subscale	0.29	1.04	−0.62	0.85	−0.03	0.94	21.12***	0.08
PCL-5 avoidance subscale	0.31	1.07	−0.61	0.81	−0.05	0.92	22.10***	0.08
PCL-5 negative alterations in cognitions and mood subscale	0.43	1.09	−0.52	0.76	−0.14	0.89	29.84***	0.10
PCL-5 alterations in arousal and reactivity subscale	0.25	1.04	−0.51	0.85	−0.04	0.96	14.70***	0.05
PCL-5 total	0.37	1.04	−0.61	0.86	−0.08	0.92	26.47***	0.09
PTGI relating to others subscale	−0.28	0.91	−0.68	0.98	0.32	0.93	40.86***	0.14
PTGI new possibilities subscale	−0.25	0.90	−0.63	1.01	0.29	0.95	33.93***	0.12
PTGI personal strength subscale	−0.22	0.96	−0.76	1.02	0.31	0.89	41.60***	0.14
PTGI spiritual change subscale	−0.16	0.99	−0.55	0.88	0.22	0.97	20.07***	0.07
PTGI appreciation of life subscale	−0.16	0.95	−0.91	1.12	0.31	0.84	49.86***	0.16
PTGI total	−0.26	0.88	−0.78	1.07	0.33	0.90	48.03***	0.16

Means and standard deviations represent calculated z-scores required to perform the profile analyses

CES-V Centrality of Event Scale–Valence Version, *PCL-5* PTSD Checklist for DSM-5, *PTGI* Posttraumatic Growth Inventory

***$p < 0.001$

Fig. 1 Posttraumatic stress disorder symptom profiles by centrality of events valence group based on 7-Item Centrality of Event Scale–Valence Version. *Note. PCL-5* PTSD Checklist for DSM-5. Scores represent calculated z-scores
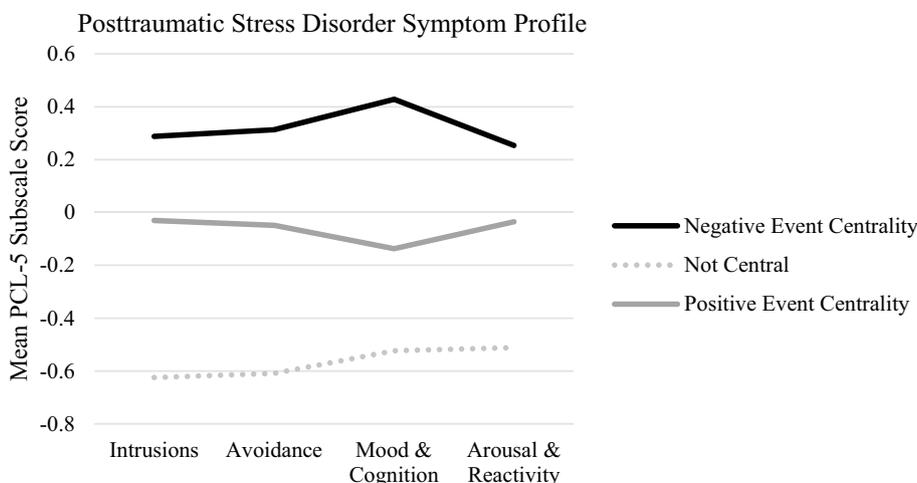
for each event centrality valence group. The profile analysis test of levels was statistically significant, $F(2, 509) = 26.81$, $p < 0.001$, partial $\eta^2 = 0.10$, suggesting that there were group differences when PCL-5 scores were averaged across subscales. The profile analysis test of flatness was not statistically significant, Hotelling's $T < 0.01$, $F(3, 507) = 0.57$, $p = 0.635$, partial $\eta^2 < 0.01$, suggesting that when scores were averaged across groups, participants tended to respond similarly between subscales. The profile analysis test of parallelism was statistically significant, Wilks' $\lambda = 0.95$, $F(6, 1014) = 4.61$, $p < 0.001$, partial $\eta^2 = 0.03$, suggesting there was a group by within-subjects interaction. If the tests of levels and parallelism are statistically significant the test of flatness is only non-significant in profile analysis when group profiles are mirror images and cancel each other out (Tabachnick and Fidell 2013), a pattern presented in Fig. 1 (and Fig. 1a in supplementary material) with the negative and positive event centrality groups. Post-hoc ANOVAs and Tukey's HSD tests indicated the positive event centrality group reported higher scores on all subscales of the PCL-5 than the not central event centrality group (all $ps < 0.01$), and the negative event centrality group reported higher scores on all subscales of the PCL-5 than both other groups (all $ps < 0.01$).

PTGI subscale means and standard deviations are presented for each group of event centrality valence in Table 4 (and Table 4a in supplementary material). Figure 2 (and Fig. 2a in supplementary material) displays the PTGI subscale profile for each event centrality valence group. The profile analysis test of levels suggested there was a statistically significant main effect for group (i.e., groups differed when PTGI scores were averaged across subscales), $F(2, 509) = 47.55$, $p < 0.001$, partial $\eta^2 = 0.16$. The profile analysis test of flatness suggested there was no statistically significant within-subjects main effect (i.e., participants tended to respond similarly on all subscales), Hotelling's $T = 0.01$,

$F(4, 506) = 1.39$, $p = 0.238$, partial $\eta^2 = 0.01$. The profile analysis test of parallelism suggested there was a statistically significant group by within-subjects interaction, Wilks' $\lambda = 0.95$, $F(8, 1012) = 3.52$, $p = 0.001$, partial $\eta^2 = 0.03$. The profile analysis results for the PTGI largely resembled results of the PCL-5 profile, in that the profiles of the negative event centrality and positive event centrality groups mirrored each other as presented in Fig. 2 (and Fig. 2a in supplementary material). Post-hoc ANOVAs and Tukey's HSD tests indicated the negative event centrality group reported higher scores on all subscales of the PTGI than the not central event centrality group (all $ps < 0.02$), and the positive event centrality group reported higher scores on all subscales of the PTGI than both other groups (all $ps < 0.001$).

Do Trauma Type and Time Since Trauma Influence Event Centrality Valence?

Table 5 (and Table 5a in supplementary material) displays the frequency and percentages of respondents who reflected on their traumas as centrally negative, not central, or centrally positive by index trauma type. Consistent with previous research (e.g., Kılıç et al. 2016; Lancaster et al. 2014), more participants reported negative ratings of event centrality for interpersonal traumas (e.g., sexual assault, being held captive) than non-interpersonal traumas (e.g., natural disasters, accidents). One-way ANOVAs were performed to determine whether ratings of event centrality valence statistically differed between trauma type. Index trauma groups were reconfigured due to the large number of index traumas reported and the unequal groups sizes. The new trauma groups consisted of *Natural Disasters* (from index trauma Group 1), *Traumatic Accidents* (from index trauma Groups 2, 3, 4, 5, and 16), *Physical Assault* (from index trauma Groups 6, 7, 10, 11, and 15), *Sexual Assault* (from index

Fig. 2 Posttraumatic growth profiles by centrality of events valence group based on 7-item Centrality of Event Scale–Valence Version. *Note. PTGI* Posttraumatic Growth Inventory. Scores represent calculated z-scores
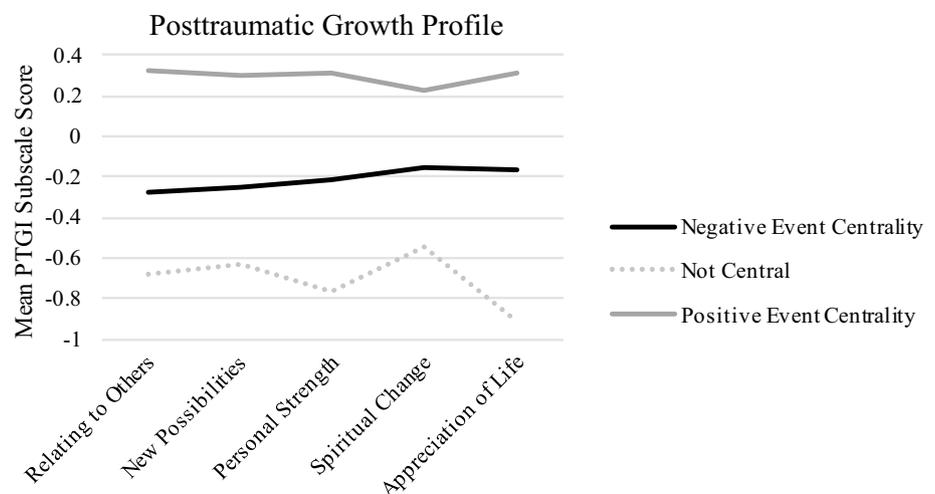

Posttraumatic Growth Profile

Table 5 Centrality of events valence group frequency by trauma type

Index trauma type	Centrality of events valence group					
	Negative		Not central		Positive	
	n	%	n	%	n	%
1. Natural disaster	5	11.4	8	18.2	31	70.5
2. Fire/explosion	4	17.4	3	13.0	16	69.6
3. Transportation accident	21	28.0	16	21.3	38	50.7
4. Work, home, or recreational accident	6	33.3	0	0	12	66.7
5. Toxic substance exposure	1	50.0	0	0	1	50.0
6. Physical assault	14	38.9	5	13.9	17	47.2
7. Assault with a weapon	8	47.1	1	5.9	8	47.1
8. Sexual assault	19	50.0	2	5.3	17	44.7
9. Other unwanted sexual experience	9	56.2	0	0	7	43.8
10. Combat or war exposure	2	33.3	0	0	4	66.7
11. Captivity	4	100	0	0	0	0
12. Illness or injury	27	33.8	5	6.2	48	60.0
13. Severe human suffering	8	40.0	0	0	12	60.0
14. Sudden accidental death	15	33.3	4	8.9	26	57.8
15. Sudden violent death	9	34.6	5	19.2	12	46.2
16. Injury, harm, or death you caused	3	60.0	1	20.0	1	20.0
17. Other	6	25.0	2	8.3	16	66.7
18. Experienced a traumatic event in lifetime, but did not specify type of index trauma	7	21.2	12	36.4	14	42.4

Groupings based on 7-Item Centrality of Event Scale-Valence Version

$N = 512$

trauma Groups 8 and 9), *Illness and Human Suffering* (from index trauma Groups 12, 13, and 14), and *Other* (from index trauma Groups 17 and 18). Results of the ANOVA when using the 7-item CES-V revealed a statistically significant group difference in event eventuality valence, $F(5, 506) = 2.88$, $p = 0.014$, $\omega^2 = 0.02$. Post-hoc Tukey's HSD tests revealed that individuals who experienced sexual assault traumas reported more negative event centrality than individuals who experienced natural disasters ($p = 0.016$, 95% BCa CI [− 15.79, − 0.96]), but there were no other statistically significant group differences. Results of the ANOVA when using the 19-item CES-V were the same, $F(5, 506) = 2.93$, $p = 0.013$, $\omega^2 = 0.02$, with post-hoc Tukey's HSD tests revealing that only individuals who experienced sexual assault traumas reported more negative event centrality than individuals who experienced natural disasters ($p = 0.019$, 95% BCa CI [− 38.78, − 2.07]). Neither Pearson correlation was statistically significant between time since trauma and the 7-item CES-V, $r = 0.06$, 95% BCa CI [− 0.03, 0.14], $p = 0.212$, nor the 19-item CES-V, $r = 0.04$, 95% BCa CI [− 0.05, 0.12], $p = 0.369$, suggesting that time since trauma does not share a linear relationship with event centrality valence.

Discussion

The current investigation was designed to develop a self-report measure of event centrality valence in order to examine whether the valence of centrality appraisals following traumatic events differentially related to symptoms of PTSD and PTG. Appraising a traumatic event as central and positive to personal identity was expected to be positively related to PTG and negatively related to PTSD, whereas appraising a traumatic event as central and negative to personal identity was expected to be negatively related to PTG and positively related to PTSD. Response patterns on subscales of PTSD and PTG measures were compared between participants appraising their index traumas as central and positive, not central, or central and negative. Differences in event centrality valence between types of index traumas experienced were also examined, as was the relationship between time since trauma exposure and valence of event centrality.

To assess the influence of the valence of centrality appraisals on post-trauma responses, the CES was modified and administered as a bivalent scale to capture valence (CES-V), allowing trauma-exposed participants to rate

how central a traumatic event was to their identity for the better or the worse or not central at all. Exploratory factor analyses suggested that Item 19 from the original scale was not suitable for inclusion in the modified version, potentially due the complexity of responding to the item on a bivalent scale for better or for worse. Subsequent exploratory factor analyses of a 19-item version and the 7-item version demonstrated unitary factor structures for both the long and short versions, which concurs with factor analytic findings for the original CES (e.g., Berntsen and Rubin 2006). The CES-V demonstrated strong internal consistency in both long and short versions. As such, all subsequent analyses were performed with both the 7-item CES-V and the 19-item CES-V and the results were compared. No discrepancies were observed.

In support of the main hypothesis, the valence of event centrality with which individuals appraised traumatic events was differentially related to post-trauma responses. That is, scores on the CES-V were positively correlated with the measure of PTG and negatively correlated with symptoms of PTSD. To our knowledge, the current results are the first to demonstrate that some individuals appraise traumatic events as central, though negative, to their identity and the understanding of other life events, while others appraise traumatic events as similarly central but positive. Contrary to what would intuitively be expected following trauma exposure, most of the current sample (55%) appraised their index trauma as a positive turning point in their life. All but four participants in the current sample responded to post-trauma outcome measures while referencing an index trauma that met DSM-5 Criterion A for PTSD, countering any suppositions that a lack of trauma severity might explain the current findings. Most participants reflecting on a past trauma as central and positive to their identity may perhaps be explained by other participant demographics, characteristics, or simply the fact that those reflecting on a trauma as a positive turning point in life might be more motivated to help advance trauma research or better able to assist with trauma research (i.e., not otherwise preoccupied with lower psychosocial functioning). Indeed, the current sample had a mean PCL-5 score of 20.13, suggesting that despite their trauma exposure, most of the sample reported subclinical levels of PTSD. Treatment-seeking samples may have a greater proportion of individuals reflecting on past traumas as central and negative to their identity.

Related to, but apparently distinct from PTG, the current evidence indicates individuals can reflect on a traumatic event as stimulus for positive change despite the negativity of the event. Measures of PTG reflect the extent to which positive life changes (i.e., new possibilities, personal strength, relating to others, appreciation of life, and spiritual change) happen following a traumatic experience. Measures of event centrality reflect the extent to which individuals

view a traumatic event as a centrally organizing framework for understanding themselves and other subsequent experiences. The CES-V accounted for a greater proportion of variance in PTG than PTSD symptoms in the current study, suggesting event centrality may play a more poignant role in PTG than PTSD; however, the magnitude of the relationship between event centrality valence and PTG suggests they are separate constructs.

Modifying the CES allowed respondents to indicate whether they perceived their trauma to have a positive, negative, or little influence on their identity and subsequent attributions of meaning for other life experiences. Measuring the valence of centrality appraisals in the current study revealed that it is not only the degree to which individuals use their traumatic event for understanding themselves and the world, but also the valence with which they appraise their traumatic event, that relates to their experience of growth or distress. The profile analyses results indicated individuals who viewed their traumatic events as non-central to understanding themselves and subsequent life events reported the lowest scores on both measures of growth and distress. The results are theoretically consistent and support previous suggestions that event centrality may be a "double-edged sword" for post-trauma responses; not viewing a traumatic event as a centrally organizing life event may reduce the likelihood that a trauma will have lasting psychological effects, whether positive or negative. Results of the profile analyses further suggested that individuals who viewed their traumatic events as central to their personal identity reported higher scores on measures of PTSD and PTG, but it was differences in valence of event centrality that was related to whether individuals reported more growth or distress. That is, individuals in the central-positive group reported higher scores on all subscales of the PTG measure than individuals in the central-negative group, whereas individuals in the central-negative group reported higher scores on all subscales of the PTSD measure than individuals in the central-positive group. The retrospective nature of the current data precludes causal interpretations; nevertheless, trauma outcome theories (e.g., Ehlers and Clark 2000; Foa and McLean 2016; Joseph et al. 2012) suggest trauma appraisals may impact subsequent psychosocial functioning and preliminary evidence suggests event centrality may be a mediator in the development of post-trauma reactions (Boals and Murrell 2016).

The current results, together with theory supporting the importance of trauma appraisals in post-trauma outcomes, underscore the clinical potential of using the CES with a modified bi-valent Likert scale. Cognitive processing and disclosure of a traumatic event to mental health professionals or other positive social supports is theorized to be critical to the development of PTG (Joseph et al. 2012; Tedeschi and Calhoun 2004). Such processing is thought to allow

individuals to integrate the traumatic event experience into a healthy, realistic worldview. Explicit assessment of event centrality valence may, therefore, inform therapeutic planning and provide a tangible measurement of progress with regards to cognitive processing. For example, when clients' concerns are associated with negative appraisals of traumatic experiences, the CES-V may serve as a useful measure of clinical progress towards challenging or reframing negative or maladaptive trauma beliefs. Reducing the negative valence or overall centrality of a trauma may be key to reducing PTSD symptoms and fostering a positive event centrality valence may be a part of PTG.

The CES-V may also have future applicability in determining who requires early intervention following a trauma. Participants who reported sexual trauma reported more negative event centrality than participants who had experienced natural disasters in the current sample, which is consistent with previous findings that interpersonal traumas tend to have more negative post-trauma outcomes (e.g., Kılıç et al. 2016; Lancaster et al. 2014). Trauma type may increase the likelihood of negative event centrality appraisals, and therefore, increase the need for preventative clinical intervention. Future research could further determine which types of trauma would be more likely contribute to negative event centrality and would benefit most from early intervention. Time since trauma exposure did not share a linear relationship with the CES-V. A lack of linear relationship with time suggests that positive or negative appraisals of traumatic events may be fairly stable over time without intervention, as has been observed in experimental research (Boals and Murrell 2016; Boals et al. 2015). Valence of event centrality may depend more on other time-related factors like age when the trauma happened (Ogle et al. 2013). Alternatively, a lack of linear relationship between time since trauma and event centrality valence might be a result of range restriction in the current sample. Time since trauma ranged from less than 6 months prior to 55 years prior in the current sample, but only 3.9% experienced their index trauma within the previous 6 months. Studying event centrality valence in the immediate aftermath of trauma when greater changes in appraisals are common may provide different results. Nonetheless, assessment of event centrality valence following trauma may help identify individuals likely to experience maladaptive trauma-responses and, therefore, require support to help them restructure their trauma appraisals through traditional cognitive behavioural therapy techniques or improve psychological flexibility through mindfulness and acceptance processes (e.g., defusion, mindfulness, self-as context in acceptance and commitment therapy; Boals et al. 2015). Future research is necessary to clarify clinically important ranges of event centrality valence that might best predict adaptive versus maladaptive responses to traumatic events and need for early intervention.

The current investigation had limitations that highlight important directions for future research. The current results support both 19-item and 7-item variants of the CES-V in a sample of predominately White, trauma-exposed, community members mostly reporting subclinical levels of PTSD; replication and additional psychometric testing in clinical, demographically diverse, treatment-seeking samples is essential regarding the use of the modified scale to study the valence of event centrality for traumatic experiences in relation to post-trauma outcomes. The present study utilized cross-sectional analyses of trauma and related factors. Longitudinal research is essential to clarify the relative onset, course, and impact of event centrality on posttraumatic outcomes. Future longitudinal research should also investigate what factors influence the valence of event centrality, such as treatment history, which was not assessed and controlled for in the current study. The current results suggested that time since trauma did not relate to event centrality valence, but longitudinal research or research in clinical samples may help elucidate how the valence of event centrality may change over time or how personal characteristics and factors like resiliency and treatment history may influence the valence of event centrality. Furthermore, index traumas had to be regrouped in the current sample to perform specific statistical analysis; future research with larger samples may find nuanced differences of the relationship between trauma types and valence of event centrality.

The current investigation was the first to examine whether the valence of event centrality that individuals assign to traumatic events differentially relates to symptoms of PTSD and PTG. The results suggested that rating a traumatic event as central and positive to personal identity related to growth and that rating a traumatic event as central and negative to personal identity related to symptoms of distress. Rating a traumatic event as not central to personal identity was associated with less growth and distress overall. Time since trauma exposure was not related to the valence of event centrality, but the type of trauma, particularly sexual assault trauma, was found to contribute to more negative event centrality appraisals. Future research is necessary to clarify clinically important ranges of event centrality valence that might best predict adaptive versus maladaptive responses to traumatic events and need for early intervention. Future research is also necessary to identify personal, peritraumatic, and environmental factors that contribute to more positive and central trauma appraisals.

Compliance with Ethical Standards

Conflict of interest Michelle J. N. Teale Sapach, Samantha C. Horswill, Holly A. Parkerson, Gordon J. G. Asmundson and R. Nicholas Carleton declare that they have no conflict of interest.

Ethical Approval The current research was reviewed and approved by the University of Regina Research Ethics Board (File # 11S1314). All procedures were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Research Involving in Animal Rights This article does not contain any studies with animals performed by any of the authors.

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