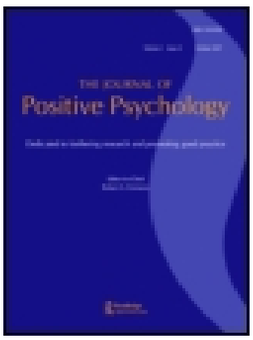

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Are sequential sample designs useful for examining post-traumatic changes in character strengths?

Raina V. Lamade[a], Eranda Jayawickreme[b], Laura E.R. Blackie[c] and Robert E. McGrath[a]

[a]Psychology Department, Fairleigh Dickinson University, Teaneck, USA; [b]Psychology Department, Wake Forest University, Winston-Salem, USA; [c]School of Psychology, University of Nottingham, Nottingham, UK

ABSTRACT

Previous research on differences in character strengths as a result of traumatic cultural events has relied on non-overlapping samples of individuals who completed online questionnaires before and after the event. This study expands on these previous studies by examining differences in self-reports of character strengths before, between, and after two terror attacks on Paris, France, in 2015, and further comparing these differences to contemporaneous differences in two other countries. Completers of the inventory during the same periods from the United States (N = 528,912) and Australia (N = 174,591) served as the comparison groups. After controlling for age and gender, six strengths in the French sample, nine strengths in the Australian sample and seven in the US sample remained significant. A clear discernable pattern did not emerge. Effect sizes were consistently miniscule, which when combined with very large samples may account for finding significance even though within-nation differences are unreliable.

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Many people report experiencing positive changes in their identity, worldviews, and relationships as a result of stressful or traumatic life experiences (Jayawickreme & Blackie, 2014). The term *post-traumatic growth* (PTG) was coined by Tedeschi and Calhoun (1996) to capture the positive changes that people frequently reported after stressful life events. Common features of PTG include increased appreciation for life, increased sense of personal strength, the perception that new possibilities exist in one's life, greater appreciation for relationships, and a more developed spiritual life (Tedeschi & Calhoun, 2004).

Although there is an extensive research literature on PTG (e.g., Blackie et al., 2017; Danhauer et al., 2013; see Jayawickreme & Blackie, 2014, for a review), the field has been criticized for relying heavily on retrospective reports of changes in personality (Infurna & Jayawickreme, 2019; Jayawickreme & Blackie, 2014; Tennen & Affleck, 2009). Prospective research offers a more desirable methodological strategy (Bleidorn, Hopwood, & Lucas, 2018; Jayawickreme & Zachry, 2018), but the practical obstacles to such research can be daunting. It is difficult to identify *a priori* when and to whom a trauma will occur, so prospective research requires large cohorts that have to be surveyed over long periods of time. For example, Frazier et al. (2009) conducted a prospective longitudinal study with undergraduate samples across four campuses and found that only 8% of the sample experienced a traumatic event and met study criteria at the two-month follow-up.

A third strategy has involved examining changes in character strengths in the wake of adversity. The VIA Classification of Strengths and Virtues (Peterson & Seligman, 2004) posits the existence of 24 character strengths that are considered reflective of six more general virtues, including wisdom, courage, humanity, justice, temperance and transcendence (although more recent research has suggested a more reliable three-virtue model) (McGrath, 2015; McGrath, Greenberg, & Hall-Simmonds, 2018). The VIA Inventory of Strengths (VIA-IS; Peterson & Seligman, 2004) was developed to measure the 24 character strengths. The VIA-IS has been available for any interested adult to complete online free of charge since 2003, in return for which the individual receives personalized feedback on their results. It has been translated into more than 30 languages, and the instrument has now been completed over 3 million times. The VIA-IS has consistently demonstrated adequate internal consistency and high test-retest reliability (Park, Peterson, & Seligman, 2004; Peterson & Seligman, 2004; Schueller, Jayawickreme, Blackie, Forgeard, & Roepke, 2015). The strengths also mirror to some extent the five dimensions typically

CONTACT Raina V. Lamade rainalamade@hotmail.com

Data from this study were provided by the VIA Institute on Character.

assessed in PTG research. For example, the ideas measured in the PTG domains of appreciation of life and spirituality are perhaps best captured by character strengths in the transcendence virtue, whereas ideas measured in the PTG domains of improved relationships with others, personal strength, and identification of new possibilities for one's life are perhaps best captured by character strengths in the humanity, courage and wisdom virtues, respectively.

The VIA-IS has been used in a number of studies assessing group-level patterns of strengths in the period before and after a culturally shared trauma. The first of these studies was conducted by Peterson and Seligman (2003), who compared participants' responses on the VIA-IS before and after the 9/11 terrorist attacks. Using a predominantly U.S. sample, they found that individuals who completed the VIA-IS in the months after the attacks generated significantly higher means than those who completed the inventory in the months before the attacks on seven character strengths: gratitude, hope, kindness, leadership, love, spirituality, and teamwork. The means were still higher 10 months post-event. The authors suggested these strengths reflected the 'theological virtues' of faith, hope, and love. In terms of the five domains of post-traumatic growth (Tedeschi & Calhoun, 2004), these strengths also suggest higher levels of relationship appreciation, spirituality and appreciation of life.

Schueller et al. (2015) similarly examined differences in VIA-IS scores among individuals living within a 100-mile radius of three shooting tragedies that occurred in the U.S., at Virginia Polytechnic Institute and State University (2007), a movie theater in Aurora, Colorado (2012), and Sandy Hook Elementary School in Newtown, Connecticut (2012). They found differences in the mean levels of strengths in the immediate aftermath of the Sandy Hook shooting but not for the Virginia Tech and Aurora, Colorado shootings. A number of strengths, including prudence, self-control, social intelligence, spirituality, teamwork, bravery, gratitude, honesty, hope, humor, kindness, leadership, love, modesty, perseverance, perspective, and zest were significantly lower one month post-event at Sandy Hook. At two months post-event, however, several strengths were reported at higher levels than before, including hope, kindness, leadership, love, modesty, fairness, gratitude, honesty, and perseverance. Love of learning was greater one-month post-event; however, it was lower two months post-event. They found that spirituality was lower post one month in the Sandy Hook sample, and then higher at the post two months period, but only at the one-month post incident at Virginia Tech, and did not differ among those in the Aurora sample.

While the extant studies have converged on some common findings (kindness, leadership, and spirituality tended to be associated with higher means after the event), Schueller et al. (2015)noted the substantial variation in results across studies, claiming more research was needed to explore these inconsistent findings to understand when tragedy may act as a catalyst for change in signature character strengths. Thus, the observed differences in character strengths demonstrate considerable variation across events, and further replication is necessary to work towards identifying the traits most likely to be affected by collectively shared (and in some cases national) tragedies.

Though these studies avoid the problem of retrospective reports, they introduce a different potential confound. Specifically, these studies rely on sequential discrete samples of individuals who completed the inventory before and after the traumatic event: different individuals are completing the inventory at different times. The absence of a true prospective design means the results could reflect at least three different possibilities. The first is that they indicate true changes in the population that were potentially influenced by the event. For example, Vázquez, Pérez-Sales, and Hervás (2008) described how citizens in the U.S. responded to the 9/11 terrorist attacks with increased patriotism and commitment to the government, which in turn created a sense of national cohesion. Páez, Basabe, Ubillos, and González-Castro (2007) found that citizens in Spain reported PTG after the 2004 train bombings in Madrid when they had participated in demonstrations against war and terrorism and felt part of a positive and supportive climate. However, a recent longitudinal study by Luhmann and Bleidorn (2018) found that changes in mood declined significantly compared to pre-attack levels after the 2015 Paris terrorist attacks, but returned to pre-attack levels among vicarious victims after 8 weeks. There were no changes in life satisfaction across the eight weeks and fearful preoccupation with the attacks declined over eight weeks. In contrast, to the aforementioned correlational studies on PTG, these findings suggest that the effects of national tragedy are short-lived, at least among individuals witnessing the events without being directly involved. The second is that there is a systematic difference in the character of the people who chose to go online and complete the VIA-IS in the months following the event. The third possibility is that the availability of very large samples means random variations in those who access the test or measurement

error in the instrument can produce differences that are significant but unreliable.

The present study aimed to explore these alternative explanations for the existing literature on 'PTG' in the VIA-IS. Although Luhmann and Bleidorn (2018) found temporary changes in mood, preoccupation with the Paris terror attacks and fearful behaviors, their study was based on German soccer fans, measured mood and satisfaction with life rather than aspects of eudemonic well-being that are more representative and PTG and used relatively small sample size (at least when compared to studies using the VIA-IS data). We compare differences in VIA-IS scores before, between, and after two terrorist attacks in Paris, France, during 2015. On 7 January 2015, two gunmen attacked the headquarters of a newspaper, resulting in 12 deaths and wounding 12 others. On 8 January 2015, an assailant shot a police officer and killed four more victims, and then took hostages at a kosher supermarket on January 9th. On 13 November 2015, a series of organized terrorist attacks were conducted, starting with suicide bombers who detonated an explosive device at a football match. Several mass shootings with hostages followed at a concert, cafes, and theater venues, resulting in 130 deaths and 413 injuries. Using three distinct time periods consisting of a pre-attack period (i.e., T1); a post-pre attack period (i.e., after one attack, but prior to a second attack, T2); and a post two attacks period (i.e., T3) allow us to determine if there are similar patterns of change across adverse events. This helps discern potentially cumulative effects as well.

However, our study differs from previous research on this topic by comparing the results for France to contemporaneous samples representing two western industrialized democratic countries that did not experience culturally traumatic events at those times, the United States and Australia. We chose these two countries for their geographic distance from France, as nations where there was little chance that the Paris attacks would have had any effects on the culture at large. If trauma is driving change in the national character, then we would have expected the French sample to demonstrate greater differences across time periods than the other two samples. Evidence for similar levels of differences across time periods in the U.S. and Australian samples would argue more strongly for naturally occurring variation in the completers over time.

Method

Participants

The website of the VIA Institute on Character (viacharacter.org) offers access to the VIA-IS. Individuals who approach the site create an account, provide basic demographic information including their nation of residence, and receive immediate feedback about their results upon completing the instrument. The initial sample used for this study consisted of 767,417 individuals who met the following conditions. First, they identified their country of residence as France, Australia, or the United States. Second, they completed the VIA-IS between 1 March 2014 and 1 September 2016. Finally, individuals who completed the VIA-IS on the actual dates of the Paris terror attacks (January 7–9, 2015 and November 13–14, 2015) were also excluded. Table 1 provides demographic information by the nation.

Measure

The version of the VIA-IS administered during the data collection period consisted of 120 items that were drawn from the original 240-item version. Each of the 24 scales consisted of five items with the highest corrected item-total correlations for that scale based on a large sample collected earlier. VIA-IS items are completed on a 5-point scale from 1 (*very much unlike me*) to 5 (*very much like me*), and item scores are averaged to generate scale scores. All reliability coefficients varied between .70 and .90 except that for

Table 1. Demographic statistics by country.

	France (N = 63,914)		U.S. (N = 528,912)		Australia (N = 174,591)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	36.6	11.4	34.1	13.6	37.3	12.2
	N	%	*N*	%	*N*	%
Time Period						
1	23,204	36.3	156,856	29.7	48,177	27.6
2	20,760	32.5	204,062	38.6	62,694	35.9
3	19,950	31.2	167,994	31.8	63,720	36.5
Gender						
Female	47,403	74.3	329,102	62.3	115,321	66.1
Male	16,442	25.8	199,303	37.7	59,071	33.9

Note. Time Period: 1 = 1 March 2014–6 January 2015; 2 = January 10–12 November 2015; 3 = 15 November 2015–1 September 2016.

Teamwork, which was .54. Mean scores for scales varied between 3.23 (for Self-Regulation) and 4.35 (Honesty) with a mean of 3.82 and a mean standard deviation of .71.

Procedure

The participants were divided into three groups based on the two terror attacks that occurred in Paris, France on January 7–9, 2015 and November 13–14, 2015. The first group (Time1) completed the VIA-IS in the 10-month period between 1 March 2014 and 6 January 2015. The second group (Time 2) completed the VIA-IS during the 10 months from 10 January 2015 to 12 November 2015. The final group (Time 3) completed the VIA-IS during the period November 15–2015 to 1 September 2016. To make significance test results more comparable, random subsamples of the Australian and U.S. samples were drawn to match the French sample in size and distribution across time periods.

Confirmatory factor analyses were used to address the possibility that variation over time is due to measurement error. As noted previously, the most reliable factor structure identified for the VIA character strengths is a three-factor model, with the three factors termed Caring, Inquisitiveness, and Self-Control (McGrath, 2015; McGrath et al., 2018).[1] In the VIA literature, the factors underlying the strengths are referred to as virtues. A recent study using confirmatory factor analysis indicated that the best-fitting model for this three-virtue structure involved using Gratitude, Kindness, and Love to estimate Caring; Creativity, Curiosity, and Learning for Inquisitiveness; and Perseverance, Prudence, and Self-Regulation for Self-Control (Berger & McGrath, 2018). That finding was replicated in the original sample for the current study in the following way.

Using Mplus version 8 (Muthén & Muthén, 2017), the model was first tested with the French sample in the first time period, which served essentially as the base sample. The model demonstrated excellent fit according to standards suggested by L.-T. and Bentler (1999). The comparative fit index was .94, the root-mean-square error of approximation was .06, the Tucker-Lewis index was .92, and the standardized root-mean-square residual was .04. A multigroup confirmatory factor was then conducted to evaluate the model's fit across the nine groups formed by country and time period. In each case, the comparative fit index actually increased over that for the French sample before the first terror attack, to .96 for the configural and metric models, and .95 for the scalar model. This provides good evidence of measurement invariance across the subgroups (Cheung & Rensvold, 2002). Accordingly, it was concluded that this model was appropriate for each national sample in each of the three time periods. The three-factor scores were therefore generated for each participant in the samples matched for size.

Results

The first step in the iterative process was to identify strengths and virtues that significantly varied across the three time periods among French participants. One-way analyses of variance (ANOVAs) were conducted for each of the 27 strength and virtue variables. The French values are provided in the left-most columns of Table 2. Using a Bonferroni-corrected alpha level of .002, 11 strengths significantly varied across the three time periods in the French sample: beauty, hope, kindness, learning, perseverance, perspective, self-regulation, social intelligence, spirituality, teamwork, and zest. The virtue score for Self-Control also met the same standard for significance. Note that the eta squared values were consistently very small, on average accounting for .04% of the variance of strengths scores. Examining results for France alone would lead one to conclude that the Paris attacks had an effect on character strengths.

However, the results for the U.S. and Australian samples matched for size show similar levels of variability across the three time periods, even though these time periods have no discernible importance in those nations. Both countries also produced 12 significant effects. The mean effect size was smaller for the U.S. than for France, but the mean effect for Australia was also .0004. Australia did not have any significant effects for the virtue scales but the U.S. had two. Since unexplainable variation across time periods was found for virtues as well as for strengths, these variations probably cannot be solely attributed to measurement error.

The next set of analyses involved two-way analyses of covariance to evaluate whether sample demographic differences across time periods and countries could have accounted for differences. Unfortunately, gender and age were the only covariates available in sufficient numbers to generate useful results. Their use for this purpose was supported by evidence that both variables were related to time period, country, and most of the strengths. For 14 of the strengths and virtues, the interaction was significant at $p < .002$. Table 3 provides effect sizes and p values for the interaction effect, and least square means from each analysis. Tukey-Kramer adjustment was used to control family-wise in comparisons of these means. To simplify the presentation, Table 3 focuses exclusively on differences between adjoining time periods, in other words, with the prior time period.

Table 2. Eta Squared Values and Significance Levels for Time Period within Country.

	France		U.S.		Australia	
Strengths	$\eta 2$	p	$\eta 2$	p	$\eta 2$	p
Beauty	.0025	< .001*	.0004	< .001*	.0000	.401
Bravery	.0002	.003	.0000	.588	.0001	.030
Creativity	.0001	.021	.0000	.536	.0002	.001*
Curiosity	.0001	.052	.0000	.705	.0001	.159
Fairness	.0001	.009	.0006	< .001*	.0001	.018
Forgiveness	.0001	.125	.0004	< .001*	.0000	.718
Gratitude	.0000	.396	.0002	.001*	.0000	.448
Honesty	.0001	.030	.0000	.311	.0003	< .001*
Hope	.0003	< .001*	.0001	.195	.0002	.007
Humility	.0000	.590	.0006	< .001*	.0002	.001*
Humor	.0002	.005	.0001	.138	.0002	.002*
Judgment	.0000	.469	.0001	.086	.0003	< .001*
Kindness	.0003	< .001*	.0006	< .001*	.0001	.155
Leadership	.0002	.007	.0006	< .001*	.0003	< .001*
Learning	.0049	< .001*	.0004	< .001*	.0006	< .001*
Love	.0001	.012	.0002	.001*	.0051	< .001*
Perseverance	.0003	< .001*	.0001	.027	.0001	.151
Perspective	.0003	< .001*	.0001	.072	.0004	< .001*
Prudence	.0002	.004	.0001	.072	.0000	.229
Self-Regulation	.0002	.001*	.0002	.004	.0000	.446
Social Intelligence	.0003	< .001*	.0001	.060	.0001	.018
Spirituality	.0005	< .001*	.0003	.000	.0004	< .001*
Teamwork	.0002	< .001*	.0005	< .001*	.0003	< .001*
Zest	.0003	< .001*	.0001	.109	.0003	< .001*
Virtues						
Caring	.0001	.089	.0004	< .001*	.0001	.124
Inquisitiveness	.0002	.006	< .0001	.264	.0001	.167
Self-Control	.0002	.001*	.0002	.001*	.0001	.132
M	.0004		.0002		.0004	

*$p < .002$.

Once again, effects for these interactions are quite small, only accounting for .01% of variability in strength scores. The mean difference in scores across the 24 strengths varied by only .01 from Time 1 to Time 2 across samples, and were exactly equal to two decimals from Time 2 to Time 3 in all three samples at Time 2. In the French sample, there were 16 significant differences from one time period to the next. The number was substantially smaller for the U.S. sample, with only 7 significance shifts between time periods. However, there were 14 significant differences for the Australian sample. This pattern of findings is consistent with the previous finding that the mean effect size was similar for Australia and France, while the U.S. mean effect was substantially smaller. These results suggest covarying age and gender had little effect on the pattern of results.

Discussion

The present study built on past research (Peterson, Park, Pole, D'Andrea, & Seligman, 2008; Peterson & Seligman, 2003; Schueller et al., 2015) that interpreted differences in strength scores before and after traumatic events as signs of population changes resulting from those events. This study differed from previous research in the comparison of variations in a European sample surrounding two terrorist attacks to two comparison samples where such attacks did not occur during the same time frame (the U.S. and Australia).

A particular strength of this study was the availability of two significant terrorist attacks within a relatively brief period of time in similar locations. If terrorist attacks do cause changes in strengths, as previous studies have suggested, the occurrence of two events allowed for evaluation of two possibilities. The first is that the effects are independent, in which case one would expect similar patterns of change after the two attacks. This hypothesis was not supported: few strength means changed at both Time 2 and Time 3, and when they did the differences tend to be in opposite directions. Second, if there is a non-linear effect, the examination of both incidents allowed us to consider whether a terrorist attack in the midst of a string of

Table 3. Variations across Time Periods after Controlling for Age and Gender.

	Interaction Effect		Least Square Means								
			France			U.S.			Australia		
Scale	$\eta 2$	p	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Strengths											
Beauty	.0003	< .001**	3.97	3.91*	3.93	3.78	3.79	3.80	3.66	3.66	3.66
Bravery	.0001	.028	3.71	3.72	3.73	3.71	3.71	3.71	3.58	3.60	3.58
Creativity	.0001	.001**	3.77	3.75	3.76	3.86	3.86	3.86	3.74	3.77*	3.76
Curiosity	.0000	.124	3.79	3.79	3.78	3.90	3.90	3.90	3.78	3.80	3.80
Fairness	.0000	.976	4.00	4.01	4.03	4.17	4.18	4.20	4.15	4.16	4.17
Forgiveness	.0000	.338	3.59	3.60	3.61	3.71	3.70	3.73*	3.64	3.65	3.66
Gratitude	.0001	.020	3.63	3.66*	3.65	3.94	3.93	3.95*	3.73	3.74	3.75
Honesty	.0001	.006	4.41	4.43*	4.42	4.36	4.35	4.35	4.29	4.31*	4.30*
Hope	.0001	< .001**	3.54	3.58*	3.55*	3.84	3.83	3.84	3.74	3.77*	3.75
Humility	.0001	.009	3.49	3.49	3.50	3.56	3.57	3.60*	3.50	3.53*	3.52
Humor	.0000	.441	3.78	3.79	3.79	4.09	4.10	4.10	3.97	3.98	4.00
Judgment	.0001	< .001**	4.18	4.18	4.19	4.21	4.20	4.21	4.10	4.13*	4.11*
Kindness	.0001	< .001**	4.23	4.22	4.22	4.18	4.19	4.21	4.16	4.17	4.18
Leadership	.0000	.055	3.71	3.73*	3.73	3.92	3.93	3.95*	3.90	3.92	3.93
Learning	.0002	< .001**	3.78	3.71*	3.71	3.67	3.63*	3.64	3.57	3.56	3.53*
Love	.0002	< .001**	3.87	3.90*	3.88	4.04	4.02	4.05	3.98	3.99	4.02*
Perseverance	.0002	< .001**	3.74	3.78*	3.77	3.87	3.85	3.86	3.81	3.83	3.82
Perspective	.0001	< .001**	3.76	3.77	3.78	3.90	3.91	3.92	3.73	3.76*	3.74*
Prudence	.0001	.007	3.73	3.75	3.76	3.73	3.72	3.73	3.66	3.68	3.68
Self-Regulation	.0001	< .001**	3.30	3.32	3.33	3.26	3.24	3.26	3.23	3.24	3.23
Social Intelligence	.0001	.002**	3.97	3.98	3.96*	3.88	3.88	3.89	3.81	3.84*	3.82
Spirituality	.0003	< .001**	2.64	2.67*	2.61*	3.42	3.39	3.42	3.02	2.99*	2.98
Teamwork	.0001	.006	3.87	3.89*	3.88	3.81	3.83	3.85*	3.82	3.84*	3.85
Zest	.0002	< .001**	3.53	3.57*	3.53*	3.63	3.62	3.64	3.52	3.54	3.55
Virtues											
Caring	.0001	.005	−0.12	−0.11	−0.12	0.03	0.02	0.04*	−0.08	−0.07	−0.06
Inquisitive	.0001	.048	−0.04	−0.04	−0.05	0.03	0.03	0.03	−0.05	−0.04	−0.04
Self-Control	.0002	< .001**	−0.02	0.00*	0.00	0.03	0.02	0.03	−0.02	−0.01	−0.02
M	.0001			0.02	0.01		0.01	0.01		0.02	0.01

*Least square mean significantly different than that for the prior time period ($p < .05$ with Tukey-Kramer adjustment)
**$p < .002$
Note. Means for Time 2 columns were computed using the absolute values of the differences between Time 1 and Time 2 strengths. Means for Time 3 were computed using the absolute values of the differences between Time 2 and Time 3 strengths. Virtues were omitted from these computations since they were on a different scale, but did not change the means markedly.

such events (as in the case of the two 2012 attacks examined by Schueller et al., 2015), has a greater effect on strength scores. However, mean change showed little difference for Time 2 versus Time 3.

Taken together, the results suggest that these significant findings are random spurious findings resulting from large samples. All three countries showed significant variations in teamwork and learning, but teamwork was no longer significant after controlling for age and gender. Significant differences in the following strengths: fairness, forgiveness, gratitude, humor, leadership, humility, and in one virtue, were no longer significant after controlling for age and gender. Beauty, kindness and social intelligence all increased in the U.S. and Australian samples, but not in the French sample. Perhaps this is the function of changes resulting from events in the U.S. and Australia, but it is not clear why these specific strengths would be changing. Likewise, zest increased in the U.S. and Australian samples and initially increased but then decreased in the French sample. The variations in hope, perseverance, perspective, and spirituality did not consistently differ between those in France versus those in the U.S. and Australia and appeared to be particularly random. Similar to the results obtained by Schueller et al. (2015), there was no discernible pattern to these changes. The amount of variation across time periods across all three countries was quite similar.

Results were similar for factor scores, providing no evidence to suggest that these results can be attributed to measurement error. Explanation of the findings based on systematic variations in samples over time was also evaluated and not supported. However, only age and gender were available for this test; other

person variables could have played an important role, such as differences in the education or socioeconomic status of those approaching the site. It would be worthwhile for future studies to explore other covariates. While the unrestricted availability of the online VIA-IS allows for the collection of large samples very quickly, it is limited as a data source for this type of research because there are no validity checks to detect careless responding. While careless responding is relatively unlikely on the VIA-IS itself, since individuals are approaching the site to complete the inventory in exchange for feedback about their character strengths, the same cannot be said for demographic variables. Finally, it is possible that different types of adverse events may impact character strengths differently. For example, a personal trauma such as a sexual assault may result in a very different impact on character strengths than a more communal event, particularly if the individuals were not exposed to the communal event directly. We did not have control over who visited the website to take the survey, and we had no ability to ascertain or include information about the extent to which participants had been personally affected by the attacks.

In summary, we believe that the best explanation for these findings (as well as the findings from prior studies utilizing similar designs) is that they represent random variation in the characteristics of individuals approaching the VIA website. These findings suggest that the use of sequential samples as a proxy for longitudinal prospective samples in PTG research should be undertaken and interpreted with great caution. Although there are significant practical challenges to collecting prospective longitudinal data on PTG, the current findings suggest that researchers cannot infer the variables most likely to change in the wake of collective trauma on the basis of sequential samples such as this one with any real confidence. The findings from the current study and those from Schueller et al. (2015) – both of which used comparison groups – found there to be no consistent pattern of changes in personal strengths after collective traumas. Thus, as other researchers have argued (Jayawickreme & Blackie, 2014; Jayawickreme & Blackie (2016); Tennen & Affleck, 2009), this study shows that PTG is a research topic that requires prospective longitudinal data in order to make meaningful scientific advancement.

Importantly, the current study findings also cannot conclude that PTG is not a true and observable phenomenon. Although we found no evidence of a consistent pattern of change in personal strengths that was attributed solely to the event-affected sample from France, there is a reason to reserve judgment on the veracity of PTG. First, our data demonstrated that there were no differences between groups of individuals completing the VIA-IS questionnaire before and after the two terrorist attacks in Paris in 2015, but our design did not collect repeated measures from the same participants across the time points. In the current design, we cannot rule out the possibility that some individuals completing the questionnaire after the attacks may have already experienced some changes in personal strengths. To be able to infer conclusively on PTG, we need baseline data to determine participants' pre-trauma levels. Second, we selected participants that had completed the questionnaire in Paris at our selected time points, but we do not know the nationality of the individuals or the extent to which they were affected by the trauma. Tedeschi and Calhoun (2004) have maintained it is the personal significance of the trauma that makes PTG possible, not simply that the event occurred.

In summary, we set out in the current study to investigate the methodological value of using large multinational sequential sample data as a proxy for prospective longitudinal data to address questions of PTG. The findings of our study contribute to the existing literature that have utilized this method and the VIA-IS measure (Peterson & Seligman, 2003; Schueller et al., 2015), yet our findings indicate that there is limited value to this approach. As no discernable pattern of results was found, researchers interested in investigating the veracity of PTG cannot rely on this literature to guide their hypotheses, and should abandon this method for examining the veracity of PTG. Nonetheless, our study does demonstrate the importance of using appropriate comparison groups when making inferences about differences. This is a methodological insight that even prospective longitudinal PTG studies can apply in order to separate out patterns of change caused by trauma from more normative patterns of change evidenced in appropriate control groups.

Note

1. These three dimensions may be said to overlap with the PTG dimensions of increased appreciation for life, increased sense of personal strength, greater appreciation for relationships (Caring), the perception that new possibilities exist in one's life (Inquisitiveness), and personal strength (Self-Control).

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Disclosure statement

Robert McGrath is a Senior Scientist with the VIA Institute on Character, the copyright holder for the VIA Inventory of

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