**Perceived Characteristics of Life Events –
Short-Term Changes in Prosociality and Empathy?**

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This paper has been accepted for publication in the *European Journal of Personality* on 22 June, 2021.

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The final article will be available, upon publication, via its DOI:
10.1177/08902070211031762

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We thank our research assistants for their help with the literature search, data collection, and coding of major life events: Nick Augustat, Charlotte Michel, Merle Widlock, and Kira Wolff.

Funding statement:

Preparation for this manuscript was supported by a generous award by the Pathways to Characters Project (John T. Templeton Foundation and Arizona State University) to Maike Luhmann (Subagreement Number 18-385).

Abstract

Post-traumatic growth can be understood as positive change in desirable personality traits after adverse life events. However, recent research questioned whether adversity is a relevant, necessary, and sufficient condition for change in desirable personality traits. Using five-wave longitudinal data, this study explored changes in the desirable personality traits prosociality and empathy before and after life events. We included all life events participants had experienced between the second and third assessment, that is, adverse, ambiguous, and positive events. Participants rated their life events on the Event Characteristics Questionnaire which assesses the individual perception of life events on nine continuous dimensions: *challenge, emotional significance, extraordinariness, external control, impact, valence, social status change, predictability* and *change in world views*. We used multilevel growth curve models to explore changes in prosociality and empathy as a function of these event characteristics. Prosociality and empathy remained stable in the assessment period of six to nine months after the reported life event, independently of whether the event had been perceived as adverse or not. We discuss our findings with respect to the inclusion of positive and ambiguous events as predictors of personality change and with respect to its theoretical implications for post-traumatic growth and personality development more broadly.

Introduction

Theories of post-traumatic growth state that experiencing an adverse life event can lead to growth in desirable personality traits (Jayawickreme & Blackie, 2014; Tedeschi & Calhoun, 1996). These theories postulate that recovering from adverse life events, which involves processes such as rebuilding cognitive schemata and meaning-making of the event, provides individuals with a broader range of capacities (Jayawickreme & Blackie, 2014; Park, 2010; Tedeschi & Calhoun, 2004) that may ultimately result in positive changes in desirable personality traits such as empathy and prosociality (e.g., “altruism born of suffering” hypothesis; Staub & Vollhardt, 2008; Vollhardt, 2009). Although post-traumatic growth refers, by its very nature, to a process that unfolds over time, early research has predominantly relied on cross-sectional designs in which individuals who had recently experienced an adverse life event were asked to report any perceived changes. This approach has a number of limitations, the most serious one being that perceived changes may not correspond to actual changes in personality traits (Infurna & Jayawickreme, 2019; Jayawickreme et al., 2021; Jayawickreme & Blackie, 2014).

One way to overcome these limitations is to integrate research on post-traumatic growth with research on personality development. From this integrated perspective, post-traumatic growth can be conceptualized as positive personality change that occurs after adverse life events (Jayawickreme & Blackie, 2014). Changes in personality traits after life events are also increasingly studied in the personality development literature (e.g., Bleidorn et al., 2018), and this literature provides empirical and theoretical insights that can be applied to post-traumatic growth (Jayawickreme et al., 2021). For example, personality change surrounding life events can only be meaningfully captured with prospective longitudinal study designs in which the outcome is measured multiple times before and after the event (Bleidorn et al., 2020; Luhmann et al., 2014). Studies using such prospective longitudinal data to study changes in the Big Five personality traits after life events have provided inconsistent findings. Some studies found that

the Big Five personality traits can change in reaction to some life events (e.g., Lüdtke et al., 2011; Vaidya et al., 2002), whereas others found no or few significant effects (e.g., Denissen et al., 2019). Similarly, variables that are traditionally of interest in the post-traumatic growth literature (so-called “character strengths”) have been found to change after some life events but not after others, and these divergent findings can even be found for events that appear similar, for example, terrorist attacks (Peterson & Seligman, 2003) and mass shootings (Schueller et al., 2015).

One approach to explain the divergent findings for different life events that has been used in both research fields is to focus on the valence of the events (e.g., Lüdtke et al., 2011). In the post-traumatic growth literature, a current debate centres on whether the perceived valence of a life event—and especially its adversity—is the relevant, necessary, and sufficient condition for personality change (Jayawickreme et al., 2021; Luhmann et al., 2014; Mangelsdorf et al., 2019). Therefore, Jayawickreme and colleagues (2021) proposed to move beyond the predominant focus on adverse events and instead “consider assessing multiple perceived characteristics of [...] events” (p. 5).

This paper is one of the first to take up this call and systematically examine the relation between perceived characteristics of life events and changes in personality traits in a longitudinal study. We focused on two personality traits that are frequently studied as indicators of post-traumatic growth: prosociality and empathy (e.g., El-Gabalawy et al., 2020; Frazier et al., 2013; Greenberg et al., 2018; Vollhardt, 2009). Using prospective longitudinal data, we examined to what extent life-event related changes in these variables are associated with how these life events are perceived by those who experienced them. For this purpose, we applied the taxonomy by Luhmann et al. (2020) which comprises nine continuous dimensions of event characteristics: (1) *challenge* (amount of stress and anxiety associated with the event), (2) *emotional significance* (extent to which the event elicited strong feelings), (3) *extraordinariness* (extent of how extraordinary the event was), (4) *impact* (extent to which one’s life has changed

due to the event), (5) *external control* (extent to which the event was controlled or caused by others), (6) *valence* (positive and negative aspects of the event), (7) *social status change* (extent of negative changes in one's social status), (8) *predictability* (extent to how predictably the event had occurred), and (9) *change in world views* (extent to which one's views have changed due to the event). Of these nine characteristics, valence has been studied quite systematically. A recent meta-analysis showed that contrary to early theorizing, positive personality change can occur not only after negative events, but also after positive events (Mangelsdorf et al., 2019). For this reason, our analyses do not focus explicitly on traumatic or negative events, but we included any events participants reported, that is, positive, negative, and ambiguous events.

Furthermore, there is initial evidence that other characteristics of major life events are also relevant to explain personality change. For example, the distinction between dependent and independent events (which conceptionally overlaps with the event characteristic external control of the taxonomy by Luhmann et al., 2020) has been applied in several studies: dependent and independent events seem to influence personality in a different manner (e.g., Conway et al., 2018 Kandler et al., 2012 Rakhshani & Furr, 2021 Shiner et al., 2017). Apart from that, one could imagine that other event characteristics such as the predictability of a break-up or the social status change due to job loss might also be related to personality change. We therefore additionally explored whether the other event characteristics included in the taxonomy by Luhmann et al. (2020) explained event-related changes in prosociality and empathy.

Prosociality Development and Event-Related Changes in Prosociality

Prosocial behaviour is described as intentional and voluntary actions aimed at benefitting others (Luengo Kanacri et al., 2017). It combines different behaviours such as caring, comforting, donating, helping, and sharing (e.g., Eisenberg et al., 2006). Prosociality stabilizes in late childhood or in early adolescence (Caprara, Steca, et al., 2005). Longitudinal studies show no age-related changes from ages 16 to 26 (e.g. Alessandri et al., 2014) and

increases from 30 years of age until a peak in mid-adulthood (36 to 52 years) and a subsequent decline for an age group of 53 to 92 years (Shane et al., 2021). A recent meta-analysis shows higher altruism in adults aged 60+ years than in younger adults (18-35 years) with a decline in very old adults (Sparrow et al., 2021). Furthermore, prosociality is generally higher in females than in males (Caprara, Steca, et al., 2005; Shane et al., 2021). Consequently, when analysing event-related changes in prosociality, both gender and age should be controlled for.

Adverse life events have been found to increase prosociality. Assessing two specific adverse life-events retrospectively, in their first cross-sectional study, Vollhardt and Staub (2011) found an increased disposition to volunteer in undergraduate students with such adverse experiences. This finding is supported by El-Gabalawy et al. (2020) who, in a similar cross-sectional design, asked undergraduate students for the worst event that ever occurred to them. They found the severity of the event to be an important predictor for increases in prosocial behaviour. Another important factor is the time since the event occurrence. Frazier et al. (2013) found 18 to 20 year olds who reported having experienced a traumatic event within eight weeks prior to the assessment to engage in more helping behaviours after the event than people who did not experienced such an event. Although the exact time between the event occurrence and the assessment of prosocial behaviour was not controlled for, their study provides first evidence that the experience of an adverse event may lead to an increase in prosocial helping behaviour during a time frame of up to eight weeks. Yet, the onset and the persistence of this increase are unclear and should be further explored.

Empathy Development and Event-Related Changes in Empathy

Empathy is defined as the ability to understand and to feel what others feel. It is part of moral development and can be understood as a motivational component of prosocial behaviour (Caprara, Steca, et al., 2005; Grühn et al., 2008). Empathy encompasses perspective taking, empathic concern, and prosocial moral reasoning, which A. N. Davis and Carlo (2018) define

as socio-cognitive and emotive elements of personality. In adolescents, these elements have been identified as mechanisms that can lead to prosocial behaviours aiming at alleviating distress in others (Fabes et al., 1999). In adult samples, empathy has also been found to motivate prosocial behaviour (Sze et al., 2012) and to have various prosocial correlates (Allemand et al., 2015). Caprara, Capanna, et al. (2005) define perspective taking as an integral component of adult prosociality because helping others implies the ability to feel and to correctly interpret their needs. Thus, this element is necessary to understand a request for help and to of help adequately. This might be an explanation for why, as described by Eisenberg et al. (2009), empathetic individuals are considered as more socially competent, less aggressive, and to have more supportive peer relations than less empathetic individuals.

Age and gender are also associated with empathy. In term of empathic concern and perspective taking, empathy increases during young adulthood (O'Brien et al., 2013; Oh et al., 2020) and similarly to prosociality, there is a peak in mid-adulthood with a very slow decline afterwards (O'Brien et al., 2013). Regarding feelings of sympathy, older adults score higher than younger adults, but in emotion recognition, it is the other way around (Wieck et al., 2021). Furthermore, women tend to show more empathic concern than men (O'Brien et al., 2013, Oh et al., 2020, Sze et al., 2012; Wieck et al., 2021). Thus, gender and age should be controlled for when analysing empathy.

Regarding event-related changes in empathy, Lim and DeSteno (2016) found increasing severity of past life event adversity to predict higher levels in empathic concern and perspective taking. The authors assessed frequency, recency and severity of adverse life events retrospectively with checklist in two cross-sectional studies (one with a undergraduate sample and one with a more heterogenous sample aged 22 to 74 years). Furthermore, empathic concern and perspective taking were linked to a stable tendency to feel compassion for others in need. In two cross-sectional studies, Greenberg et al. (2018) found adults (age ranges 19 to 65 and 18 to 65) with childhood trauma to score higher in one (Study 1) and two (Study 2) empathy

measures than adults without childhood trauma. Similarly, asking for the worst event participants had ever experienced, in a cross-sectional study with undergraduate students, El-Gabalawy et al. (2020) found more perceived post-traumatic growth the more adverse events had been experienced, and they found empathy, especially empathic concern, to be related to higher levels of post-traumatic growth. Thus, very severe adverse life events may increase empathy in an enduring manner. At the same time, recent life events also lead to increases in empathy (Lim & DeSteno, 2016), but it remains unclear how persistent such changes are. These results indicate that negative valence alone is not the only characteristic of a life event responsible for changes in empathetic capacities. It is also important how much time passed since the adverse event and how severe or impactful these events were.

The Present Study

In the present paper, we aimed to intertwine existing knowledge on post-traumatic growth and broader personality change surrounding life events. We used a prospective longitudinal study design with multiple measurements of empathy and prosociality before and after a life event. Moreover, we assessed perceived event characteristics to explore whether valence or other event characteristics are associated with event-related changes in empathy and prosociality. We had no concrete hypotheses regarding these associations. The analysis plan for this study was preregistered at <https://osf.io/vrcmu/>. As we had used part of the data included in this study in previous analyses, the preregistration includes an overview of these previous applications. We report any deviations from this preregistration in Table S1 in the Supplemental Material.

Methods

Procedure

Data were taken from the *What's Next Study*, a one-year longitudinal online survey with five assessments (T1 to T5). At each assessment, the participants completed various questionnaires assessing their personality (including prosociality and empathy). Additionally, they were asked to report the most important life event they had experienced since the last assessment and to report the perceived characteristics of this event using the Event Characteristics Questionnaire (ECQ; see below). For an overview of all scales and the items used in the *What's Next Study* see <https://osf.io/kvf5g/>. The scales were displayed in randomized order, and the items were randomized within each scale. At each assessment, the survey duration was about 20-25 minutes. For our analyses, we used the ECQ data of events that had occurred between T2 and T3 and were described at T3 (Table S2 provides an overview which events were described by the participants). Consequently, there was a maximum of two pre-event measures (T1 and T2) and three post-event measures (T3, T4 and T5) of the outcomes prosociality and empathy.

Participants

Participants were recruited through social media platforms and at German universities in summer and autumn 2018. To motivate participation, there were voucher raffles with increasing incentives after each assessment and at the end of the study. The initial sample size at T1 was $N = 779$. We excluded participants with false or no responses on any of two instructed response items at each assessment ($N = 82$ at T1, $N = 28$ at T2, $N = 31$ at T3, $N = 35$ at T4 and $N = 19$ at T5) and participants who had finished the survey in less than 10 minutes ($N = 11$ at T1, $N = 10$ at T2, $N = 18$ at T3, $N = 17$ at T4 and $N = 8$ at T5)¹. Because our analyses focused

¹ This exclusion criteria are stricter than preregistered, see Table S1 in the Supplemental Material.

on a life event reported at T3, we further excluded participants with incomplete data on the ECQ at T3 and those who reported an event that had occurred before T2, that is, not between T2 and T3. We also excluded participants with incomplete data on prosociality, perspective taking, and empathic concern at T2 and T3. This reduced the sample to $N = 320$ (238 female, 82 male) at T2 and T3. The samples sizes and gender distribution for each assessment are provided in Table S4 in the Supplemental Material; sample sizes for each outcome at each assessment analysis are furthermore provided in Table 1. The mean age (assessed at T1) of the final sample was 22.1 years ($SD = 4.12$, range 18-51 years).

Table 1. Sample sizes, scale means and Cronbach's α coefficients for prosociality, empathic concern, perspective taking and ECQ scales.

Scale	T1				T2				T3				T4				T5			
	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α
<u>Prosociality Scale</u>	318	3.64	0.74	.80	320	3.52	0.68	.78	320	3.54	0.74	.80	257	3.51	0.73	.80	256	3.53	0.71	.80
<u>IRI-Empathic concern</u>	318	3.63	0.72	.67	320	3.64	0.68	.65	319	3.65	0.70	.63	257	3.61	0.70	.70	256	3.68	0.72	.70
<u>IRI-Perspective Taking</u>	317	3.67	0.69	.64	320	3.69	.068	.74	320	3.71	0.67	.73	257	3.71	0.64	.74	256	3.78	0.66	.82
ECQ valence									320	3.82	1.27	.96								
ECQ <u>challenge</u>									320	3.36	1.15	.86								
ECQ <u>emotional significance</u>									320	3.86	0.92	.84								
ECQ <u>external control</u>									320	2.61	1.15	.88								
ECQ <u>extraordinariness</u>									320	2.25	0.97	.87								
ECQ <u>impact</u>									320	3.46	0.96	.75								
ECQ <u>predictability</u>									320	3.45	1.29	.92								
ECQ <u>social status change</u>									320	1.30	0.58	.85								
ECQ <u>change in world views</u>									348	2.67	0.92	.80								

Notes. ECQ assessment at T3 only

Measures

Descriptive statistics and Cronbach's α for all scales used in this study and for all assessments are provided in Table 1.

Perceived event characteristics. At each assessment, participants reported the most important event they had experienced since the last assessment and then evaluated this event with the ECQ (37 items as in Study 5 in Luhmann et al., 2020). The items were rated on a five-

point Likert scale ranging from “strongly disagree” to “strongly agree”. Responses were reverse-scored when appropriate and averaged to form a scale score where higher values reflect higher levels of the respective life event characteristic. Figure S1 shows the density distributions of the nine event characteristics.

Prosociality. Prosociality was assessed with a self-developed six-item short form of the Prosociality Scale (original Scale by Caprara, Steca, et al., 2005, German items listed at <https://osf.io/kvf5g>). Items were rated on a 5-point Likert scale ranging from “(almost) never” to “(almost) always”. There were no reverse coded items. Items were averaged and higher values reflected higher levels of prosociality.

Empathy. In accordance with previous research (Lim & DeSteno, 2016; Oh et al., 2020), we used the subscales empathic concern and perspective taking of the Interpersonal Reactivity Index (M. H. Davis, 1983; Koller & Lamm, 2015) as empathy measures. Each scale consisted of three items rated on a 5-point Likert scale ranging from “never” to “always” (self-developed short form listed at <https://osf.io/kvf5g/>). There were no reverse coded items. Items were averaged and higher values reflected higher levels of empathic concern and perspective taking, respectively.

Given that Caprara, Capanna, et al. (2005) and Caprara, Steca, et al. (2005) had included “empathy” in the Prosociality Scale, Table S2 displays the correlations of prosociality, empathic concern and perspective taking at all five assessments. The three correlations were significant at each assessment. Empathic concern and prosociality were correlated around $r = .50$ at all assessments, whereas perspective taking was correlated between $r = .14$ and $r = .31$ with empathic concern and prosociality. These correlations indicate that it is important to distinguish between different facets of empathy and that empathic concern is closer to the empathy concept of the Prosociality Scale.

Statistical Analyses

Data preparation for analyses

We examined changes in prosociality, empathic concern, and perspective taking before and after a life event with multilevel growth curve models. Data preparation was as follows: Using the R package *lubridate* (Grolemund & Wickham, 2011), we calculated the exact time in weeks between each assessment and the event reported at T3. This procedure resulted in negative time scores for T1 and T2 and in positive time scores for T3, T4 and T5. We standardized the outcomes prosociality, empathic concern, and perspective taking on the T2 mean and standard deviation, that is, on the immediate pre-event level, so that changes in these outcomes can be interpreted in pre-event standard deviation units. The ECQ-subscales were standardized on their grand mean and standard deviation unless the scale mean was lower than 2.5 or higher than 3.5, that is, too far from the scale midpoint. In these cases, the respective ECQ-subscales (emotional significance, extraordinariness, social status change, and valence) were centred on the scale midpoint (3.0) and standard deviation. We chose this procedure to ensure that simple slopes (for + 1 SD and – 1 SD) do not fall outside the range of the response format for this scale (ranging from 1 to 5).

Time variables

Based on the exact timing of the event before and after all assessments, we calculated two time variables to account for changes in the outcomes before and after the event²:

- (1) A linear variable *pre_lin* in which all positive time counts were scored zero. This variable reflected the number of weeks before the event occurrence and allowed us to explore possible pre-event changes in the outcome variables.
- (2) A linear variable *post_lin* in which all negative time counts were scored zero. This variable reflected the number of weeks since the event and allowed us to analyse changes in the outcomes after the event.

² This procedure deviates from the preregistration, cf. Table S1 in the Supplemental Material.

Modelling strategy

Using the R package *lmerTest* (Kuznetsova et al., 2017), we applied a step-wise modelling strategy, starting with a basic random intercept model which was extended by including random slopes and Level-2 predictors. Due to the exploratory nature of our analyses, the significance level for all test was set at 0.01.

First, we estimated a basic random intercept model for each outcome that included only the Level-1 time variables *pre_lin* and *post_lin*. We then extended the model for each outcome variable by including a quadratic time variable *post_qua* ($post_lin^2$) to test whether the changes after the event were non-linear. As this inclusion did not improve the model fit for any outcome, we dropped the quadratic time variable. Next, we extended the basic model by including random slopes for *pre_lin* and *post_lin*. As this model did not converge for any of the outcomes, random slopes were excluded. Finally, we included age and gender as covariates as well as interaction effects between gender and the two time variables to test for gender-related changes in both *pre_lin* and *post_lin*. Since main effects of gender and age were significant for at least one outcome and since there are theoretical reasons to take them into account (as described above), we kept them as covariates in all analyses. However, interaction effects between gender and *pre_lin* and *post_lin* were not statistically significant for any outcome, so that we excluded them in the following analyses. Consequently, in our final basic model, we predicted the outcomes by age, gender, *pre_lin* and *post_lin* with fixed slopes (Model 1). This model allowed to examine average changes in the outcomes before and after the event, controlling for age and gender.

Second, we included the cross-level interaction between the event characteristic *valence* (at Level 2) and *post_lin* (at Level 1) to test whether the perceived valence (i.e., negativity vs. positivity) of an event moderated changes in prosociality, empathic concern, and perspective taking (Model 2). Third, we added all other event characteristics as additional Level-2 predictors to test whether there were main effects of the remaining event characteristics on

either of the three outcomes (Model 3). To check whether all event characteristics taken together explained differences in the outcomes, we compared the model fit of Models 2 and 3. Main effects of event characteristics would indicate that specific event characteristics are associated with the absolute level of the outcomes. Finally, we tested three-way interactions between *post_lin*, *valence*, and the remaining eight event characteristics, separately for each event characteristic (Models 4a to 4h). These models allowed us to examine the relation between the other event characteristics and possible event-related changes in the outcomes. Equations for our all models are provided in Table S5.

Results

Prosociality

For prosociality, Model 1 with *pre_lin*, *post_lin*, age and gender as predictors revealed a statistically significant effect of *pre_lin* ($b = -0.009$, $SE = 0.002$, $p < .001$) indicating a decline in prosociality before the event occurred. There was no effect for *post_lin* ($b = 0.002$, $SE = 0.002$, $p = .189$) indicating stability after the event. Furthermore, we found main effects for both age and gender ($b = -0.229$, $SE = 0.051$, $p < .001$ and $b = -0.532$, $SE = 0.126$, $p < .001$ respectively) but not interactions with the time variables. Women reported higher prosociality than men, and younger participants reported higher prosociality than older participants.

After adding valence as the first ECQ-subscale for cross-level-interactions (Model 2), there was neither a significant main effect for valence ($b = 0.029$, $SE = 0.052$, $p = .577$) nor a significant cross-level interaction between valence and *post_lin* ($b = -0.001$, $SE = 0.001$, $p = .556$). Thus, valence did not predict any post-event changes in prosociality.

The inclusion of the other ECQ-subscales (Model 3) significantly improved model fit ($\chi^2(8) = 21.20$, $p = .007$). Emotional significance was a significant predictor ($b = 0.227$, $SE = 0.056$, $p < .001$), indicating that participants scoring higher in prosociality rated the reported life events higher on emotional significance.

The results of the three-way interactions between *post_lin*, valence and the remaining ECQ-subscales are summarized in Table 2. Overall, post-event changes in prosociality were not significantly related to the different event characteristics using our strict significance level of $p < .01$. However, three effects were significant under more traditional levels of significance. First, there was a two-way-interaction of impact and *post_lin* ($b = -0.003$, $SE = 0.001$, $p = .042$), second, a three-way interaction of *post_lin*, external control and valence ($b = -0.002$, $SE = 0.001$, $p = .035$) and third, a two-way interaction of changes in worlds views and valence ($b = 0.124$, $SE = 0.050$, $p = .013$), but the latter subscales did not interact with *post_lin*. To visualize the overall pattern, all two-way interactions of the ECQ subscales and *post_lin* are displayed in Figure S2.

Table 2. Fixed effects coefficients for longitudinal growth curve models with *pre_lin* and *post_lin* as time variables for prosociality with three-way interactions between time variables, valence, and one event characteristic (EC).

Predictor	Valence		Challenge		Emotional significance		External control		Extraordinariness		Impact		Predictability		Social status change		Changes in world views	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
(Intercept)	-0.24	.189	-0.22	.260	-0.16	.421	-0.23	.211	-0.27	.155	-0.22	.233	-0.23	.215	-0.22	.256	-0.11	.583
Weeks before event (<i>pre_lin</i>)	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001	-0.01	<.001
Weeks after event (<i>post_lin</i>)	<0.01	.215	<0.01	.260	0.01	.116	<0.01	.165	<0.01	.279	<0.01	.208	<0.01	.527	<0.01	.294	<0.01	.275
Valence	0.07	.268	0.08	.278	-0.01	.900	0.08	.228	0.12	.101	0.06	.281	0.06	.415	0.21	.197	0.06	.312
Challenge	0.02	.803	<0.01	.962	0.01	.912	0.02	.743	0.01	.861	0.01	.902	0.01	.816	0.01	.892	<0.01	.985
Emotional significance	0.23	<.001	0.23	<.001	0.18	.018	0.23	<.001	0.23	<.001	0.23	<.001	0.23	<.001	0.23	<.001	0.23	<.001
External control	-0.04	.476	-0.03	.511	-0.03	.560	-0.07	.236	-0.03	.619	-0.04	.468	-0.04	.504	-0.03	.513	-0.03	.629
Extraordinariness	-0.06	.244	-0.06	.252	-0.05	.339	-0.06	.285	-0.01	.067	-0.06	.292	-0.06	.258	-0.06	.241	-0.05	.377
Impact	0.12	.041	-0.12	.038	-0.11	.054	-0.12	.034	-0.11	.048	-0.11	.105	-0.12	.040	-0.11	.044	-0.12	.028
Predictability	0.01	.928	0.01	.930	0.01	.878	<0.01	.954	0.01	.920	0.01	.812	0.03	.682	0.01	.900	0.03	.676
Social status change	-0.02	.743	-0.02	.788	-0.02	.717	-0.01	.811	-0.02	.744	-0.01	.821	-0.02	.723	-0.02	.726	0.02	.761
Change in world views	0.01	.841	0.01	.840	0.01	.802	-0.01	.815	0.02	.747	0.01	.859	0.01	.838	0.01	.822	-0.07	.306
Gender: Male	-0.51	<.001	-0.51	<.001	-0.52	<.001	-0.52	<.001	-0.51	<.001	-0.51	<.001	-0.51	<.001	-0.52	<.001	-0.52	<.001
Age	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001	-0.24	<.001
EC x valence (for weeks after event <i>post_lin</i>)			0.03	.608	0.06	.289	0.06	.200	0.07	.133	0.02	.792	-0.02	.706	0.05	.344	0.12	.013
Weeks after event (<i>post_lin</i>) x EC	<0.01	.841	<0.01	.636	<0.01	.296	<0.01	.375	<0.01	.972	<0.01	.042	<0.01	.295	<0.01	.139	<0.01	.184
Weeks after event (<i>post_lin</i>) x EC x valence			<0.01	.647	<0.01	.244	<0.01	.035	<0.01	.730	<0.01	.164	<0.01	.598	<0.01	.122	<0.01	.479

Notes. EC = focal event characteristic. The EC (continuous predictors) were standardized: challenge, external control, impact, predictability and change in world views on the total sample mean and T3 standard deviation, valence, emotional significance, extraordinariness and social status change on the scale midpoint (3) and the T3 standard deviation. Regression coefficients for standardized predictors reflect effects in standard deviation units. Weeks before event (*pre_lin*) and weeks after event (*post_lin*) reflect the number of weeks before and after the event. Gender was a categorical variable (female, male) with female as the reference category.

Empathic Concern

For empathic concern, Model 1 with *pre_lin*, *post_lin*, age and gender as predictors revealed no significant changes in the time variables ($b = -0.001$, $SE = 0.002$, $p = .662$ for

pre_lin and $b = 0.001$, $SE = 0.002$, $p = .533$ for *post_lin*), but main effects for both age and gender ($b = -0.130$, $SE = 0.048$, $p < .001$ and $b = -0.706$, $SE = 0.122$, $p < .001$ respectively).

Women scored higher on empathic concern than men, and younger participants scored higher than older ones. There were no interactions of gender or age with the time variables.

After adding valence as the first ECQ-subscale for cross-level-interactions (Model 2), there was neither a significant main effect for valence ($b = -0.030$, $SE = 0.050$, $p = .544$) nor a significant cross-level interaction with *post_lin* and valence ($b = <0.001$, $SE = 0.001$, $p = .897$). Thus, valence was not significantly associated with any post-event changes in empathic concern.

The inclusion of the other ECQ-subscales (Model 3) improved model fit ($\chi^2(8) = 30.95$, $p < .001$). Emotional significance was a significant predictor ($b = 0.194$, $SE = 0.053$, $p < .001$): Participants scoring higher in empathic concern rated the reported life events higher on emotional significance.

Table 3. Fixed effects coefficients for longitudinal growth curve models with *pre_lin* and *post_lin* as time variables for empathic concern with three-way interactions between time variables, valence, and one event characteristic (EC).

Predictor	Valence		Challenge		Emotional significance		External control		Extraordinariness		Impact		Predictability		Social status change		Changes in world views	
	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p
(Intercept)	-0.07	.679	-0.12	.554	-0.02	.929	-0.07	.748	-0.08	.634	-0.08	.659	-0.06	.754	-0.11	.546	<-0.01	.984
Weeks before event (<i>pre_lin</i>)	<-0.01	.590	<-0.01	.578	<-0.01	.579	<-0.01	.591	<-0.01	.588	<-0.01	.572	<-0.01	.594	<-0.01	.597	<-0.01	.597
Weeks after event (<i>post_lin</i>)	<-0.01	.192	<-0.01	.003	<-0.01	.253	<-0.01	.199	<-0.01	.286	<-0.01	.187	<-0.01	.401	<-0.01	.217	<-0.01	.268
Valence	0.04	.450	0.06	.325	<-0.01	.971	0.06	.380	0.07	.297	0.05	.456	0.03	.705	-0.03	.846	0.05	.475
Challenge	0.02	.729	0.07	.394	0.02	.799	0.03	.659	0.02	.765	0.02	.707	0.02	.750	0.02	.705	0.01	.840
Emotional significance	0.19	<.001	0.19	<.001	0.15	.026	0.19	<.001	0.20	<.001	0.19	<.001	0.19	<.001	0.19	<.001	0.19	<.001
External control	-0.12	.014	-0.12	.002	-0.12	.018	-0.15	.009	-0.11	.022	-0.12	.014	-0.12	.019	-0.12	.014	-0.12	.020
Extraordinariness	-0.12	.030	-0.11	.030	-0.11	.043	-0.11	.042	-0.13	.024	-0.11	.030	-0.11	.034	-0.12	.030	-0.10	.046
Impact	-0.11	.039	-0.10	.047	-0.11	.047	-0.12	.030	-0.11	.043	-0.08	.237	-0.11	.036	-0.11	.039	-0.11	.033
Predictability	-0.04	.432	-0.04	.436	-0.04	.458	-0.05	.407	-0.04	.437	-0.05	.422	-0.01	.887	-0.04	.428	-0.03	.554
Social status change	0.03	.606	0.03	.629	0.03	.621	0.03	.532	0.03	.604	0.03	.637	0.03	.637	0.02	.754	0.05	.407
Change in world views	0.07	.210	0.07	.211	0.07	.198	0.07	.194	0.07	.183	0.07	.206	0.07	.208	0.07	.213	0.05	.556
Gender: Male	-0.57	<.001	-0.57	<.001	-0.57	<.001	-0.59	<.001	-0.58	<.001	-0.57	<.001	-0.58	<.001	-0.57	<.001	-0.58	<.001
Age	-0.12	.015	-0.16	.002	-0.12	.015	-0.14	.013	-0.12	.014	-0.12	.017	-0.11	.017	-0.12	.015	-0.12	.015
EC x valence (for weeks after event <i>post_lin</i>)			-0.05	.440	0.03	.528	0.05	.275	0.04	.392	-0.03	.570	-0.03	.543	-0.03	.603	0.04	.357
Weeks after event (<i>post_lin</i>) x EC	<-0.01	.871	<-0.01	.091	<-0.01	.821	<-0.01	.904	<-0.01	.858	<-0.01	.060	<-0.01	.210	<-0.01	.564	<-0.01	.866
Weeks after event (<i>post_lin</i>) x EC x valence			<-0.01	.067	<-0.01	.318	<-0.01	.968	<-0.01	.842	<-0.01	.078	<-0.01	.660	<-0.01	.205	0.16	.152

Notes. EC = focal event characteristic. The EC (continuous predictors) were standardized: challenge, external control, impact, predictability and change in world views on the total sample mean and T3 standard deviation, valence, emotional significance, extraordinariness and social status change on the scale midpoint (3) and the T3 standard deviation. Regression coefficients for standardized predictors reflect effects in standard deviation units. Weeks before event (*pre_lin*) and weeks after event (*post_lin*) reflect the number of weeks before and after the event. Gender was a categorical variable (female, male) with female as the reference category.

The results of the three-way interactions between *post_lin*, valence and the remaining ECQ-subscales (Models 4a - 4h) are summarized in Table 3. There were no changes in empathic concern that could be explained by certain characteristic of the experienced events, as none of the interaction effects of *post_lin* with the event characteristics were significant. The two-way interactions of *post_lin* with the ECQ-subscales are displayed in Figure S3. The mean levels of empathic concern remained stable after life events in our study.

Perspective Taking

For perspective taking, Model 1 with *pre_lin* and *post_lin*, age and gender as predictors revealed no effect for *pre_lin* ($b = 0.003$, $SE = 0.002$, $p < .294$). *Post_lin* revealed an increase which was insignificant with our strict criterion but significant under more traditional levels of significance ($b = 0.004$, $SE = 0.002$, $p = .023$). In contrast to the other two outcomes, there were no significant main effects for age and gender in perspective taking in the basic random intercept model. There were also no interaction effects of age or gender with the time variables.

After adding valence as the first ECQ-subscale for cross-level-interactions (Model 2), there was neither a significant main effect for valence ($b = 0.029$, $SE = 0.048$, $p = .553$) nor a significant cross-level interaction with *post_lin* and valence ($b = -0.001$, $SE = 0.001$, $p = .412$). Thus, valence was not significantly associated with post-event changes in perspective taking.

The inclusion of the other ECQ-subscales (Model 3) improved model fit ($\chi^2(8) = 20.42$, $p = .009$). Emotional significance and social status change were significant predictors ($b = 0.140$, $SE = 0.052$, $p = .006$ and $b = -0.157$, $SE = 0.052$, $p = .003$ respectively), indicating that participants scoring higher in perspective taking reported events with higher emotional significance and lower social status change.

The results of the three-way interactions between *post_lin*, valence and the remaining ECQ-subscales (Models 4a – 4h) are summarized in Table 4. There were no significant interaction effects of *post_lin* with the event characteristics. The (insignificant) main effect of *post_lin* was largely unaffected by the event characteristics.

Table 4. Fixed effects coefficients for longitudinal growth curve models with *pre_lin* and *post_lin* as time variables for perspective taking with three-way interactions between time variables, valence, and one event characteristic (EC).

Predictor	Valence		Challenge		Emotional significance		External control		Extraordinariness		Impact		Predictability		Social status change		Changes in world views	
	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p
(Intercept)	-0.46	.007	-0.40	.026	-0.44	.018	-0.45	.009	-0.46	.008	-0.44	.011	-0.50	.004	-0.53	.004	-0.44	.015
Weeks before event (<i>pre_lin</i>)	<0.01	.210	<0.01	.209	<0.01	.221	<0.01	.208	<0.01	.211	<0.01	.207	<0.01	.204	<0.01	.208	<0.01	.209
Weeks after event (<i>post_lin</i>)	<0.01	.021	<0.01	.046	<0.01	.121	<0.01	.026	<0.01	.058	<0.01	.021	0.01	.014	0.01	.053	<0.01	.029
Valence	<0.01	.968	-0.01	.815	<0.01	.989	<0.01	.939	0.01	.878	<0.01	.977	0.05	.438	-0.08	.622	<0.01	.991
Challenge	0.03	.644	-0.04	.627	0.02	.670	0.03	.618	0.03	.645	0.02	.733	0.03	.597	0.03	.591	0.02	.685
Emotional significance	0.14	.005	0.15	.005	0.12	.078	0.14	.007	0.14	.007	0.14	.006	0.14	.008	0.14	.007	0.14	.007
External control	-0.01	.868	<0.01	.974	-0.01	.900	<0.01	.935	-0.01	.879	-0.01	.859	-0.02	.693	-0.01	.830	-0.01	.904
Extraordinariness	0.09	.090	0.09	.088	0.09	.086	0.09	.084	0.08	.133	0.09	.078	0.08	.121	0.09	.091	0.09	.085
Impact	-0.06	.217	-0.07	.171	-0.06	.226	-0.07	.203	-0.06	.221	-0.09	.160	-0.06	.287	-0.06	.214	-0.07	.208
Predictability	0.05	.348	0.05	.357	0.05	.339	0.05	.360	0.05	.350	0.06	.297	-0.01	.930	0.05	.369	0.05	.325
Social status change	-0.16	.003	-0.15	.005	-0.16	.003	-0.15	.004	-0.16	.003	-0.15	.005	-0.15	.005	-0.18	.002	-0.15	.006
Change in world views	0.01	.851	0.01	.845	0.01	.840	0.01	.838	0.01	.847	0.01	.872	0.01	.884	0.01	.876	-0.01	.906
Gender: Male	-0.16	.132	-0.17	.107	-0.16	.128	-0.17	.124	-0.16	.132	-0.17	.124	-0.16	.134	-0.16	.148	-0.16	.130
Age	-0.02	.629	-0.03	.571	-0.02	.628	-0.02	.620	-0.02	.627	-0.03	.594	-0.03	.574	-0.02	.615	-0.23	.619
EC x valence (for weeks after event <i>post_lin</i>)			0.07	.253	<0.01	.986	0.01	.765	0.01	.802	0.03	.462	0.09	.065	-0.03	.605	0.03	.478
Weeks after event (<i>post_lin</i>) x EC	<0.01	.429	<0.01	.929	<0.01	.829	<0.01	.285	<0.01	.825	<0.01	.705	<0.01	.769	<0.01	.282	<0.01	.644
Weeks after event (<i>post_lin</i>) x EC x valence			<0.01	.844	<0.01	.169	<0.01	.644	<0.01	.614	<0.01	.456	<0.01	.286	<0.01	.949	<0.01	.278

Notes. EC = focal event characteristic. The EC (continuous predictors) were standardized: challenge, external control, impact, predictability and change in world views on the total sample mean and T3 standard deviation, valence, emotional significance, extraordinariness and social status change on the scale midpoint (3) and the T3 standard deviation. Regression coefficients for standardized predictors reflect effects in standard deviation units. Weeks before event (*pre_lin*) and weeks after event (*post_lin*) reflect the number of weeks before and after the event. Gender was a categorical variable (female, male) with female as the reference category.

Discussion

In a longitudinal study of 320 young adults, we explored event-related changes in prosociality, empathic concern and perspective taking within six to nine months after a life event. We found that these traits remained relatively stable after a life event and that perceived valence and other perceived characteristics of life events were not related to such changes. However, the event characteristics emotional significance and social status change were related to the absolute levels of the outcomes.

Our findings are contradictory to previous findings from cross-sectional studies on event-related changes in prosociality and empathy (El-Gabalawy et al., 2020; Greenberg et al., 2018; Vollhardt & Staub, 2011). In most of these cross-sectional studies, participants who experienced an adverse event retrospectively indicated whether they subjectively *perceived* growth after the event. The Post-Traumatic Growth Inventory (Tedeschi & Calhoun, 1996),

used for example in El-Gabalawy et al. (2020), consists of items such as: “I discovered that I’m stronger than I thought I was”. To respond to such an item, participants are asked to recall their trait level before the event to estimate the magnitude of the trait change since the event and to evaluate the extent to which this trait change can be attributed solely to the experience life event (Ford et al., 2008). As this procedure has several methodological issues (e.g., limited ability to accurately recall a previous trait level), more recent studies tried to assess post-traumatic growth with prospective longitudinal designs. This growing body of literature indicates that *actual* growth (i.e., quantifiable change instead of global self-perceptions) in desirable personality traits after life events may be less widespread than *perceived* growth. For example, the meta-analysis by Mangelsdorf and colleagues (2019) found only little evidence for post-traumatic growth for outcomes such as meaning in life or spirituality after adverse life events. Consequently, our results of rather stable mean levels of desirable personality traits surrounding life events are in line with longitudinal findings indicating that post-traumatic growth may be less universal than initially assumed.

In our study, we did not specifically focus on adverse events but we asked participants to rate the most important event experienced within the last three months, including negative, ambiguous, and positive life events. As Figure S1 shows, the reported events were rather positive than adverse. Advocates of post-traumatic growth may argue that our lack of significant changes in prosociality and empathy may be due to our inclusion of positive and ambiguous events as, per definition, post-traumatic growth can only occur after adversity. However, the meta-analysis by Mangelsdorf and colleagues (2019) suggests that growth in desirable personality traits may occur equally or may be even more frequent after positive than after negative life events. Looking at the broader research field of personality change, this finding is consistent with some longitudinal studies on personality traits such as the Big Five reporting little or no changes after both positive and negative life events (e.g., Denissen et al., 2019). Contextual theories of personality development such as social investment theory (Roberts et al.,

2005) highlight the importance of major life events for personality change (Bleidorn et al., 2013; Denissen et al., 2019). Social investment theory assumes that personality changes as people invest into new roles after a life transition (Roberts et al., 2005). Our results find no evidence for this notion for the desirable personality traits empathy and prosociality.

One explanation for the absence of significant changes in this study might be a lack of statistical power. To investigate the plausibility of this explanation, we ran power simulations using our strict level of significance of $\alpha = 1\%$ and a power of 80% with the R-package *simr* (Green & MacLeod, 2016). Results indicated that our sample size was sufficient to detect a two-way interaction between time and the event characteristics of $b \approx 0.0055$. This means that we were able to detect a 0.33 SD difference at T5 in trajectories of individuals rating a certain event characteristic either as high (+ 1 SD) or as low (– 1 SD). Thus, if the event perceptions predicted post-event changes in prosociality or empathy, these effects would have to be small.

Our results show that two event characteristics, emotional significance and social status change, are related to the absolute levels of the outcomes. Individuals with higher levels of prosociality and empathy rated their events as more emotionally significant, and individuals with higher levels of perspective taking rated their events lower on social status change than individuals with lower levels on these variables. This is especially interesting as the events reported in this study scored generally very low in social status change. There are at least two possible explanations for these associations. First, they might reflect selection effects such that high levels of prosociality and empathy might predispose people to *experience* more emotionally significant and fewer social status-threatening events. Second, these associations might reflect selective reporting effects as we did not assess all events that occurred between measurement occasions but rather asked participants to report the single most important or memorable event they had experienced in this time frame. Prosociality and empathy might be systematically related to which event participants chose to report. For example, individuals who

care for others and who are sensitive to others' needs, that is, individuals who have high levels on prosociality and empathy, may be more emotionally perceptive as well (Werner et al., 1977).

Limitations and Future Directions

Our longitudinal study only covered a time frame of six to nine months after the event occurrence. This time frame allowed us to track short-term changes in prosociality and empathy, but no long-term changes. As Jayawickreme et al. (2021) state, personality assessment captures characteristics a person normally has and thus, relatively stable traits. If empathic concern, perspective taking and prosociality were also such stable personality traits, to assess positive personality changes as enduring changes in desirable personality traits, a longer time frame of several years with various assessments during that time period would be desirable. In addition, post-traumatic growth is understood as the recovery process from a difficult phase. This process might take much longer than 6 or 9 months, and it is therefore possible that the timeframe used in the present study was too short to detect any significant growth. More research is needed to better understand the temporal dynamics of character growth and personality development more generally (Bleidorn et al., 2018; Jayawickreme et al., 2020).

A replication of our findings with larger, more diverse samples and longer time frames of observations is needed. The present sample comprises mainly young adults (mean age = 22.1 years; $SD = 4.12$). Some life events typically examined in the post-traumatic growth literature (e.g., death of a spouse, severe illness) rarely happen during young adulthood. However, Roberts et al. (2005) describe the domains of love and work to be associated with personality change. These domains influence life from late adolescence on, and thus, adversity in these domains (e.g. jobloss or breakup) is typical in young adulthood. Nonetheless, as Figure S1 shows, the events described by our sample were rather positive than negative, they were not very impactful and did not change the participants' social status. Thus, the type of adversity (or positivity) experienced by our participants might not have been impactful enough

to trigger change in prosociality and empathy. If financial problems were a consequence of being left by a spouse, for example, this would worsen a person's social status whereas for another person, a breakup would not cause such and social status change. Considering (perceived) event characteristics is thus important to understand associations of life events and personality change. Future studies should thus sample individuals who experienced a certain adverse event and longitudinally assess their individual perception of this event as well as their personality. Such data could analyse to what extent personality growth is associated with (changes in) the perception of certain adverse life events and whether there are age or gender differences in recovery processes after adversity.

Finally, empathy and prosociality are by far not the only outcomes relevant for post-traumatic growth. Future research may thus investigate whether a re-evaluation in one's relationships, worldviews, or priorities in life may change related to the event characteristics studied here (Jayawickreme et al., 2021; Joseph et al., 2006; Tedeschi & Calhoun, 2004). Such views and evaluations may change more easily than apparently rather persistent traits like prosociality and empathy.

Conclusion

This study aimed at uncovering the association between perceived life event characteristics and changes in prosociality and empathy to better understand post-traumatic growth as positive personality change after life events. In a sample of young adults, we found prosociality and empathy to be quite stable personality traits. Perceived characteristics of life events were not significantly associated with any changes in either personality trait within six to nine months after the event occurrence.

Data Accessibility Statement

The data and the R script files for the data cleaning process and for all analyses can be accessed at <https://osf.io/u6x93/>.

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