Fachbereich Erziehungswissenschaft und Psychologie

der Freien Universität Berlin

Does growth require suffering?

Positive personality changes following major life events with high emotional valence

Dissertation

zur Erlangung des akademischen Grades

Doktor der Naturwissenschaften (Dr. rer. nat.)

vorgelegt von

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Staatsexamen Mathematik/ Musik

Master of Applied Positive Psychology

Berlin, Oktober 2017

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Disputation: 24.11.2017

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Acknowledgments

I would like to express my sincere gratitude and appreciation to my advisor Dr. Michael Eid. In times when very few professors took on Ph.D. students in my research area, he not only allowed me to become part of his lab, but also to work on my field of interest. His unmitigated scientific, methodological, and financial support of my research allowed me to outgrow my personal limits. Thank you for the abundance of valuable advice and for being a role model for how to handle family life in academia!

Special thanks go to Gabi Tiemer, who through all the years of my dissertation, supported me in every imaginable way.

In addition, my great appreciation goes to all the people who helped us with taking care of our son Joshua in the uncounted hours of work on my dissertation.

Last but not least, I would like to thank Dr. Martin Schultze for his statistical supervision, as well as our research assistants, without whom this work would not have been possible.

Abstract

"What doesn't kill us makes us stronger." This famous notion of the German philosopher Friedrich Nietzsche emphasizes a deep conviction concerning the development of human nature (Joseph, 2011). It highlights the idea that our worst experiences in life might have a silver lining and - after the initial suffering they cause - result in long-term benefits.

The phenomenon, that potentially traumatic life events can result in personal growth, has gained broad scientific attention in the last few years. Tedeschi and Calhoun (2004) described the term posttraumatic growth as beneficial psychological changes that occur as a result of struggling with highly challenging life situations. Going further, the pioneering work of Roepke (2013) has suggested that not only our worst, but also our best experiences might result in personal growth. While posttraumatic growth has been extensively studied in previous research, growth after positive experiences has rarely ever been addressed in existing literature. Thus, one critical question has not been answered: Does growth require suffering?

In spite of the growing number of publications, a lot of previous research has suffered from severe methodological shortcomings. First, most studies focused exclusively on negative events as possible catalysts for growth and neglected the possibility of personality changes following positive experiences. Additionally, the question of specific mechanisms that lead to personal growth has rarely been addressed in previous publications (Park & Helgeson, 2006). Finally, most studies relied on the retrospective self-perception of change, instead of using external indicators or longitudinal data, as suggested by leading experts in the field (Jayawickreme & Blackie, 2016). This dissertation has aimed to address these shortcomings and contribute to the scientific body investigating growth following life's best and worst experiences.

The goal of **Study 1** was to estimate the impact of a broad array of life events in a cross-cultural design, in order to quantify the experience of major life events and to compare the influence of positive and negative experiences. Participants from the USA (n = 555) and India (n = 599)

were provided with a revised version of the Social Readjustment Rating Scale (Holmes & Rahe, 1967). The results indicate that US American participants perceived negative events as more impactful, while Indian participants rated events with positive valence as more important. Study 1 showed that the negativity bias and the belief that negative events have a greater impact on our lives (Baumeister, Bratslavsky, Finkenauer, & Vohs; 2001) are not universal, but in part a cultural artifact.

Study 2 aimed to identify general key factors which promote posttraumatic and postecstatic growth. Based on previous research, I suggested a process model that includes three factors facilitating personal growth after positive and negative events, namely meaning-making, supportive relationships, and positive emotions. The results of US American (n = 342) and Indian (n = 341) participants indicated that posttraumatic and postecstatic growth are highly interrelated and that the model predicts growth after positive, as well as negative, experiences across countries.

Study 3 was a longitudinal MRI study with the goal of identifying structural neural correlates of coping strategies that are likely to contribute to personal growth. We recruited pregnant women and followed them through pregnancy and the first months of parenthood. Before childbirth, women answered questions about their proactive coping behavior, measured with the Personal Growth Initiative Scale (PGIS-II; Robitschek et al., 2012). One month and then four months after delivery, structural brain data were acquired. For $N = 22$ women, postpartal MRI data were available. Prenatal PGI levels were correlated with gray matter volume after birth through voxel-based morphometry. Personal growth initiative before childbirth was positively associated with postpartal gray matter volume in the ventromedial prefrontal cortex, a brain region that shows reductions in participants suffering from posttraumatic stress disorder (PTSD).

Study 4. Most research on posttraumatic growth is based on cross-sectional data. This circumstance has been identified as one of the most critical aspects of previous research (Frazier

et al., 2009; Jayawickreme & Blackie, 2014; 2016). In order to investigate actual benefits of positive and negative life events, we conducted Study 4, a large-scale meta-analysis based on longitudinal studies, including 364 effect sizes. The results indicate that genuine personal growth exists in the areas of self-esteem, social relationships, and environmental mastery. The findings show that genuine growth can occur as a result of positive as well as negative events.

In summary, people can grow as much from life's best as from its worst experiences. The notion that "bad is stronger than good" (Baumeister et al., 2001) is rather a cultural bias than a universal truth. Factors such as meaning-making, supportive relationships, positive emotions, and proactive coping are more critical for growth than the valence of the event encountered. This dissertation showed that suffering is a possible, but not necessary, prerequisite for personal growth.

Zusammenfassung (Abstract in German)

Braucht menschliches Wachstum das Erleben von Leid? Die Überzeugung, dass einschneidende Lebensereignisse zu Persönlichkeitswachstum führen können, hat in den vergangenen zwei Jahrzehnten stark an wissenschaftlicher Aufmerksamkeit gewonnen. Durch den Fokus auf traumatische Ereignisse als Katalysatoren persönlicher Entwicklung entstand dabei die weithin geteilte Auffassung, dass Leid und dessen Bewältigung eine notwendige Voraussetzung für Persönlichkeitswachstum nach einschneidenden Erlebnissen ist. Gleichzeitig weist ein Großteil existierender Publikationen erhebliche methodische Mängel auf: Die Mehrheit der bisherigen Studien untersuchte ausschließlich negative Ereignisse als mögliche Katalysatoren für psychologisches Wachstum und vernachlässigte damit die Möglichkeit, dass auch positive Ereignisse zu Persönlichkeitsveränderungen führen könnten. Außerdem wurde kaum der Frage nachgegangen, welche spezifischen psychologischen Mechanismen zu diesen Veränderungsprozessen führen (Park & Helgeson, 2006). Schlussendlich operationalisierten die meisten Studien Persönlichkeitswachstum nicht in einem längsschnittlichen Design, wie es von führenden Experten des Feldes geraten wurde (Jayawickreme & Blackie, 2016). Stattdessen wurden Teilnehmer gebeten, post-hoc einzuschätzen, inwieweit sie ein spezifisches Ereignis in bestimmten Lebensbereichen geprägt hat.

Die vorliegende Dissertation hatte zum Ziel, diese methodischen Defizite systematisch aufzuarbeiten und damit einen Beitrag zum wissenschaftlichen Diskurs über Persönlichkeitswachstum nach einschneidenden Erlebnissen zu leisten.

Studie 1 zielte darauf, den Einfluss eines breiten Spektrums verschiedener Lebensereignisse messbar zu machen, um damit den Vergleich zwischen Erlebnissen mit positiver und negativer Valenz zu ermöglichen. Hierzu wurde ein kulturvergleichendes Design umgesetzt, um mögliche kulturelle Unterschiede abzubilden. Teilnehmern aus den USA (n = 555) und Indien (n = 599) wurde eine revidierte Version der Social Readjustment Rating Scale

(Bewertungsskala der sozialen Wiederanpassung; Holmes & Rahe, 1967) vorgelegt. Amerikanische Teilnehmer nahmen negative Ereignisse als einschneidender wahr, während indische Teilnehmer Ereignisse mit positiver Valenz als bedeutsamer erlebten. Studie 1 hat gezeigt, dass der „negativity bias“, die Annahme, dass negative Ereignisse den größeren Einfluss auf unser Leben haben (Baumeister et al., 2001), zumindest teilweise ein kulturelles Artefakt ist.

Studie 2 hatte zum Ziel, Schlüsselfaktoren zu identifizieren, die zu posttraumatischem und postekstatischem Wachstum beitragen. Basierend auf vorangegangener Forschung wurde ein Modell zur Vorhersage von Wachstum vorgestellt, das drei zentrale Variablen beinhaltet: Sinnstiftung bezüglich des Ereignisses, sowie das Vorhandensein unterstützender Beziehungen und positiver Emotionen. Die Ergebnisse amerikanischer (n = 342) und indischer (n = 341) Teilnehmer haben ergeben, dass posttraumatisches und postekstatisches Wachstum in starkem Bezug zueinander stehen. Gleichzeitig hatte das Modell eine gute Passung und war in der Lage, Wachstum nach positiven und negativen Ereignissen in beiden Kulturen vorherzusagen.

Studie 3 war eine längsschnittliche MRT-Studie, die darauf abzielte, neuronale Korrelate von Bewältigungsfähigkeiten zu identifizieren, die zu persönlichem Wachstum beitragen. Für die Studie wurden schwangere Frauen rekrutiert, die ihr erstes Kind erwarteten. Einen Monat vor Entbindungstermin (T1) wurden proaktive Copingfähigkeiten mit der Personal Growth Initiative Scale (Skala zur Messung der Initiative für Persönlichkeitswachstum; PGIS-II; Robitschek et al., 2012) gemessen. Einen Monat und vier Monate nach Entbindung wurden strukturelle Bildgebungsverfahren (MRT) zum Einsatz gebracht. Mit Hilfe von Voxel-basierter Morphometrie wurden strukturelle Korrelate zwischen pränatalen proaktiven Copingfähigkeiten und postpartalen Volumen der grauen Substanz berechnet. Proaktive Copingfähigkeiten vor der Entbindung waren positiv assoziiert mit dem Volumen der grauen Substanz im ventromedialen präfrontalen Cortex nach der Geburt, einem Hirnareal, dessen Volumen bei PTBS-Patienten deutliche Reduktionen zeigt.

Studie 4. Die Mehrheit der Forschung im Bereich posttraumatischen und postekstatischen Wachstums basiert auf querschnittlichen Daten. Dieser Umstand wurde von führenden Wissenschaftlern der Disziplin als einer der kritischsten Aspekte bisheriger Forschung identifiziert (Frazier et al., 2009; Jayawickreme & Blackie, 2014). Dies gilt besonders deshalb, weil die retrospektive Einschätzung persönlicher Veränderungsprozesss nur eingeschränkt reliabel und valide ist. Um diesem Umstand zu begegnen und tatsächliche positive Auswirkungen einschneidender Erlebnisse zu untersuchen, haben wir eine umfassende Meta-Analyse aller längsschnittlichen Studien vorgenommen, die im Bereich Persönlichkeitsveränderung nach traumatischen und positiven Ereignissen existierten. Insgesamt umfasst die Meta-Analyse 364 eingeschlossene Effektstärken. Die Ergebnisse legen nahe, dass authentisches Persönlichkeitswachstum in den Bereichen Selbstwert, soziale Beziehungen und Alltagsbewältigung existiert. Die Studie zeigt, dass Persönlichkeitswachstum sowohl nach negativen als auch nach positiven Lebensereignissen auftreten kann.

Zusammengefasst zeigen die Ergebnisse der Dissertation, dass Menschen genauso an den besten Erlebnissen ihres Lebens wachsen können, wie an ihren schlimmsten Erfahrungen. Die Überzeugung, dass negative Erlebnisse den stärkeren Einfluss haben (Baumeister et al., 2001), ist eher eine kulturelle Verzerrung als eine universelle Wahrheit. Faktoren wie Sinnstiftung, unterstützende Beziehungen, positive Emotionen und proaktives Coping sind bedeutsamere Faktoren für Persönlichkeitswachstum nach einschneidenden Erlebnissen als die Valenz des Ereignisses. Die vorliegende Dissertation hat gezeigt, dass auch positive Lebensereignisse zu Persönlichkeitswachstum führen können und dass Leid eine mögliche, aber keine notwendige Voraussetzung für Persönlichkeitsentwicklung ist.

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CHAPTER 1

Introduction

1. Introduction

Many of the role models of our times, such as Mahatma Gandhi, Martin Luther King, and Nelson Mandela, are known not only for their heroism and their inspiring characters, but also for the struggles they have faced throughout their lives (Jayawickreme & Blackie, 2016). Tedeschi and Calhoun (1996) were among the first scientists to observe that patients who suffered from the aftermath of traumatic experiences also reported certain psychological gains, such as a deeper understanding of what life is really about (Tedeschi & Calhoun, 1996). Furthermore, Csikszentmihalyi and Beattie (1979) emphasized decades ago that the challenging events of our childhood not only shape our life story, but also our interpretation of reality and the course of our future. Thus, the potentially traumatic events we must encounter in life can either be risk factors for mental illnesses and suffering or opportunities for personal development.

Numerous researchers have acknowledged the possibility of thriving in the face of highly adverse events (for syntheses of scientific studies see: Prati & Pietrantoni, 2009; Sawyer, Ayers, & Field 2010; Vishnevsky, Cann, Calhoun, Tedeschi, & Demakis, 2010). Meanwhile, the idea that suffering or the struggle with traumatic experiences is a possible, but not strictly necessary path to personal growth, has rarely been investigated. In addition, researchers have emphasized that our life is dominated by the negativity bias (Rozin & Royzman, 2001) and therefore bad events have a stronger influence on us than good ones (Baumeister, Bratslavsky, Finkenauer, & 2001). However, since most of the research in the field focuses either exclusively on negative or on positive experiences, the question of the superior role of negative events for personal development has rarely been addressed. This dissertation aimed to systematically investigate the effects of major life events with both positive and negative valence on personal growth.

In the following sections major life events and their characteristics will be discussed, and the negativity bias – the assumption that negative events have a stronger influence on our lives – will be explained. Thereafter, I will introduce the concepts of posttraumatic and postecstatic growth, including their conceptualizations, measurements, and underlying mechanisms. The relationship between posttraumatic and postecstatic growth will be briefly addressed, before introducing facilitating factors of growth following major life events. Finally, I will address the shortcomings of previous research and provide an overview of the studies included in this dissertation.

1.1 Major life events and their influence on psychological functioning

The term *major life event* refers to a large array of experiences ranging from childhood abuse to falling in love. Major life events can be defined as experiences which often mark a critical transition or turning point in one's life (Elder, 1977), challenge our assumptive world (Filipp & Aymanns, 2010; Janoff-Bulman, 1992), and are important aspects of an individual's identity (McAdams & McLean, 2013). In retrospect, we often understand our lives as a row of life stages that are separated by major life events (Hareven, 2013), for example, life before and after childbirth.

One of the most salient characteristics of major life events is their psycho-emotional impact (Cohen, Barker, & White, 2017; Holmes & Rahe, 1967; Horowitz, Wilner, & Alvarez, 1979). This feature enables us to distinguish major life events from daily hassles and uplifts, which could be defined as everyday pleasant or unpleasant events (Graf, Ramsey, Patrick, & Gentzler, 2016). Filipp and Aymanns (2010) used the term critical life events to distinguish negatively valenced major, highly impactful life events from daily hassles. Based on Janoff-Bulman's (2004) theory of the assumptive worlds, which proposes that every person holds subjective theories that help us to explain the world we live in, critical life events are those experiences that shake our implicit assumptions. Thus, critical life events are characterized by

a strong psycho-emotional impact, since they challenge the fit of the individual-environment interaction (Filipp & Aymanns, 2010). Furthermore, they are associated with strong emotional reactions and demand socio-emotional readjustment in order to overcome the experience (Filipp & Aymanns, 2010).

An important question in life event research is how to evaluate the impact of a given experience in order to make events with different characteristics comparable (e.g., Brugha, Bebbington, Tennant, & Hurry, 1985; Cohen, Barker, & White, 2017; Holmes & Rahe, 1967; Sarason, Johnson, & Siegel, 1978). In their pioneering work, Holmes and Rahe (1967) asked participants to rank a given list of major life events based on their perceived impact and the necessary readjustment needed following each event. The original list of life events by Holmes and Rahe (1967) was criticized several times for the limited scope of the included life events (e.g., Tausig, 1982), for focusing on negative or ambiguous events (Cohen et al., 2017), and for assuming that the relative values of different events are generalizable across cultures (e. g., Zimmerman, 1983). However, the idea that the impact of major life events and the associated social readjustment are critical for an individual's well-being and health still remains prominent in the literature (e.g., Boss, Bryant, & Mancini, 2016; Knoll, Scholz, & Rieckmann, 2013)

Another important characteristic of major life events is their desirability (Cohen et al., 2017; Dohrenwend, Askenasy, Krasnoff, & Dohrenwend, 1978) or valence (Vinokur & Selzer, 1975). Life events can be classified as positive (generally desirable), negative (generally undesirable), or ambiguous (having desirable as well as undesirable aspects). An example of an ambiguous event is the birth of a child with Down syndrome. While childbirth is generally perceived as a positive event (Neuhaus, Piroth, Kiencke, Göhring, & Mallman, 2002), the diagnosis of an incurable condition for the baby would make it an ambiguous experience for many.

The valence or desirability of a life event and its developmental consequences can best be defined in terms of gains and losses (Uttal & Perlmutter, 1989). Positive events are usually

characterized by a gain of resources, such as a partner, role, position, or possibilities, while negative events are connected to a loss of or a potential threat to these assets. Thus, life events are usually described as positive, when the gains clearly outweigh possible losses (Dohrenwend, 1987). For example, most people consider childbirth a positive experience (Neuhaus et al., 2002), since having a baby afterwards outweighs the pain during labor. In contrast, for negative events the losses outweigh possible gains. Ambiguous or neutral experiences are characterized by the presence of gains as well as losses, while neither of them is clearly stronger than the other (Vinokur & Selzer, 1975). Recently, Cohen et al. (2017) introduced a standardized list of affect-related life events, which classifies events as positive, negative, or neutral and also rates their significance.

It is important to note that in this dissertation the valence of an event is defined as the overall desirability of the events as explained above. This approach is based on the general and not individual perception of specific events. Thus, there may be exceptions where the personal experience diverges from the general rule.

A special category of negative life events are traumatic experiences. The American Psychiatric Association (2013) defines traumatic events as exposure to death, sexual violence, or a serious injury. In contrast to other major life events, traumatic experiences are mostly associated with a severe threat to one's life or the life of another close person. Figure 1 comprises the conceptualizations of the different experiences introduced above. Furthermore, it highlights two aspects, which are critical for this dissertation. First, that this thesis is concerned with major life events (also referred to as critical events) that have a strong psycho-emotional impact for many people, and not with daily experiences. Second, we are interested in the similarities and differences between consequences of life events that are generally perceived as positive, negative, or ambiguous.

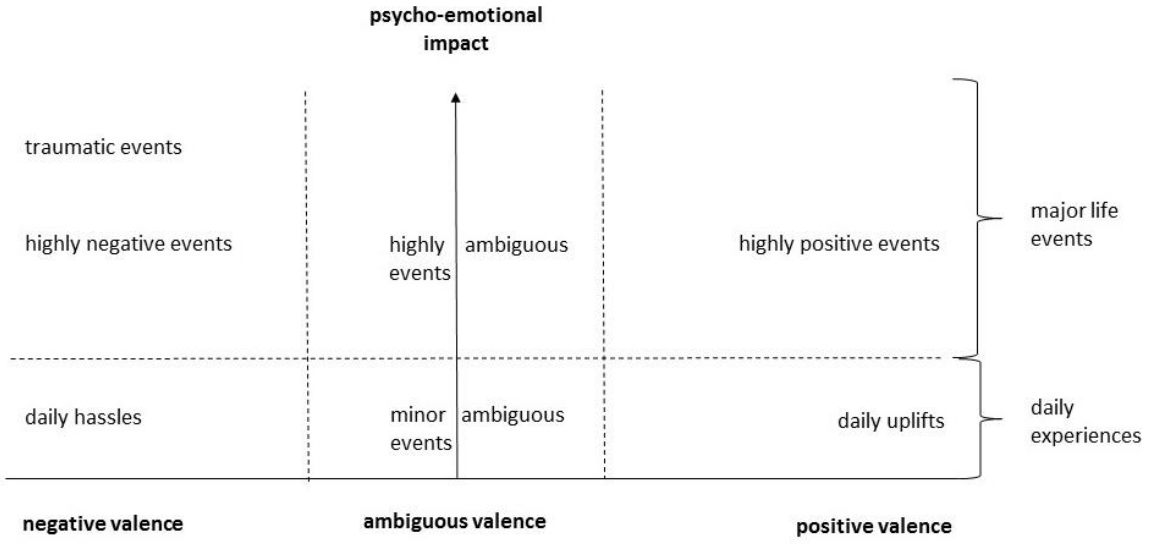

Figure 1. Overview of event categories.

When researchers refer to positive (Roepke, 2013) or negative events (Blonski, Conradi, Oldehinkel, Bos, & de Jonge, 2016) they usually mean major life events that have a high impact. In Figure 1, these experiences are coined "highly positive" or "highly negative" events, emphasizing the distinction between daily positive or negative experiences (hassles and uplifts), and major life events. As this dissertation focuses mainly on major life events, the terms positive or highly positive events, and peak experiences, are used interchangeably and refer to positively valenced major life events with a high psycho-emotional impact.

While the APA (2013) definition distinguishes between traumatic events, as defined above, and other negative life events, research on posttraumatic growth is not limited to events which meet the APA criteria. Instead, also other negative events, such as severe illnesses, are considered possible catalysts of posttraumatic growth (e.g., Danhauer et al., 2014; Gall, Charbonneau, & Florack; 2011; Silva, Crespo, & Canavarro, 2012) and are often referred to as (potentially) traumatic experiences. Following this general approach in growth literature, the terms negative, highly negative, traumatic, and potentially traumatic events are used interchangeably in this dissertation and refer to negatively valenced major life events.

1.2 The negativity bias

A question closely related to the valence and impact of major life events is the superiority of negative life events over positive ones (Baumeister et al., 2001). Rozin and Royzman (2001) define the negativity bias as the principle that "in most situations, negative events are more salient, potent, dominant in combinations, and generally efficacious than positive events" (p. 297). They acknowledge that there may be exceptions, but argue that these exceptions only apply to a minority of cases and are associated with special circumstances.

In their famous article entitled "Bad is stronger than good" Baumeister et al. (2001, p. 323) argue that the negativity bias is a universal phenomenon. They claim that bad events have greater power than good ones and argue that they are more impactful, since there is no corresponding positive concept to trauma, as can also be seen in Figure 1. Hence, they conclude that bad events have more intense and longer-lasting consequences. Following this assumption, it would be reasonable to assume that negative events should lead to more growth than positive ones.

A couple of widely cited articles have emphasized the superiority of the negative (Rozin & Royzman, 2001; Smith, Cacioppo, Larsen, & Chartrand, 2003; Vaish, Grossmann, & Woodward, 2008). However, most of these articles either investigated short-term consequences of negative and positive stimuli (Smith et al., 2003) or were based on theoretical considerations and the review of previous literature (Vaish et al., 2008). The negativity bias has hardly ever been studied systematically in the context of major life events. In addition, previous literature on the universality of the positivity bias in attribution found differences between cultures, indicating that psychological biases are sensitive to cultural influences (Mezulis, Abramson, Hyde, & Hankin, 2004). Thus, it appears to be an open question whether negative events lead to longer-lasting changes than positive ones.

1.3 Posttraumatic growth: conceptualizations, measurement, and underlying mechanisms

For decades, one of the main endeavors of research in clinical psychology has been to investigate the psychopathological consequences of traumatic life events as defined by the APA (2013), especially posttraumatic stress disorder (PTSD; e.g., Breslau, Davis, Andreski, & Peterson, 1991; Janoff-Bulman & Timko 1987; Liu & Miller, 2014;). PTSD is a psychopathological reaction that individuals can develop as a result of being exposed to an extreme stressor (following the APA criteria introduced above; Yehuda 2002). A PTSD diagnosis is given when a patient is exhibiting three types of symptoms more than one month after the event: avoidance of triggers associated with the event, hyperarousal, and re-experiencing the event through flashbacks or nightmares (Yehuda, 2002).

The study of PTSD interventions focused on the endeavor to help patients regain their pre-event level of psychological functioning and reduce PTSD symptoms (Kuester, Niemeyer, & Knaevelsrud, 2016; Olthuis et al., 2016; Yehuda, 2002). Meanwhile, the question of how to prevent the development of PTSD symptoms in the first place led to a new scientific perspective: the study of resilience (for a comprehensive review see Agaibi & Wilson, 2005).

Resilience is the "ability to maintain a stable equilibrium" in the face of potentially traumatic experiences (Bonanno, 2004, p. 20). In many studies, resilience is operationalized as the absence of PTSD symptoms and other pathological reactions after trauma exposure (e.g., Zerach, Solomon, Cohen, & Ein-Dor, 2013; Pietrzak et al., 2014; Horn, Charney, & Feder, 2016). A highly interesting finding of trauma research was that resilient reactions are not the exception, but the norm (Bonanno, 2004). Ozer, Best, Lipsey, and Weiss (2003) found that the majority of people experience at least one truly threatening event at some point in their life. However, only a small minority of people (5%-10%) develop post-traumatic stress symptoms (Ozer et al., 2003). Thus, the most common reaction to potentially traumatic events is indeed not PTSD, but resilience. In summary, trauma research has focused on the impairment of

psychological functioning due to extremely adverse events (e.g. Yehuda, 2002) or the absence of these reactions (Bonanno, 2004). With the scientific goal of better understanding the effects of traumatic experiences on mental illness, researchers have discounted another possible trajectory after serious life events: personal growth.

1.2.1 The conceptualization of posttraumatic growth

In their work with clinical patients, Tedeschi and Calhoun (1996) made an important observation. Namely, people who underwent traumatic events did not only report negative consequences of their traumatic experiences, but also beneficial changes. Across different potentially-traumatic events, people perceived that they had gained a deeper understanding of themselves and life in general because of the event they endured. Tedeschi and Calhoun (1996; 2004) labeled this phenomenon posttraumatic growth. They have identified five specific domains of posttraumatic growth, namely: *appreciation of life* (having an increased appreciation for life in general), *social relationships* (having more meaningful and deeper interpersonal relationships), *personal strength* (having an increased sense of personal strength, feeling stronger than before), *new priorities* (having changed priorities about what really matters in life), and *spirituality* (having an enhanced sense of spirituality, feeling connected to something bigger than oneself; Tedeschi & Calhoun, 1996; 2004).

Other authors refer to the same phenomenon with terms such as stress-related growth (Park, Cohen, & Murch, 1996), benefit finding (Tomich & Helgeson, 2004), or positive illusions (Taylor & Armor, 1996). Table 1 provides a systematic overview of the concepts and measurements of benefit finding, posttraumatic, and stress-related growth. In order to allow the comparison between growth concepts focusing on positive and negative events, Table 1 also includes the conceptualization of postecstatic growth (Roepke, 2013), detailed below.

Table 1

Growth concepts and their characteristics

	Posttraumatic growth	**Stress-related growth**	**Benefit-finding**	**Growth through adversity**	**Postecstatic growth**
Publication	Tedeschi & Calhoun (1996; 2004)	Park, Cohen, & Murch (1996)	Tomich & Helgeson (2004)	Joseph & Linley (2005)	Roepke (2013)
Definition	"Positive psychological change experienced as a result of the struggle with highly challenging life circumstances" (Tedeschi & Calhoun, 2004, p. 1)	"Positive changes in personal resources, social relationships, and coping skills" following negative life events (Park et al., 1996, p. 79)	"We refer to positive changes that result from the trauma of being diagnosed with cancer as benefit finding." (Tomich & Helgeson, 2004, p. 16)	"The observation that stressful and traumatic events can provoke positive psychological changes" (Joseph & Linley, 2005, p. 262)	Postecstatic growth is "a general term covering positive changes that result from a diverse range of positive experiences". (Roepke, 2013, p. 288)
Event valence	Negative	Negative	Negative	Negative	Positive
Subdomains	Deeper relationships A new appreciation of life Deeper sense of spirituality Enhanced personal strengths Seeing new possibilities	More social resources More personal resources Better coping skills	Family/ Relationships Increased social contact World views Career Daily activities Personal priorities Religion	Deeper relationships More self-acceptance More Autonomy More meaningful goals Better sense of mastery Personal growth	Deeper relationships More self-esteem Deeper sense of spirituality More meaning in life
Scale	Posttraumatic Growth Inventory (PTGI)	Stress-Related Growth Scale (SRGS)	Behr's Positive Contributions Scale (adapted version; Behr, Murphy, & Summers, 1991)	Psychological Well-being Scale (PWB; Ryff, 1989)	Inventory of Growth After Positive Experiences (IGPE)
Item example	"Indicate the degree to which this change occurred in your life as a result of your crises: My priorities about what is important in life [changed]."	Because of the critical event, I experienced "a prior relationsbip with another person became more meaningful."	Through my breast cancer experience, I "expanded my social contact with other women who have breast cancer."	"In general, I feel I am in charge of the situation in which I live."	Because of the positive event I experienced "I have more respect for myself."

While the different conceptualizations of growth after negative events share the conviction of beneficial changes following negative events, they include different subdomains. The concept of stress-related growth has arisen in psychological areas that are closely related to the coping process, such as the activation of personal and social resources and coping skills (Park et al., 1996). In contrast, posttraumatic growth also proposes changes in areas that might be independent from the concrete coping process, such as new priorities in life (Tedeschi & Calhoun, 1996). Thus, while stress-related growth suggests a training process through coping with negative events, the effects of which may not be long-lasting, posttraumatic growth proposes deep psychological changes that go beyond the psychological domains involved in the coping process. With the intention to improve Tedeschi and Calhoun's approach, Tomich and Helgeson (2004) introduced additional behavioral components, such as career (e.g., The experience "made me improve my job skills".) and daily activities (e.g., "I am now participating in more different activities"). The fourth concept, growth through adversity (Joseph & Linley, 2005), conceptualizes growth as enhanced psychological wellbeing (Ryff, 1989). While all three approaches have valuable aspects, the predominantly-used concept nowadays is posttraumatic growth (Jayawickreme & Blackie, 2014). Even authors that formally introduced other approaches have used the conceptualization of posttraumatic growth in more recent publications (e.g., Tomich & Helgeson, 2012)

This dissertation will coincide with the conceptualization of Jayawickreme and Blackie (2014), which understands posttraumatic growth as positive personality change following potentially traumatic events in the domains introduced by Tedeschi and Calhoun (1996). This conceptualization classifies posttraumatic growth as a developmental outcome which captures genuine changes in the five specific psychological areas introduced above. It is important to notice that these perceived benefits do not deny or demean the severity of the encountered events, but are a silver lining to them.

Helgeson, Reynolds, and Tomich (2006) have demonstrated in their meta-analysis of cross-sectional studies that posttraumatic growth is associated with greater wellbeing and less depression. Hence, it can be assumed that posttraumatic growth is a salutogenic outcome, which is adaptive and might help individuals to overcome trauma. When comparing to studies that have investigated the prevalence of resilience (Bonanno, 2004), the perception of posttraumatic growth appears to be a very common phenomenon. Longitudinal studies in the field found that 58-83% of the survivors of various forms of trauma report some kind of a positive change in at least one domain of life (Affleck, Tennen, Croog, & Levine, 1987; Affleck, Tennen, & Rowe, 1991; Joseph & Linley, 2004; McMillen, Smith, & Fisher, 1997; Sears, Stanton, & Danoff-Burg, 2003). Thus, the conviction "what doesn't kill us makes us stronger" seems to be true for many individuals.

An ongoing debate on the genuine nature of posttraumatic growth led to a critical conceptual distinction. Multiple authors have argued for making a differentiation between self-perceived and actual posttraumatic growth (Frazier et al., 2009; Jayawickreme & Blackie, 2014; 2016; Park & Helgeson, 2006). Perceived posttraumatic growth can be defined as the retrospective self-report of a person claiming to have changed for the better after an adverse life event. Genuine posttraumatic growth can be defined as an actual positive change in the psychological subdomains of posttraumatic growth as a result of struggling with the adverse event. While the majority of people perceive to have grown from their negative experiences when directly asked, through questions such as "Do you feel you have closer relationships now, because of the event?", it is not clear to which extent these perceptions reflect genuine personal changes, which could be conceptualized as a pre- and post-event difference (Jayawickreme & Blackie, 2016). Multiple researchers have argued that genuine posttraumatic growth should be assessed with prospective longitudinal studies, which allow researchers to directly investigate changes in the subdomains of posttraumatic growth through a comparison of pre- and post-event data (Frazier et al., 2009; Jayawickreme & Blackie, 2014; 2016; Park & Helgeson, 2006).

In one of the few studies examining the relationship of perceived and genuine posttraumatic growth in a prospective design, PTGI scores were only slightly related to independent measures of the subdomains (Frazier et al., 2009). However, since the given study has suffered from severe methodological flaws, such as a small time interval between measurements, independent scales not directly reflecting the subdomains of the PTGI and the sample (convenient sample of undergraduate students, while it was expected that a sufficient number of experiences of trauma in the period of the study would be present), the relationship of perceived and genuine growth is still unknown.

1.2.1 Measuring posttraumatic growth

The scales which are predominantly used to measure beneficial changes following negative life events are the PTGI (Tedeschi & Calhoun, 1996) and the SRGS (Park et al., 1996). Example items and subdomains are provided in Table 1. Both scales rely on the retrospective self-perception of change, asking participants to estimate the level of change they experienced in specific psychological domains as a consequence of the adverse event.

This approach may be challenging for the individual, since participants have to be able to judge their current standing in a certain domain, remember their former standing, and compare these estimations (Jayawickreme & Blackie, 2014). Thus, the PTGI and the SRGS are able to measure what is perceived, but not necessarily the genuine growth; since growth is not measured directly as a pre- and post-event difference. The vast majority of studies on posttraumatic growth relies on one of these measures, especially on the PTGI (Jayawickreme & Blackie, 2016).

In contrast, only a very limited number of previous studies has aimed to investigate the genuine nature of posttraumatic growth in longitudinal studies using other questionnaires to directly measure the subcomponents of posttraumatic growth at multiple time points (e. g., Frazier et al., 2009; Seery, Holman, & Silver, 2010; Yanez, Stanton, Hoyt, Tennen, & Lechner,

2011). However, the results of these studies indicate that genuine posttraumatic growth might exist, but it appears to be less common than the perception of posttraumatic growth.

Even though these facts have been recognized for more than a decade, there are very few longitudinal studies which are not based on measures of self-perceived change (e.g., Ransom, 2005). This dissertation includes both of these methodological approaches in order to investigate self-perceived and genuine growth.

1.2.2 Proposed mechanisms underlying posttraumatic growth

Previous research has shown that the occurrence of posttraumatic growth is influenced by personality characteristics, such as openness (Shakespeare-Finch, Smith, Gow, Embelton, & Baird, 2003; Kashdan & Kane, 2011) and event characteristics, including the level of traumatization (Moore, Varra, Michael, & Simpson, 2010) and the severity of the stressor (Park and Helgeson, 2006). However, the critical endeavor of research in the field remains the understanding of the particular mechanisms through which posttraumatic growth occurs. Many researchers agree that the experience of adverse events in and of itself is insufficient to promote personal growth (Jayawickreme & Blackie, 2016; Joseph & Linley; 2005; Tedeschi & Calhoun, 2004). Instead, the psychological processes following the potentially traumatic event are critical for the occurrence of positive personality changes.

The most prominent explanation for the development of posttraumatic growth is the disruption of core beliefs (Cann et al., 2010a) or assumptive worlds (Janoff-Bulman & Timko, 1987). Experiences, for instance losing a child or being diagnosed with a life-threatening illness, shatter our basic convictions and challenge our worldview (Cann et al., 2010a). Depending on the resources from which we can draw, these experiences can lead to long-lasting psychological impairments (for example PTSD) or facilitate personal growth through the process of reconstructing core beliefs (Cann et al., 2010b; Danhauer, Russell, Charlotte, & Jesse, 2013; Davis & Novoa, 2013) and reestablishing worldviews (Janoff-Bulman, 2004).

While there is a growing body of research investigating posttraumatic growth, there is hardly any scientific evidence that shows growth cannot only stem from trauma. A more likely assumption is that personal growth can also result from the best experiences encountered in life.

1.4 Postecstatic growth: conceptualization, measurement, and underlying mechanisms

When the concepts of posttraumatic growth (Tedeschi & Calhoun, 1996) and stress-related growth (Park et al., 1996) were introduced, they opened a new perspective for research investigating traumatic life events. However, since both research groups attributed the specific gains to the challenging struggle with highly adverse events, they neglected the possibility that positive experiences might lead to growth as well. Consequently, most studies in the field focused exclusively on traumatic events as possible catalysts for personal growth (e.g., Joseph & Linley, 2004; Swickert & Hittner, 2009; Larner & Blow, 2011). With this uni-directional approach, research on major life events excluded the possibility of personal growth after positive life events for years.

Taubman-Ben-Ari, Findler and Sharon (2011) were among the first researchers to investigate the possibility that personal growth might also stem from highly positive experiences. They studied perceived changes as a consequence of transitioning into parenthood, measured with an adapted version of the PTGI. After childbirth, which is generally considered a positive experience (Neuhaus et al., 2006), participants perceived that they had changed for the better as well (Taubman-Ben-Ari, Findler, & Sharon, 2011). Furthermore, research on positive turning points has shown that positive life events increase resilience and thereby support individuals to overcome future challenges (Gilligan, 2000).

1.4.1 The conceptualization of postecstatic growth

In the first year of this dissertation, Roepke (2013) proposed the formal concept of postecstatic growth. In contrast to the approach that Taubman-Ben-Ari and colleagues took, she suggested that growth after positive experiences is a distinct phenomenon. She used the term

ecstatic to describe highly positive events associated with strong positive emotions and, as suggested by the Greek term *ekstasis*, refer to a state of being, which lies outside the normal self and daily experiences (Roepke, 2013). Instead of a general theory of personal growth, she introduced a parallel concept to posttraumatic growth that relies on the positive valence of the event encountered. Roepke (2013) proposed that postecstatic growth occurs in specific areas, namely *spirituality* (having a closer connection to something bigger than oneself), *meaning* (having a clearer sense of the meaning of one's life), *social relationships* (having deeper and closer relationships), and *self-esteem* (having more self-esteem). As shown in Table 1, postecstatic and posttraumatic growth share the subdomains of social relationships and spirituality, while Roepke proposes that enhanced meaning in life and more self-esteem are growth areas, which are specific for positive events. Until now, Roepke's (2013) model is the only formal conceptualization of the phenomenon of postecstatic growth.

1.4.2 Measuring postecstatic growth

Roepke (2013) introduced the IGPE as the first, and until now only, instrument that is meant to assess perceived growth following positive life events. The IGPE assesses the extent to which individuals perceive to have grown from positive experiences (for an example item, see Table 1). Another research team used an adapted version of the PTGI in order to investigate growth following positive events (e.g., childbirth, grandmother-, or grandfatherhood; Taubman-Ben-Ari, Findler, & Sharon, 2011; Taubman-Ben-Ari, Findler, & Shlomo, 2012; Taubman-Ben-Ari, Shlomo, Sivan, & Dolizki, 2009). They concluded that participants also perceived to have grown from positive experiences and that the PTGI (with its subscales) is an appropriate measure for assessing growth following positive events (Taubman-Ben-Ari, 2009). Similar to studies investigating posttraumatic growth, the few studies that focused on postecstatic growth have also predominantly used cross-sectional approaches and therefore primarily investigated perceived and not genuine growth.

Even though postecstatic growth is still a new construct, which has only recently been investigated in a very small number of studies, the question concerning the measurement of growth and the genuine nature of self-perceived change also applies to postecstatic growth.

1.4.3 Mechanisms underlying postecstatic growth

Haidt (2003) suggested in his inspire and rewire hypothesis that experiences which inspire individuals have a beneficial impact on their values, social relationships, and self-concept. Perceptually vast positive stimuli can overwhelm existing mental structures, but can simultaneously facilitate their accommodation and contribute to the enhancement of a person's self-concept (Shiota, Keltner, & Mossman, 2007). Keltner and Haidt (2003) investigated the consequences of awe-inspiring positive events. They emphasized that highly positive experiences are often accompanied by an "inability to assimilate an experience into current mental structures" (p. 297). Thus, comparable to the idea of core-belief disruption (Cann et al., 2010a), positive experiences might also challenge the assumptive world (Janoff-Bulman, 2004) and require the establishment of new mental structures.

In addition, Fredrickson (2004) proposed in her broaden-and-build theory that experiences which evoke positive emotions broaden our thought-action repertoire and help to build long lasting resources. Thus, it is likely that the broadening character of positive emotions connected to positive life events facilitate the necessary accommodation, and thereby helps to promote postecstatic growth.

1.5 The relationship between posttraumatic and postecstatic growth

When Tedeschi and Calhoun (1996) introduced their concept of posttraumatic growth they only considered negative life events as possible sources for beneficial psychological changes. Nearly two decades later Roepke (2013) suggested that growth might also stem from positive experiences. She proposed that while there is a conceptual overlap between both phenomena and some shared subdomains (relationships and spirituality), both concepts are

distinct and specific for the valence of the life event encountered. While Roepke (2013) validated the IGPE with many other questionnaires, she did not assess the association of posttraumatic and postecstatic growth. Since then, both concepts have existed parallel to one another, while the relationship between the two has never been investigated.

However, Taubman-Ben-Ari et al. (2011; 2012) have shown that also after positive events, people report to have grown in subdomains of posttraumatic growth. In addition, the proposed mechanisms which underly posttraumatic as well as postecstatic growth suggest, that positive and negative events challenge existing mental structures and might lead to an enhanced self-concept through the accommodation of these experiences (e.g., Shiota et al., 2007; Tedeschi & Calhoun, 2004). Thus, it is still unknown if posttraumatic and postecstatic growth are distinct processes depending on the valence of the event, or cognate constructs that rely rather on the individual than on the valence of the encountered event.

In the following chapters, the general term post-event growth will be used to refer to beneficial personal changes that can stem from either positive or negative events.

1.6 Facilitators of growth

Probably one of the most interesting questions in growth research is why some people manage to derive benefits from major life events and change for the better, while others stay the same. What distinguishes individuals who react with growth following major life events from the others who do not?

Different facilitating factors of posttraumatic growth have been discussed in the literature, which will be briefly introduced in the following section. A more comprehensive discussion of these factors is included in chapters 2 and 3. It is important to acknowledge that while it might be possible to apply the given factors to positive events as well, they have been exceptionally investigated in the context of traumatic experiences.

Positive emotions. In a prospective longitudinal study, Fredrickson et al. (2003) showed that participants who had experienced a higher level of positive emotions prior to the 9/11 terror attacks were more likely to react with posttraumatic growth afterwards. Moreover, Norlander et al. (2005) have identified positive emotions as a critical facilitator of growth. According to Tugade et al. (2004), positive emotions promote the coping process by broadening one's thinking, attention, and behavioral skills and thereby support the establishment of new mental structures to accommodate critical experiences.

Supportive relationships. Social support is one of the most intensively studied facilitators of posttraumatic growth and the key environmental resource (Nez et al., 2010; Schaefer & Moos, 1998; Schroevers et al., 2010). The emotional and practical support positive relationships offer facilitate coping processes and promote successful adaptation to crises (Prati & Pietrantoni, 2009). In their revised theory, Tedeschi and Calhoun included social relationships not only as an outcome of posttraumatic growth, but also as a critical predictor.

Meaning making. One of the most important process variables that facilitate posttraumatic growth is meaning making. According to Park (2013) meaning making is the search "for a more favorable understanding of the situation and its implications" (p. 40). This process variable may also include the reconsideration of global beliefs and the revision of larger goals (Wrosch, 2010). It is important to distinguish meaning making as a process of deriving meaning from a challenging situation and integrating it into the present worldviews, from purpose or meaning in life. Meaning making can contribute to general meaning in life, but is specific for the situation. Furthermore, it is viewed as a process, and not an outcome of growth. Multiple scientists understand meaning making as one of the key mechanisms underlying posttraumatic growth (e.g., Larner & Blow, 2011; Park, 2013; Park & Ai, 2006).

Personal growth initiative. While the above-mentioned facilitators of growth do not necessarily depend on the active steps an individual undertakes to grow, personal growth initiative (Robitschek, 1998) is a skill set closely related to an individual's will to change.

Personal growth initiative can be defined as a skill set for self-improvement, which comprises both behavioral and cognitive components (Meyers, Van Woerkom, De Reuver, Bakk, & Oberski, 2015; Robitschek et al., 2012). It is a multidimensional concept that includes the following subdomains: *readiness for change* (being prepared to change as a person, when development is needed), *planfulness* (making plans for how to change and how to work for that change), *using resources* (drawing from available recourses outside oneself), and *intentional behavior* (actively making steps to change; Robitschek et al., 2012).

In contrast to the growth concepts introduced in Table 1, personal growth initiative is not an outcome of a major life event. Rather, it is a concept which aims to explain what people can actively do in order to grow. Even though the concept of personal growth initiative was at first not applied to the outcomes of major life events in research, it has recently obtained substantial scientific attention in the field of trauma research. Blackie, Jayawickreme, Forgeard, and Jayawickreme (2015) found that personal growth initiative has a protective function when facing traumatic experiences, and might possibly contribute to posttraumatic growth.

1.7 Shortcomings of previous literature and methodological controversies

In their recently-published book on the psychological benefits of hardship, Jayawickreme and Blackie (2016) have conducted a critical reassessment of the existing literature in the field. The authors have emphasized that despite the large number of studies, research on posttraumatic growth suffers from severe methodological shortcomings. Moreover, Coyne and Tennen (2010) have stated that more scientific scrutiny through proper study designs and careful measurement is needed in growth research in order to provide credible evidence for the statements made by researchers in the field. This dissertation aims to address three of these most critical scarcities.

First, a severe shortcoming of the existing literature is the exclusive focus on negative life events as possible catalysts for growth (Damian, & Roberts, 2014; Roepke, 2013; Taubman-

Ben-Ari, Findler, & Sharon, 2011). This uni-directional approach reverses the natural occurrence of negative and positive experiences, because we tend to encounter many more positive events than negative ones in life (Gable, 2000). Additionally, because of the lack of research on growth following positive events, general assertions such as "Bad is stronger than good" (Baumeister et al., 2001, p. 323) have become widely accepted assumptions without being sufficiently backed up by empirical evidence.

Second, there are a few studies that aim to explore the facilitating factors leading to personal growth (Jayawickreme & Blackie, 2014). Most of the existing models have focused either exclusively on negative (e.g., Tedeschi & Calhoun, 2004) or on positive experiences (e.g., Roepke, 2013). Meanwhile, there is no comprehensive process model explaining why some people grow and others stay the same.

Finally, one of the most challenging aspects of rigorous scientific research on the consequences of major life events is the necessary study design. In order to investigate psychological benefits of challenging experiences, prospective longitudinal studies would be required allowing to compare pre- and post-event data and to follow participants over a long period of time (Jayawickreme & Blackie, 2016). Since this type of research design is expensive and time-consuming, most researchers in the field have chosen to abstain from this methodological approach and have used cross-sectional study designs with retrospective measures of change instead.

While this approach allows for the measurement of growth within a cross-sectional design, it poses additional challenges. Self-perceived growth is not solely mirroring genuine personality changes, but it can also be a cognitive distortion based on self-enhancement (McFarland & Alvaro, 2000). Maercker and Zoellner (2004) have referred to this problem as the Janus face of self-perceived growth. Hence, more longitudinal research would be needed in order to investigate the genuine nature of post-event growth (Frazier & Kaler, 2006; Frazier et al., 2009; Jayawickreme & Blackie, 2016).

1.8 The present dissertation

In their introduction to the special section on posttraumatic growth, Park and Helgeson (2006) have introduced three main endeavors for future researchers to consider. First, they have asked for the mechanisms underlying personal growth to be addressed more thoroughly. Second, they have urged researchers to incorporate external indicators in growth research. Finally, Park and Helgeson (2006) have emphasized that future research needs to pursue a distinction between perceived and actual change in order to obtain a clearer picture of the nature of personal growth. These endeavors have also been highlighted in more recent publications (Jayawickreme & Blackie, 2014; 2016). This dissertation aimed to systematically address the named issues in the following four studies.

1.5.1 Study 1: Is bad really stronger than good? Cross-cultural investigation of the negativity bias and the impact of major life events

Although Rozin and Royzmen (2001), as well as Baumeister et al. (2001), emphasized the prior role of negative events, and despite the fact that the two articles together have been cited over 5000 times, there was hardly any systematic investigation of the negativity bias in major life events.

Study 1 aimed to estimate and compare the impact of positive and negative events across cultures. In order to make this step possible, it was necessary to establish an estimate of the impacts of various life events. When Holmes and Rahe (1967) introduced their pioneering work on major life events, they provided participants with a list of events and asked them to rate the impacts of these experiences. While this work was revolutionary at the time, it had some serious shortcomings. First, some traumatic life events that belong to most trauma inventories nowadays, such as sexual abuse, were not included in the original list of events. Second, the SRRS underrepresented positive events, which could therefore not be ranked by the participants (Cohen et al., 2017). Third, the original study included exclusively American participants and was therefore not sensitive to cultural differences in the perception of major life events (e.g.,

Harmon, Masuda, & Holmes, 1970; Rahe, Lundberg, Bennett, & Theorell, 1971; Woon, Masuda, Wagner, & Holmes, 1971). In order to address these shortcomings, we have modified the original scale by extending it with items from the Trauma Assessment for Adults (TAA; Cusack, Frueh, & Brady 2004), as well as with positive events identified in Roepke's (2013) study on postecstatic growth, and by applying the scale in a cross-cultural approach. In summary, the goal of Study 1 was to assess the perceived impact of a large array of life events and investigate the negativity bias across countries.

1.5.2 Study 2: Which factors facilitate posttraumatic and postecstatic growth? Introduction of a comprehensive model to explain the prerequisites of personality change after major life events

Previous publications on growth after major life events have generally focused either on positive (Roepke, 2013) or negative experiences (Joseph & Linley, 2004; Tedeschi & Calhoun, 2004; Park & Ai, 2006) as possible catalysts for beneficial personality changes. The distinction between posttraumatic and postecstatic growth has led to the perception that both phenomena differ and that possible facilitating factors must be specific for the valence of the encountered life event. Study 2 aimed to investigate the relationship between posttraumatic and postecstatic growth, which has not been addressed in any previous research. We hypothesized that posttraumatic and postecstatic growth are highly interrelated and that people who perceive that they have grown from negative experiences report growth after positive events as well.

We introduced a novel framework based on the hypothesis that it is not the valence of the life event, but rather internal personal factors which are decisive for the occurrence of growth. The thriver model unifies three factors which potentially contribute to posttraumatic as well as to postecstatic growth: meaning-making (Larner & Blow, 2011; Park & Ai, 2006), social relationships (Nez, Páez, Basabe, & Martínez, 2010; Schaefer & Moos, 1998; Schroevers, Helgeson, Sanderman, & Ranchor, 2010; Prati & Pietrantoni, 2009) and positive emotions (Norlander, von Schedvin, & Archer, 2005; Fredrickson, Tugade, Waugh, & Larkin, 2003). We

expected the thriver model to predict growth irrespective of the valence of the individual life event or cultural differences. Hence, we aimed to identify personality characteristics that explain why some people are more likely to grow from major life events than others. In contrast to Study 1 and the investigation of the negativity bias, we assumed that the thriver model is universal and should be generalizable across cultures. We applied structural equation models to control for measurement errors in the predictor variables and to increase precision.

1.5.3 Study 3: Do people who strive for personal growth have different brains? Neural correlates of personal growth initiative as a proactive coping strategy

Every person's life path is marked by major life events. Additionally, most people experience at least one potentially traumatic event (Ozer et al., 2003). However, while some people show positive personality changes as a consequence of coping with the particular experience, others remain unaltered. Previously, Study 2 has identified general factors to explain such variance in personality growth. During Study 3, the focus switched from the general contributing factors to a more specific one: personal will. We applied the concept of personal growth initiative (Robitschek et al., 2012) as a proactive coping strategy, which helps people to increase personal resources and has a protective function when facing potentially traumatic life events (Blackie et al., 2015). We aimed to investigate the protective and facilitating character of personal growth initiative in the context of childbirth, with a structural MRI approach.

In a meta-analysis on neural correlates of PTSD patients, Kühn and Gallinat (2013) found that PTSD patients suffer from cerebral gray matter reductions in the ventromedial prefrontal cortex. We hypothesize that neural correlates for personal growth initiative would be most likely to occur in this brain area. Voxel-based morphometry was used to identify brain structural correlates in a whole brain approach. Notably, Study 3 is the first study to investigate brain structural associations in the context of personal growth.

1.5.4 Study 4: Is there genuine growth? A meta-analysis on genuine personality changes following major life events

Most research on posttraumatic growth relies on cross-sectional studies that are based on self-reported benefits of specific events (Jayawickreme & Blackie, 2014). Thus, one critical question arises: does genuine personality growth truly exist or is it merely a misperception and cognitive distortion (McFarland & Alvaro, 2000)? To address this issue and to provide a systematic investigation of the negativity bias described above, we have conducted a large-scale meta-analysis. In contrast to all previous meta-analytic syntheses (Prati & Pietrantoni, 2009; Sawyer et al., 2010; Vishnevsky et al., 2010), only longitudinal studies which did not rely on measures of self-perceived changes were included. The present meta-analysis aimed to address three critical questions of life event research: First, is there genuine posttraumatic and postecstatic growth? Second, if genuine growth exists, to what extent does the potential degree of growth differ depending on the valence of the event? Finally, is personal growth stable and enduring over time, or are the long-term effects limited to the time of adaptation?

1.5.5 Organization of the dissertation

This dissertation includes four studies which are introduced in the following chapters. Two of these studies were published in one article previously (Mangelsdorf & Eid, 2015) and are therefore included in one chapter. The following two chapters present Study 3 and Study 4 separately. The last chapter of the dissertation is dedicated to general discussion, including a summary and discussion of the main findings, the unique contribution of this work to the existing literature, and potential directions for future research.

1.5.6 List of publications included in the present dissertation

CHAPTER 2: Study 1 and Study 2

Mangelsdorf, J., & Eid, M. (2015). What makes a thriver? Unifying the concepts of posttraumatic and postecstatic growth. *Frontiers in Psychology*, *6*, 1–17. doi: 10.3389/fpsyg.2015.00813

CHAPTER 3: Study 3

Mangelsdorf, J. (2017). Coping with childbirth: Brain structural associations of personal growth initiative. *Frontiers in Psychology, 8, 1-9.* doi: 10.3389/fpsyg.2017.01829

CHAPTER 4: Study 4

Mangelsdorf, J., Eid, M., & Luhmann, M. (2017). Does growth require suffering? A meta-analysis and systematic review on genuine posttraumatic and postecstatic growth. *Manuscript submitted for publication*.

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CHAPTER 2

Is bad really stronger than good?

Mangelsdorf, J., & Eid, M. (2015). What makes a thriver? Unifying the concepts of posttraumatic and postecstatic growth. *Frontiers in Psychology, 6*, 1–17. doi: 10.3389/fpsyg.2015.00813[1]

http://doi.org/10.3389/fpsyg.2015.00813

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What makes a thriver?

Unifying the concepts of posttraumatic and postecstatic growth

Abstract

The thriver model is a novel framework that unifies the concepts of posttraumatic and postecstatic growth. According to the model, it is not the quality of an event, but the way it is processed, that is critical for the occurrence of post-event growth. The model proposes that meaning making, supportive relationships, and positive emotions facilitate growth processes after positive as well as traumatic experiences. The tenability of these propositions was investigated in two dissimilar cultures. In Study 1, participants from the USA (n = 555) and India (n = 599) answered an extended version of the Social Readjustment Rating Scale to rank the socioemotional impact of events. Results indicate that negative events are perceived as more impactful than positive ones in the USA, whereas the reverse is true in India. In Study 2, participants from the USA (n = 342) and India (n = 341) answered questions about the thriver model's main components. Results showed that posttraumatic and postecstatic growth are highly interrelated. All elements of the thriver model were key variables for the prediction of growth. Supportive relationships and positive emotions had a direct effect on growth, while meaning making mediated the direct effect of major life events.

Keywords: thriver, thriver model, posttraumatic growth, posttraumatic growth, postecstatic growth, life event, meaning making, social readjustment rating scale (SRRS)

2.1 Introduction

A survivor is a person who lived through hardship or disaster. A thriver is more than that. It is someone who not only goes through an exceptionally positive or threatening life event, but shows subsequent growth because of the experience. Why do some people thrive after life's worst and best experiences while others stay the same?

A large number of studies had aimed to find an answer to this question. In the last decades, an increasing body of research has suggested that highly stressful experiences are a possible facilitator of personal change processes (e.g., Park et al., 1996; Tedeschi and Calhoun, 1996; Joseph and Linley, 2004). Tedeschi and Calhoun (1996) established the notion of posttraumatic growth (PTG) for this phenomenon, which has also been referred to as stress-related growth (Park et al., 1996; Moore et al., 2010; LoSavio et al., 2011), adversarial growth (Joseph and Linley, 2004; Fortune et al., 2005), and benefit-finding (Affleck and Tennen, 1996). Consistent with the work of Tedeschi and Calhoun (1996, 2004), most research on growth after major life events has focused exclusively on negative experiences as possible catalysts for positive development (e.g., Joseph and Linley, 2004; Swickert and Hittner, 2009; Larner and Blow, 2011).

This uni-directional approach has led to the perception that primarily negative events can result in complex positive change processes, which are referred to here as growth. An example is the early research on life themes (Csikszentmihalyi and Beattie, 1979). Csikszentmihalyi and Beattie (1979) suggest that by undergoing problematic life events in childhood, individuals might develop life themes that are critical for their later life path, life story, and interpretation of reality. The authors found evidence for the existence of life themes and their impact on one's later life. Simultaneously, since their basic assumption was that life themes are always based on problematic events, they only included cases that met the criterion that a problematic experience was identified. Hereby, they excluded the possibility that positive life events might result in life themes as well. Supporting this assumption, Baumeister et al.

(2001) argue that there is no corresponding positive concept to trauma, and infer the greater impact and importance of negative events. They conclude: "Bad is stronger than good" (Baumeister et al., 2001, p. 323).

While several research reviews support the assumption that bad is stronger than good (e.g., Baumeister et al., 2001; Rozin and Royzman, 2001; Eby et al., 2010), there are critical limitations to them. Most of the research on the predominant role of negative experiences is limited by one critical factor; they are based on Western, mostly American populations. This fact leaves a key question unanswered: Is the negativity bias a cultural artifact? Studies on post-event growth have mainly evaluated personal development as a function of the negative stress level of a challenging event (e.g., Kesimci et al., 2005; Kashdan and Kane, 2011). They found evidence for a positive relationship between experienced posttraumatic distress and posttraumatic growth (Frazier et al., 2001), while other studies found a negative relation (Park et al., 1996). Meanwhile, based on the assumption that a negative disruption of core beliefs enables growth (Cann et al., 2010), most of these studies excluded events that are perceived as positive at the time they happen.

In the last years, a new perspective on human flourishing is found in research examining the possibility of growth after emotional peak experiences (Keltner and Haidt, 2003; Taubman-Ben-Ari et al., 2012; Roepke, 2013). Different authors argue that life events which enhance positive emotions, such as awe and elevation, can also foster personal development (Keltner and Haidt, 2003; Fredrickson, 2004; Taubman-Ben-Ari et al., 2012). In her pioneering research, Roepke (2013) termed this phenomenon postecstatic growth (PEG). Concepts, such as the broaden-and-build theory (Fredrickson, 2004) and the inspire-and-rewire hypothesis (Keltner and Haidt, 2003) provide theoretical frameworks for the idea of thriving after highly positive experiences, including moral growth and a deepening of close relationships. In support of this hypothesis, Berntsen et al. (2011) conducted a study with over 2000 adults rating the Centrality of Event Scale (CES) as well as different measures of well-being, posttraumatic stress disorder,

and depression. Participants reported, that with the passage of time, the centrality of negative events decreased, while their positive life events became more central to them. They found that highly positive life events are considerably more central to an individual's identity and personal life story than negative ones. While the importance of positive experiences increases over time, the one of negative experiences diminishes (Berntsen et al., 2011). This assumption is also supported by earlier studies on the relation of life scripts, autobiographical memory, and major life events (e.g., Rubin and Berntsen, 2003). Thus, one could argue that, in the long run: Good is stronger than bad. However, from a growth perspective, does it really make a difference if a person has been subjected to trauma or peak experiences?

Research on experimental disclosure of major life events showed that the positive effects of disclosure occur independent of an event's valence (Frattaroli, 2006). In a broad meta-analysis on experimental disclosure, Frattaroli showed that the effect of writing about major life events was not moderated by the valence of the event encountered. Writing about positive as well as negative events resulted in higher levels of psychological health. Individuals who lived through posttraumatic growth typically report positive changes in the areas of relationships, spirituality, appreciation of life, openness for new possibilities, and personal strengths (Tedeschi and Calhoun, 1996; Joseph and Linley, 2004; Park and Helgeson, 2006). After emotional peak experiences people tend to report improved relationships, more meaning in life, enhanced spirituality, and more self-esteem (Roepke, 2013). Surprisingly, there is a significant overlap in the perceived benefits of both kinds of experiences, despite the obvious differences between highly positive and negative life events (see Tedeschi and Calhoun, 2004; Roepke, 2013). These similarities suggest a new perspective to examine human thriving. It is possible that PTG and PEG are cognate processes, which can be facilitated by the same factors independent of an event's emotional valence. Possibly, it is not the quality of an event, but within-person factors that influence the processes following major life events and enable personal growth.

2.1.1 The thriver model

The thriver model has been developed to unify psychological factors contributing to posttraumatic as well as postecstatic growth. The model is based on the assumption that people who are more likely to experience posttraumatic growth are also more likely to experience postecstatic growth and vice versa. Various research on positive changes after critical life events suggests that there are different variables that influence the occurrence of growth, such as openness (Shakespeare-Finch et al., 2003; Kashdan and Kane, 2011), severity of the stressor (Park and Helgeson, 2006), or level of traumatization (Moore et al., 2010). At the same time, there are only a few critical variables mentioned in the existing research that apply to positive and negative life events and are influenceable by the individual. The thriver model combines three well-investigated key factors that have been extracted from posttraumatic and postecstatic growth theories, facilitating positive development after major life events. The three contributing factors of the model are positive emotions (Fredrickson, 2004; Norlander et al., 2005), supportive relationships (Prati and Pietrantoni, 2009; Schroevers et al., 2010), and meaning making (Kray et al., 2010; Wong et al., 2011; Park and George, 2013). Figure 2 depicts the thriver model.

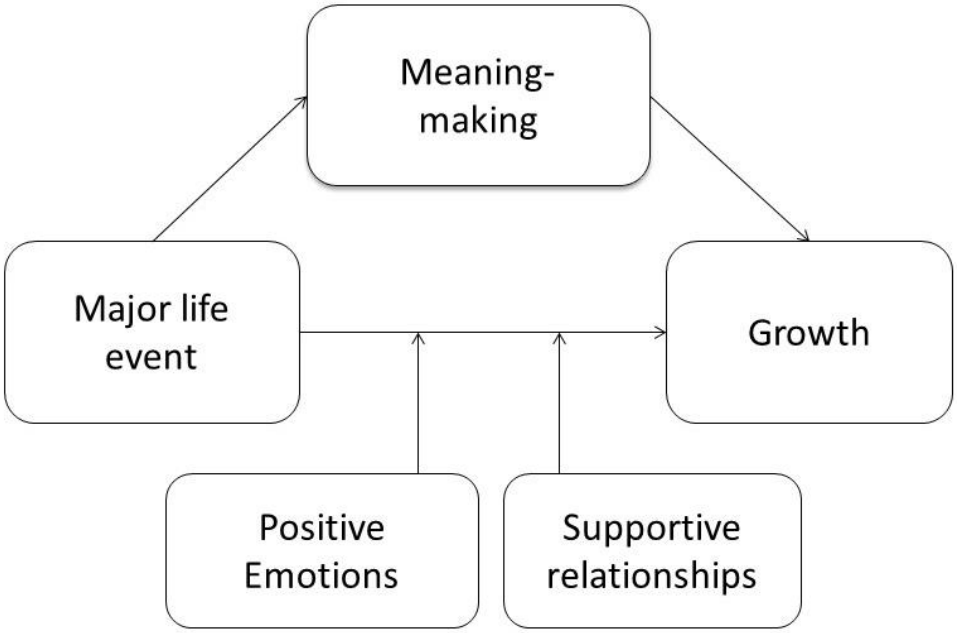

Figure 2. Thriver model of contributing factors to positive development after major life events.

The thriver model is a process model that aims to describe how growth after major life events can be facilitated. One consequence of critical life experiences is a process referred to as core belief disruption (Cann et al., 2010). Major life events can question our general assumption of the world and hereby make it necessary to integrate the new experience into existing mental structures. The thriver model suggests that meaning making is a key process to enable integration and mental reorganization for positive and negative life events. Supportive relationships and positive emotions might directly effect the occurrence of growth by creating an emotional and social environment that contributes to positive change processes. Alternatively, they might moderate the direct effect of major life events on growth by fostering positive development that is a direct reaction to the experience.

2.1.2 Positive emotions

One aspect that distinguishes major life events from daily experiences is the high emotional valence connected to these events. Under stressful situations with positive or negative valence, memory processes are strongly enhanced (Phelps, 2004). These neurological

processes increase one's ability to form lasting memories and enhance learning processes (Hu et al., 2007).

While positive or negative emotions can facilitate enhanced memory processes (Seng, 2012), research indicates that especially positive emotions are critical for the occurrence of psychological growth (Norlander et al., 2005). In a longitudinal study, Fredrickson et al. (2003) investigated the influence of positive emotions on trauma-related outcomes of the terrorist attacks on September 11th. They found that participants who reported higher levels of positive emotions before the terrorist attacks were more likely to react with resilience or posttraumatic growth afterwards. Fredrickson explains the relation between positive emotion and post-crises growth with a mechanism based on her broaden-and-build theory (Fredrickson, 2004). High prevalence of positive emotions provides the neuronal activation for changes in the brain related to a broadening of thought-action repertoires (Fredrickson, 2004). Positive emotions support coping processes by broadening one's attention, thinking, and behavioral skills (Fredrickson, 2004; Tugade et al., 2004). As a consequence, individuals build long-lasting resources, such as a broader arsenal of coping strategies, deeper relationships, and higher well-being. Hereby, individuals develop critical capabilities to draw from in times of adversity that facilitate posttraumatic growth (Folkman and Moskowitz, 2000; Folkman, 2008). Norlander et al. (2005) found that people who report a high level of positive emotions in daily life are more likely to show posttraumatic growth. In Fredrickson's framework of positive emotions, also psychological peak experiences can lead to increased resilience and psychosocial growth. In this sense, positive emotions are not only a momentarily pleasant experience, but show long-term effects on an individual's cognitive and socio-emotional development.

2.1.3 Supportive relationships

Another key moderator for human thriving after major life events are supportive relationships (Nez et al., 2010; Schroevers et al., 2010). Social support is one of the critical environmental resources in understanding positive outcomes of life crises (Schaefer and Moos,

1998; Prati and Pietrantoni, 2009). Close relationships may contribute to personal growth by facilitating coping processes and fostering successful adaptation to life crises and challenging events (Prati and Pietrantoni, 2009). Individuals who are surrounded by supportive friends and family members are more likely to integrate the new experience and develop posttraumatic growth (Schroevers et al., 2010). Tedeschi and Calhoun's (1996) primary model of posttraumatic growth included closer social relationships as an outcome variable of PTG. However, in their revised theory, social support also functions as an important predictor of growth after life crises when it remains stable throughout the coping process (Tedeschi and Calhoun, 2004).

In addition to the importance of supportive relationships for posttraumatic growth, they may also be an important factor for growth after good experiences. Many individuals experience changes after positive events by using a strategy of capitalization and savoring (Bryant, 2003; Bryant and Veroff, 2007). Scales et al. (2011) emphasize that supportive relationships help young people to develop their "sparks in context" (p. 265) and orient them toward thriving. Simultaneously, sharing good experiences improves the relationship with those who participate in them (Gable et al., 2004).

2.1.4 Meaning making

While positive emotions and good relationships support growth processes, one critical question remains unanswered: How is it possible to integrate a truly threatening or an overwhelming ecstatic experience into one's self? The inability to integrate a new experience into existing mental structures and the necessity to develop a possibility to do so are important elements for the occurrence of growth (Cann et al., 2010; LoSavio et al., 2011; Siegel, 2012). One cognitive process that is likely to build the link between mentally challenging experiences and existing cognitive patterns is meaning making (Park and Ai, 2006). Seligman et al. (2006) emphasize that "A consistent theme throughout meaning making research is that the people who achieve the greatest benefits are those who use meaning to transform the perception of

their circumstances from unfortunate to fortunate" (p. 77). Frankl (1992) proposed that finding meaning in a stressful life event is a major facilitator, which helps people to cope more effectively. Meaning making coping is seen as instrumental and one of the core mechanisms of the process underlying posttraumatic growth (Larner and Blow, 2011). "In a general sense, people will have a more positive outcome if they are able to somehow incorporate their traumatic experience into their existing global meaning system" (Larner and Blow, 2011, p. 188). Models of meaning making coping propose that the process of recreating coherent meaning after the violation of existing global meaning can be seen as a main process of posttraumatic growth (Park and Ai, 2006; Larner and Blow, 2011). Also on the positive side, meaning making seems to be one of the major facilitators of postecstatic growth. Roepke's (2013) research emphasized the fact that positive life events are more likely to lead to growth when they evoke a sense of meaning.

The current study used one main mechanism that has been suggested as a key process of meaning making after negative life events: counterfactual thinking. Counterfactual thinking is defined as meaning making by considering alternatives to the past (Kray et al., 2010). Kray et al. (2010) found that counterfactual thinking and creating meaning in life are causally interrelated and that thinking "what, if not. . . " increases the meaningfulness of major life events. "Reflecting on and mentally undoing moments in which life was profoundly altered is critical for appreciating life transitions." (p. 108). Wong et al. (2011) state that counterfactual thinking is not just a random quality of cognitive processing; rather, it heightens the meaningfulness of key life events. Most importantly, reflecting on alternative pathways to critical positive or negative turning points produces greater meaning than the direct reflection on the meaning of the event itself (Kray et al., 2010). Fate perceptions (the assumption that an event "was meant to be" or "was meant to happen") and benefit-finding (the recognition of positive consequences) were identified as independent causal links between counterfactual thinking and the construction of meaning (Kray et al., 2010). Therefore, counterfactual

reflection may facilitate an individual's choosing of a point of view of critical life events that identifies the upsides of reality, creates or strengthens a belief in fate, helps to derive more meaning from important experiences and, by this, helps a person to thrive.

2.1.5 The current research

Which factors facilitate growth after positive as well as negative life events? Existing research on psychological growth processes either considered negative life events as possible facilitators for human thriving (e.g., Joseph and Linley, 2004; Tedeschi and Calhoun, 2004; Park and Ai, 2006) or focused solely on positive life events (Roepke, 2013). The current article is the first scientific study, known to the authors, which systematically examined the connection between posttraumatic and postecstatic growth. It integrates, for the first time, good and bad life events as possible triggers for accelerated positive psychological change. In the main study (Study 2) we examined whether people who experience psychological growth after traumatic experiences are also more likely to experience growth after positive life events. Furthermore, the study aimed to test the thriver model, which proposes that supportive relationships, positive affect, and meaning making facilitate growth independent of the valence of the event encountered. Since we assumed that the model predicts positive development irrespective of cultural context, it was tested in two different nations, the U.S. and India. There were no specific hypotheses concerning cross-cultural differences beyond the assumption that the model should be generalizable across cultures, while the impact of different events might differ across countries (see Masuda & Holmes, 1967). In order to test the thriver model and to compare positive and negative events, it was necessary to quantify major life events and their impact in a pre-study (Study 1). We conducted Study 1 in order to retrieve specific ratings for the impact of different life events and use these ratings to weight events reported in Study 2. Also Study 1 was conducted with an Indian and a U.S. sample, since we assumed that there are intercultural differences in the perception of major life events (see Masuda and Holmes, 1967). At the same time we expected that the model is applicable independently from these differences. Both

studies had a cross-sectional design to learn more about the associations of posttraumatic and postecstatic growth, before conducting a more extensive longitudinal study in the future. We propose that it is not the emotional quality of a given event but individual factors which determine the occurrence of growth. The present paper seeks to determine if there are thrivers who show beneficial psychological changes not only after experiencing negative life events but as a result of highly positive experiences as well. It provides a unique contribution to the field by introducing a framework that explains why some people are more likely to grow than others. Our goal is to identify factors that promote positive psychological development that can be influenced by the individual and can be used to help people thrive.

2.2 Study 1

2.2.1 Materials and methods of Study 1

Participants. Individuals were recruited online through Amazon Mechanical Turk (MTurk), a web service site provided by Amazon. Users can fill out questionnaires for a modest financial compensation that is directly transferred to their Amazon account. After submitting their informed consent, participants were directed to the online questionnaire. Every person who completed the survey received a $0.50 reimbursement. The sample consist of N = 1154 participants from the U.S. (n = 555) and India (n = 599) with 50.5% of the American and 54.1% of the Indian participants being female. The mean age was M = 32.79 (SD = 12.35) in the U.S. sample and M = 30.75 (SD = 10.27) in the Indian sample. The Indian sample was more highly educated than the American sample with 77.3% of all participants holding a bachelor‘s or master’s degree, compared to 41.5% in the U.S. sample.

Procedures. The first study aimed to quantify and compare the impact of a variety of different major life events. Following the approach of Holmes and Rahe (1967), participants were asked to rate the necessary readjustment to 62 different life events of positive and negative

valence. The perceived necessary readjustment to an event was used to estimate the relational impact of different events.

The presented life event list was composed of the original Social Readjustment Rating Scale (SRRS; Holmes and Rahe, 1967) and the Trauma Assessment for Adults (TAA; Cusack et al., 2004). The list was complemented by positive life events identified in Roepke's (2013) study on postecstatic growth in order to provide a comprehensive measure of trauma and emotional peak experiences. The wording of some original items from the SRRQ had to be modified to correspond to changed life circumstances in the new century (e.g., "Partner beginning or ceasing work outside the home" instead of: "Wife beginning or ceasing work outside the home; "Holmes and Rahe, 1967, p. 214). All participants were provided with the English version of the following original instruction by Holmes and Rahe (1967, p. 213):

"(A) Social readjustment includes the amount and duration of change in one's accustomed pattern of life resulting from various life events. As defined, social readjustment measures the intensity and length of time necessary to accommodate to a life event, regardless of the desirability of this event.

(B) You are asked to rate a series of life events as to their relative degrees of necessary readjustment. In scoring, use all of your experience in arriving at your answer. This means personal experience where it applies as well as what you have learned to be the case for others. Some persons accommodate to change more readily than others; some persons adjust with particular ease or difficulty to only certain events. Therefore, strive to give your opinion of the average degree of readjustment necessary for each event rather than the extreme.

(C) The mechanics of rating are these: Event 1, Marriage, has been given an arbitrary value of 500. As you complete each of the remaining events think to yourself, "Is this event indicative of more or less readjustment than marriage?" "Would the readjustment take longer or shorter to accomplish?" If you decide the readjustment is more intense and protracted, then choose a proportionately larger number and place it in the blank directly opposite the event in

the column marked "VALUES." If you decide the event represents less and shorter readjustment than marriage then indicate how much less by placing a proportionately smaller number in the opposite blank. (If an event requires intense readjustment over a short time span, it may approximate in value an event requiring less intense readjustment over a long period of time.) If the event is equal in social readjustment to marriage, record the number 500 opposite the event."

The original instruction did not include a maximum value to avoid outliers. Therefore, as a robust measure of location and variance, a 5% trimmed mean and 20% Winsorized variance was used to retrieve a rank order list and improve accuracy (Wilcox and Keselman, 2003). To account for intercultural differences, the analysis was conducted separately for the two samples.

To compare life events with positive and negative valence, all events on the list were categorized according to their emotional valence. Ambiguous items, such as "major change in eating habits," were not included in further analyses. A complete list of the ratings for all events is displayed in Tables 2 and 3. The data of a few respondents (n = 16) could not be analyzed because they misunderstood the task and provided answers, such as "yes" or "no," instead of numeric values.

Additionally, to compare the results of the Indian and the U.S. sample, mean values were normalized to a maximum value of 100. In each sample the event with the highest rating was set to a value of 100, while the remaining events were transformed accordingly with the following formula:

$$x_{norm} = (x * 100)/ x_{max} \qquad (1)$$

We have chosen a robust mixed model approach to compare the impact of positive and negative events in both countries.

2.2.2 Results of Study 1

Tables 2, 3 show the rank list of the U.S. and the Indian participants.

Table 2
Rank order of life events (US sample)

Event	*Valence*	*Rank*	*TM*	*Winsorized SD*	*TM norm*
Death of a spouse	N	1	885.54	924.06	100.00
Childhood sexual molestation with pressure or threats	N	2	803.42	702.29	90.73
Childhood sexual molestation (before age 13)	N	3	781.45	621.65	88.25
Forced sexual assault	N	4	692.23	407.82	78.17
Birth of a child	P	5	691.58	372.10	78.10
Birth of the first child	P	6	677.93	284.69	76.56
Death of a close family member	N	7	676.18	362.12	76.36
Forced sexual contact	N	8	668.82	328.35	75.53
Divorce	N	9	609.47	194.16	68.82
Marital separation from mate	N	10	585.13	202.36	66.08
Pregnancy	P	11	567.11	218.81	64.04
Death of a close friend	N	12	566.72	278.33	64.00
Major personal injury or illness	N	13	520.04	230.19	58.73
Attack with a weapon	N	14	517.51	248.79	58.44
Gaining a new family member	P	15	501.92	222.18	56.68
Being fired from work	N	16	501.22	220.12	56.60
Marriage	P	17	500.00	*	56.46
Serious accident	N	18	486.60	233.00	54.95
Natural disaster	N	19	479.45	243.08	54.14
Foreclosure on a mortgage or loan	N	20	468.76	199.06	52.93
Retirement from work	0	21	459.68	182.26	51.91
Marital reconciliation with mate	P	22	447.18	172.09	50.50
Major change in financial state	0	23	445.29	194.43	50.28
Falling in love	P	24	442.84	233.42	50.01
Living a life dream	P	25	439.43	236.57	49.62
Attack without a weapon	N	26	418.08	224.96	47.21
Major change in the health or behavior of a family member	0	27	406.07	197.60	45.86
Son or daughter leaving home	0	28	392.55	188.97	44.33
Taking on a mortgage greater than $10,000	0	29	376.25	198.75	42.49
Achieving a crucial-long term goal	P	30	373.81	169.44	42.21
Major change in living conditions	0	31	370.40	171.63	41.83
Changing to a different line of work	0	32	368.91	186.87	41.66
Sexual pressure	N	33	365.28	235.07	41.25
Having a spiritual "awakening"	P	34	361.36	244.18	40.81
Major change in the number of arguments with spouse	0	35	353.44	168.36	39.91

Event	*Valence*	*Rank US*	*TM*	*Winsorized SD*	*TM Norm*
Finding a great new job	P	36	346.83	164.74	39.17
Change in residence	0	37	342.62	181.95	38.69
Sexual difficulties	N	38	326.78	189.38	36.90
Witnessed violence	N	39	316.58	203.90	35.75
Major business readjustment	0	40	316.16	190.57	35.70
Taking on a mortgage less than $10,000	0	41	309.06	219.06	34.90
Outstanding personal achievement	P	42	307.21	181.43	34.69
Major change in responsibilities at work	0	43	301.11	122.61	34.00
Partner beginning or ceasing work outside the home	0	44	298.43	146.37	33.70
Major change in working hours or conditions	0	45	289.88	146.55	32.73
Change to a new school	0	46	277.83	160.84	31.37
Meeting an inspiring person	P	47	248.33	165.64	28.04
In-law troubles	N	48	238.59	155.19	26.94
Major change in usual type/ amount of recreation	0	49	217.43	134.41	24.55
Major change in social activities	0	50	198.02	120.05	22.36
Major change in sleeping habits	0	51	197.46	119.82	22.30
Major change in eating habits	0	52	194.35	115.77	21.95
Trouble with the boss	N	53	189.74	143.08	21.43
Vacation	P	54	167.99	135.39	18.97
Major change in number of family get-togethers	0	55	159.45	127.08	18.01
Revision of personal habits	0	56	157.72	129.65	17.81
Major change in church activities	0	57	157.62	132.16	17.80
Christmas	0	58	142.38	134.79	16.08
Minor violations of the law	N	59	121.98	108.17	13.77

Note: TM = 5% trimmed mean; TM norm = normalized 5% trimmed mean; event valence: N = highly negative event, P = positive event, 0 = event neutral or unspecified valence.

Table 3
Rank order of life events (Indian sample)

Event	*Valence*	*Rank India*	*TM*	*Winsorized SD*	*TM norm*
Marriage	P	1	500.00	*	100.00
Death of a spouse	N	2	419.75	303.88	83.95
Birth of the first child	P	3	399.14	266.11	79.83
Pregnancy	P	4	381.73	227.72	76.35
Birth of a child	P	5	379.18	239.81	75.84
Falling in love	P	6	375.34	243.80	75.07
Divorce	N	7	358.32	247.16	71.67
Serious accident	N	8	349.09	247.28	69.82
Meeting an inspiring person	P	9	349.09	192.69	69.82
Finding a great new job	P	10	348.75	196.75	69.75
Sexual pressure	N	11	336.64	229.86	67.33
Childhood sexual molestation with pressure or threats	N	12	335.60	282.09	67.12
Living a life dream	P	13	335.23	213.96	67.05
Marital separation from mate	N	14	334.18	238.58	66.84
Outstanding personal achievement	P	15	332.83	194.51	66.57
Forced sexual assault	N	16	330.33	258.33	66.07
Death of a close family member	N	17	329.94	402.49	65.99
Childhood sexual molestation (before age 13)	N	18	324.39	268.35	64.88
Achieving a crucial-long term goal	P	19	321.00	183.97	64.20
Major personal injury or illness	N	20	320.26	207.06	64.05
Forced sexual contact	N	21	318.86	255.64	63.72
Natural disaster	N	22	316.25	237.64	63.25
Death of a close friend	N	23	314.75	218.78	62.95
Gaining a new family member	P	24	314.30	196.90	62.86
Major change in financial state	0	25	312.67	196.37	62.53
Being fired from work	N	26	309.75	230.01	61.95
Taking on a mortgage greater than $10,000	0	27	306.55	198.50	61.31
Major change in the health or behavior of a family member	0	28	306.26	162.55	61.25
Son or daughter leaving home	0	29	304.86	200.86	60.97
Retirement from work	0	30	303.60	197.23	60.72
Major change in responsibilities at work	0	31	298.45	154.37	59.69
Attack with a weapon	N	32	293.17	218.26	58.63
Major change in living conditions	0	33	293.17	156.38	58.63
Sexual difficulties	N	34	282.59	193.02	56.52
Taking on a mortgage less than $10,000	0	35	282.26	202.64	56.45
Major business readjustment	0	36	280.43	184.40	56.09
Major change in working hours or conditions	0	37	279.39	164.47	55.88
Having a spiritual "awakening"	P	38	278.55	179.53	55.71
Vacation	P	39	277.68	180.33	55.54

Event	*Valence*	*Rank India*	*TM*	*Winsorized SD*	*TM norm*
Major change in the number of arguments with spouse	0	40	272.82	167.65	54.56
Changing to a different line of work	0	41	270.63	160.30	54.13
Change in residence	0	42	269.69	162.92	53.94
In-law troubles	N	43	269.14	184.43	53.83
Partner beginning or ceasing work outside the home	0	44	268.99	168.63	53.80
Christmas	0	45	263.47	192.01	52.69
Marital reconciliation with mate	P	46	261.99	173.68	52.40
Change to a new school	0	47	249.75	155.05	49.95
Trouble with the boss	N	48	248.32	163.92	49.66
Major change in social activities	0	49	242.67	136.74	48.53
Foreclosure on a mortgage or loan	N	50	238.62	159.45	47.72
Witnessed violence	N	51	234.46	165.79	46.89
Major change in usual type and/or amount of recreation	0	52	232.47	142.17	46.49
Major change in number of family get-togethers	0	53	231.25	157.20	46.25
Attack without a weapon	N	54	229.66	174.45	45.93
Revision of personal habits	0	55	225.15	147.72	45.03
Major change in sleeping habits	0	56	215.61	140.18	43.12
Major change in eating habits	0	57	209.50	140.25	41.90
Major change in church activities	0	58	205.58	146.21	41.12
Minor violations of the law	N	59	201.31	148.20	40.26

Note: TM = 5% trimmed mean; TM norm = normalized 5% trimmed mean; event valence: N = negative event, P = positive event, 0 = event neutral or unspecified valence.

The U.S. sample showed higher variability, a greater number of outliers, higher trimmed mean values and, for many items, a different rank order than the Indian sample. Outstanding differences occurred for traumatic items linked to sexual abuse and for peak experiences such as falling in love or marriage. While participants of the U.S. sample amplified the impact of sexual molestation, love and marriage played only a minor role in their ranking. The reverse effect could be found in the Indian sample. Both samples showed far-reaching cross-cultural differences in the rating of major life events.

A critical finding is the varying importance of negative and positive events in the US and India displayed in Figure 3. The U.S. sample rated negative events as more impactful (rank, M = 20.67, SD = 16.05; TM, M = 57.51, SD = 21.84) than positive experiences (rank, M = 24.81, SD = 14.37; TM, M = 51.12, SD = 16.69). Meanwhile, the Indian sample rated negative

events as less impactful (rank, $M = 23.08$, $SD = 15.38$; TM, $M = 64.26$, $SD = 11.50$) than positive ones (rank, $M = 16.90$, $SD = 14.06$; TM, $M = 67.31$, $SD = 8.43$). The main and interaction effects of country and valence of events were tested in a robust two-way mixed design with M-estimator and bootstrapping. We found a significant main effects of country ($\Psi = -127.88$, $p < 0.01$), with higher trimmed means values in India, and event valence ($\Psi = 42.84$, $p < 0.01$), with higher values of negative events. However, these main effects should not be interpreted given the highly significant interaction effect of country and event valence ($\Psi = -125.72$, $p < 0.01$). Positive events showed higher impact in the Indian sample than negative ones, while the U.S. sample rated negative events as more impactful.

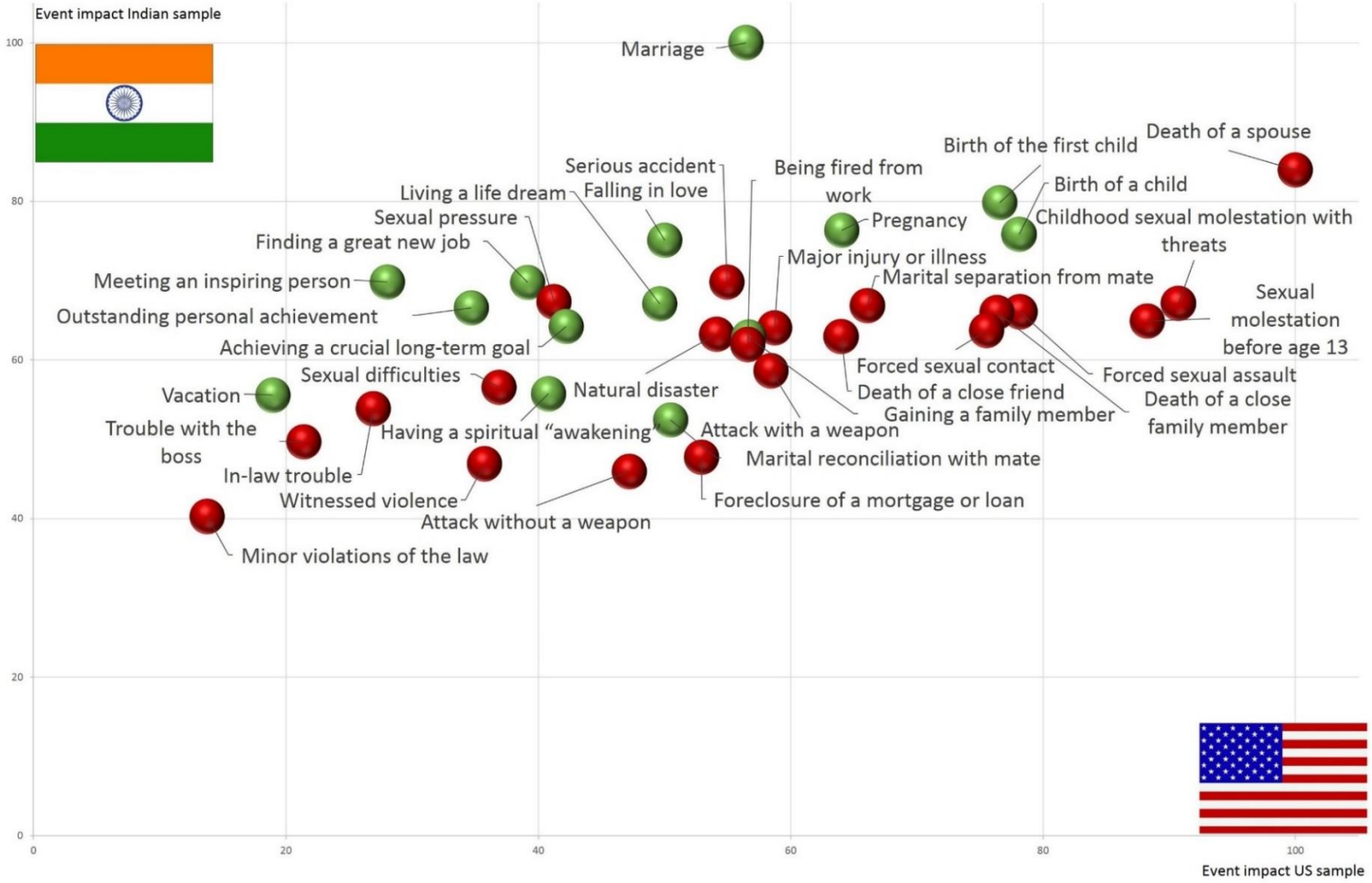

Figure 3. Results of the event rating for the Indian and U.S. sample. Green data points represent positive life events, red data points represent negative events.

2.2.3 Discussion of Study 1

Is bad stronger than good? The impact and importance of traumatic experiences has been emphasized and studied extensively, emphasizing the prior role of negative experiences (Baumeister et al., 2001). However, the majority of these finding were based on Western samples or did not investigate positive experiences. Following the approach of Holmes and Rahe (1967), a systematic investigation of the impact of major life events with positive and negative emotional valence was conducted. The life event ranking performed here highlights sociological changes over the last decades as well as intercultural differences. Compared to the results of the original study, some items, such as marriage, lost their importance in the U.S. sample. Additionally, many of the items in the top ranks, such as "sexual molestation" or "birth of a child," were not even included in the original SRRS list (Holmes and Rahe, 1967). This finding is critical to future research on major life events based on the SRRS, indicating that the original list should be extended and adapted to fit the present times and social situations.

Limitations. The original instruction by Holmes and Rahe (1967) did not include a maximum value. Therefore, some participants rated single items with values up to 10,000. Most of these items focused on childhood sexual abuse. Furthermore, the instruction invites participants to rate the impact of these events based on either personal experiences or the experiences of others they know, which might distort the results. Future studies should ask participants to indicate which of the events were rated on personal experiences.

Intercultural Differences. The social emotional impact of life events differed to a great extent across countries. This may be due to the diverse normativity of certain events, such as the death of a close family member. While in Western countries medical care prevents or treats life threatening illnesses or accidents more effectively, the likelihood of losing a close family member is lower, which might result in higher perceived impact of these events. Moreover, the severity of an event might also be higher or lower because of the consequences specific events have in different countries. Being fired from work might only be a minor impairment in places

where a sufficient social security system provides support in times of need. Finally, the perception of the severity of events, such as child abuse, might differ because of media and cultural influences communicating an event as less or more severe.

To account for these intercultural differences in the perception of major life events, results of Study 1were used to operationalize and compare different events in the two countries in Study 2. The basic assumption was that even though the impact of different events varies to a great extend across countries the facilitating factors of growth are universal.

Negativity Bias. A particularly intriguing finding is the disparity in the negativity bias (see Rozin and Royzman, 2001). While the results of the U.S. sample support the hypothesis that negative experiences are stronger than positive ones, the Indian sample indicated the reverse effect. These findings raise the question of the universality of the negativity bias and highlight the importance of cross-cultural comparison in basic research.

2.3 Study 2

The main study aimed to test the thriver model and to examine its generalizability and external validity. The model was applied to good and bad experiences in order to investigate its independency from the emotional valence of events.

2.3.1 Materials and methods of Study 2

Participants and Procedures. Six hundred and three participants from the U.S. (n = 342) and India (n = 341) enrolled in the study. In this sample 64.3% of the US and 40.2% of the Indian subjects were female. Participants were recruited through the website Amazon Mechanical Turk. Following standard informed consent procedures, they provided responses to a series of questions. The primary dependent variable was the level of reported growth, operationalized by perceived posttraumatic and postecstatic growth. The independent variables were the extent to which participants experienced the potentially facilitating factors of positive emotions, social support, and meaning making in the form of positive counterfactual thinking.

Participants provided basic demographic information, such as year of birth, home country, and educational level, as well as basic information about the traumatic and ecstatic events, including what happened and how much time elapsed since the event. After they had submitted this information, participants were redirected to the study survey hosted on the survey software site Qualtrics. Through the Amazon Mturk network, participants received a reimbursement of $0.50. Ethical approval for this study was provided by the institutional review board of the University of Pennsylvania.

To estimate the model fit of the thriver model, structural equation modeling was applied. The normalized trimmed mean values calculated in Study 1 were used to estimate the impact of the most powerful positive (MLE-P) and negative (MLE-N) events reported by each participant in Study 2. The data from the Indian and U.S. sample in Study 1 were applied for the corresponding group in Study 2. Item parceling was used to create three manifest variables from every scale as indicators of the latent variables of the model (Hall et al., 1999). Five latent variables were included in the SEM testing: impact of major life event (MLE), meaning making in form of counterfactual thinking (CFT), positive emotions (PE), supportive relationships (SR), and reported growth. The resulting structural equation model is displayed in Figure 4. Because there is only one indicator of the latent variable MLE, the factor loading was fixed to 1 and the error variance was fixed to 0. Hence, this variable is equal to its observed indicator.

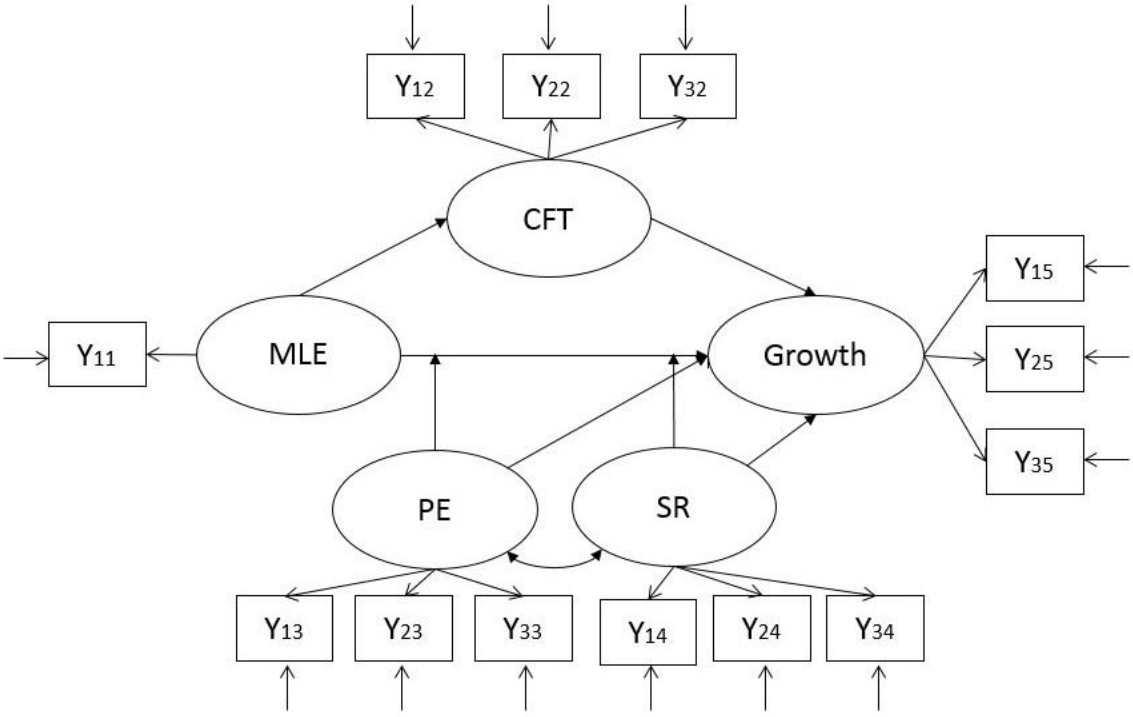

Figure 4. Applied structural equation model.

Note: This model was applied separately to positive and negative events. Positive events: MLE-P, highest impact of experienced positive event; Growth-P, postecstatic growth; CFT-P, counterfactual thinking about positive experiences; Negative event: MLE-N, highest impact of experienced negative event; CFT-N, counterfactual thinking about negative experiences; Growth-N, reported posttraumatic growth; PE, positive emotions; SR, supportive relationships.

The factorial structure and the cross-cultural equivalence of the thriver model was tested using multiple group modeling.

2.3.2 Measures of Study 2

Negative Life Events (MLE-N). A short form of the Trauma Assessment for Adults (TAA; Cusack et al., 2004) has been used to indicate potentially traumatic life events in the past. No particular time frame was given to allow participants to report childhood experiences. The reported events were weighted with the results from Study 1 in the same country. The highest result, indicating the most severe event, was included as indicator for the impact of negative life events (MLE-N). Therefore, the individual score is the trimmed mean of this event from the country to which the individual belongs.

Positive Life Events (MLE-P). Participants were provided with a list of positive events, such as birth of a child, which had been extracted from Roepke's (2013) study on ecstatic life events. An "other" box has been provided to give subjects the opportunity to choose a life event not included in the list. Comparable to the determination of the MLE-N, participants were not provided with a fixed time frame for the MLE-P. The reported experiences were weighted with the results from Study 1 from the same country. The highest result, indicating the most powerful experience, was included as indicator for the impact of positive life events (MLE-P). Hence, the individual score is the trimmed mean of this event from the country to which the individual belongs.

Growth Following Negative Events (Growth-N). After indicating their most severe experience, participants were asked to estimate how this event changed their lives. The Posttraumatic Growth Inventory (PTGI) measures the perceived positive psychological changes after stressful life events. Participants respond to items such as: "I have a greater appreciation of the value of my own life." The PTGI has been validated multiple times (Tedeschi and Calhoun, 1996) and shows a good internal consistency with Cronbach's alpha coefficients of $\alpha = 0.83–0.91$ for its subscales. For the SEM analysis, the subscale "deeper social relationships" was excluded to avoid an overlap with the factor "positive relationships."

Growth Following Positive Events (Growth-P). After indicating the most positive event they had experienced, participants were provided with the Inventory of Growth after Positive Experiences (IGPE). The IGPE measures the extent to which people feel they have experienced psychological changes because of a positive event in their past (Roepke, 2013). It includes items such as "I have a new role in life." The inventory has shown good reliability and validity (Roepke, 2013). With $\alpha = 0.95$, the scale had a very good internal consistency.

Positive Emotions (PE). The Positive and Negative Affects Schedule (PANAS) measures the extent to which individuals felt negative (e.g., distressed) and positive affects (e.g., interested) during the last month (Watson et al., 1988; Crawford and Henry, 2004). For

the present study, only the positive subscale (PANAS-P) was used. The PANAS-P displayed good internal consistency (α_{US} =0.85, α_{India} = 0.89).

Supportive Relationships (SR). The Multidimensional Scale of Perceived Social Support (MSPSS) measures the extent to which persons feel that they receive support from others, including significant others, family members, and friends. Participants respond to questions such as: "I have a special person who is a real source of comfort to me." Its reliability and validity are well-established (Zimet et al., 1988). With a Cronbach's alpha coefficient of α = 0.92, the scale displayed suitable internal consistency.

Counterfactual Thinking (CFTI). The Counterfactual Thinking Inventory (CFTI) asks subjects about their reflection habits when they remember past life events (Mangelsdorf, 2012). The CFTI consists of two subscales for positive (CFTI-P) and negative experiences (CFTI-N). Participants respond on a Likert scale ranging from 1 (not at all like me) to 5 (just like me) to questions such as "When I think about past life events, I often ask myself where I would be now without these experiences." Confirmatory factor analyses showed that counterfactual thinking can be distinguished from posttraumatic as well as postecstatic growth. The CFTI-P and CFTI-N showed good internal consistencies (α = 0.82 and 0.84).

Methods of Data Analyses. The collected data were analyzed in two steps. First, a correlation analysis was conducted to estimate the relation of posttraumatic and postecstatic growth and to test the interdependence of the constructs, included in the thriver model. Second, the general thriver model was tested separately for positive and negative events with SEM. This approach allowed us to compare its fit for life events with different emotional valence.

2.3.3 Results of Study 2

Table 4 shows the bivariate correlations of the measures that were utilized, while Table 5 displays their descriptive statistics.

Table 4
Intercorrelations of questionnaires used for the validation of the thriver model

	PTGI	IGPE	SPSS	PANAS	CFTI-P	CFTI-N	MLE-P	MLE-N
Posttraumatic growth (PTGI)		.63**	.41**	.54**	.41**	.38**	.16**	.07
Postecstatic growth (IGPE)	.67**		.39**	.54**	.34**	.33**	.18**	.02
Supportive relationships (MSPSS)	.52**	.48**		.30**	.26**	.15**	.14*	.04
Positive emotions (PE)	.58**	.49**	.46**		.13*	.10	.09	.04
Counterfactual thinking (CFTI-P)	.38**	.41**	.26**	.28**		.57**	.12	.02
Counterfactual thinking (CFTI-N)	.39**	.34**	.14*	.26**	.50**		.06	.00
Impact Positive Event (MLE-P)	.07	-.01	.10	-.13	.03	-.02		.26
Impact Negative event (MLE-N)	.09	.03	.02	-.04	.09	.12*	.12	

Note: The upper triangle shows intercorrelations in the US sample. The lower triangle shows intercorrelations in the Indian sample. PTGI = Posttraumatic Growth Inventory without the subscale social relationships; IGPE = Inventory of Growth after Positive Experiences; MSPSS = Multidimensional Scale of Perceived Social Support; PANAS = Positive and Negative Affect Scale (positive items); CFTI-P = Counterfactual Thinking Inventory (positive events); CFTI-N = Counterfactual Thinking Inventory (negative events); MLE-P = Impact of the most positve event; MLE-N = Impact of the most negative event; *p< .05; **p< .01.

Because the number of positive and negative events were also assessed in Study 2, we checked whether the number of events is important for growth. While the number of negative events showed no significant relations to posttraumatic ($r = -0.01$, $p = 0.79$) or postecstatic growth ($r = -0.04$, $p = 0.29$), the number of positive events was positively associated with postecstatic ($r = 0.10$, $p = 0.01$) as well as posttraumatic growth ($r = 0.17$, $p < 0.01$).

One of the key questions underlying the present research focuses on the relation between posttraumatic and postecstatic growth, which has not been studied before. The two constructs showed high intercorrelations between $r = 0.63$ (Indian sample) and $r = 0.67$ (U.S. sample). This finding supports the hypothesis that posttraumatic and postecstatic growth are highly interrelated and possibly cognate processes.

Growth after positive and negative events was significantly correlated with all facilitating variables included in the thriver model. At the same time, the impact of the most severe negative event showed no significant correlation with posttraumatic growth. This result remains stable, also when the most severe traumatizing events were excluded from the sample. Most participants (87.7%) reported that they experienced at least one traumatic event included in the TAA (Cusack et al., 2004). An interesting finding is that participants who experienced a more impactful positive event also reported more posttraumatic growth, but only in the U.S. sample. In general, however, the degree of growth after positive and negative events depends only marginally on the impact of the event. This finding can be taken as hint that a person's capacity for growth seems to be more important than the impact of the event itself. We conclude, therefore, that the experience of a major life event is a necessity to ignite multi-dimensional growth but the degree of growth seems to depend more on the facilitating factors than on the event itself. The descriptive statistics, displayed in Table 5, revealed consistent cross-cultural differences [MANOVA: $F(8, 571) = 20.47$, $p < 0.001$; Pillai-Trace for difference between the two nations: $\eta 2 = 0.22$].

Table 5
Descriptive statistics of the scales used for the thriver model

	PTGI		**IGPE**		**MSPSS**		**PANAS-P**		**CFTI_N**		**CFTI_P**		**MLE-P**		**MLE-N**	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
US	3.61	1.11	4.04	1.19	5.14	1.29	3.11	.88	3.22	.75	3.30	.84	59.23	17.86	62.78	18.67
IN	3.28	.79	4.76	.82	5.42	.96	3.81	.70	3.34	.62	3.52	.60	67.65	16.62	60.50	18.36

Note: IN = India; PTGI = Posttraumatic Growth Inventory without the subscale social relationships; IGPE = Inventory of Growth after Positive Experiences; MSPSS = Multidimensional Scale of Perceived Social Support; PANAS-P = Positive and Negative Affect Scale (positive items); CFTI_N = Counterfactual Thinking Inventory (negative life events); CFTI_P = Counterfactual Thinking Inventory (positive life events); MLE-P = Major life event (positive); MLE-N = Major life event (negative).

The U.S. sample showed lower mean values than the Indian sample for all scales except the one assessing the impact of negative events (MLE-N). In sum, we found strong correlations

between PTG and PEG as well as the facilitating factors of the thriver model. These findings support our hypotheses.

Structural Equation Modeling. Multiple group structural equation modeling (SEM) using the computer program Mplus (Muthén and Muthén, 1998–2012) was applied to analyze the thriver model for positive and negative experiences. First, measurement equivalence was tested across countries (Byrne, 2008). Second, the fit of the thriver model for positive and negative events was tested for the Indian and the U.S. sample in a multi group analysis. Mplus does not provide model fit coefficients for models with latent interaction variables. Therefore, in the first step, we tested the model in Figure 4 without moderating effects in order to see whether the general model structure fits the data (estimator: MLR). Next, the moderation hypotheses were tested (estimator: MLR). If the moderation effects were not significant, the moderation effects were excluded again to simplify the models. The path coefficients of all effects, including moderations, are reported below.

Structural equivalence. It was possible to establish configural equivalence for negative [χ^2 (120) = 141.86, p = 0.08, CFI = 0.99; TLI = 0.99; RMSEA = 0.024] and positive events [χ^2 (120) = 160.09, p = 0.01, CFI = 0.99; TLI = 0.99; RMSEA = 0.037]. These findings indicate a good fit of the thriver model in the Indian and the U.S. sample. The results for metric equivalence showed acceptable model fit results [negative events: χ^2 (132) = 202.80, $p < 0.01$, CFI = 0.98; TLI = 0.98; RMSEA = 0.042; positive events: χ^2 (132) = 209.97, $p < 0.01$, CFI = 0.98; TLI = 0.98; RMSEA = 0.05]. However, the chi-square (χ^2) difference tests showed that the assumption of metric equivalence has to be rejected for positive (χ^2diff = 45.23, df_{diff} = 12, $p < 0.01$) and negative events (χ^2_{diff} = 65.39, df_{diff} = 12, $p < 0.01$). Therefore, more restrictive models of measurement equivalence were not tested. The estimated intercept and factor loadings in Tables 6 and 7 in the Appendix show that there are only very small differences between the two countries, so that approximate measurement invariance is given. Therefore, it is meaningful to compare the estimated parameters between the two countries.

The thriver model. The thriver model was tested for positive and negative events in the U.S. and in India. All direct path coefficients of the facilitating factors were positive, relatively large, and significantly different from 0. Analyses of the full model for negative events, including interaction effects, showed highly significant direct effects but no significant interaction effect of the moderators positive emotions ($\beta_{US} = -0.003$, $p = 0.48$; $\beta_{India} = -0.01$, $p = 0.19$) or social relationships and MLE ($\beta_{US} = -0.002$, $p = 0.38$; $\beta_{India} = -0.004$, $p = 0.32$). Also, for positive events the interaction effect of positive emotions ($\beta_{US} = -0.006$, $p = 0.13$; $\beta_{India} = 0.001$, $p = 0.07$) was not significant, while the interaction of social relationships and MLE was only significant in one condition ($\beta_{US} = 0.001$, $p = 0.73$; $\beta_{India} = -0.01$, $p < 0.01$). The value of the significant interaction effect is small because of the large range of the variable MLE. This interaction effect indicates that for positive events with increasing impact in India, more social support does not necessarily lead to more postecstatic growth. The estimated model parameters are presented in Figures 5A–D.

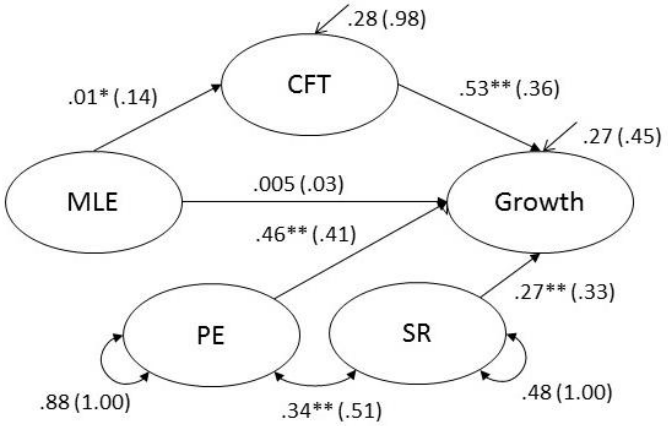

Figure 5(a). Structural model for negative events in India; unstandardized (standardized) results.

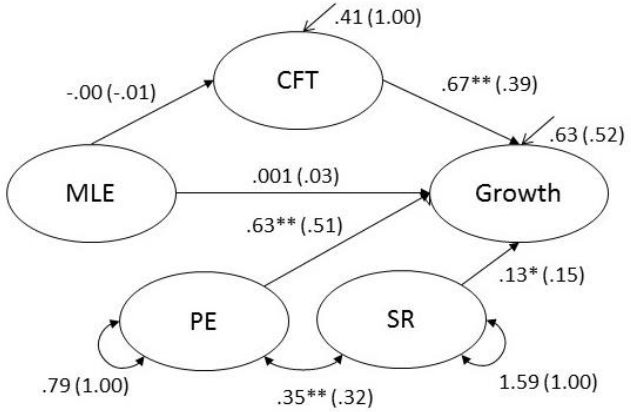

Figure 5(b). Structural model for negative events in the US; unstandardized (standardized) results.

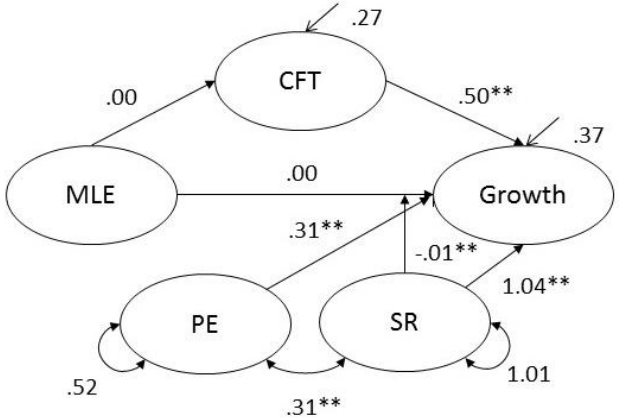

Figure 5(c). Structural model for positive events in India; unstandardized (standardized) results.

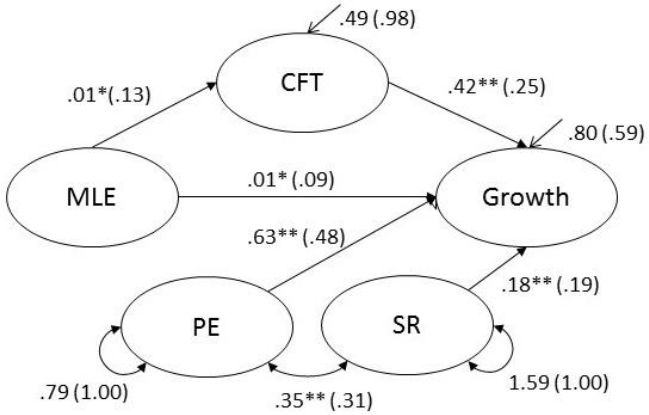

Figure 5(d). Structural model for positive events in the US; unstandardized (standardized) results.

Figure 5. Estimated model parameters of the thriver model for positive and negative events in the U.S. and India. (A–D).
Note: Structural model for negative events in India; unstandardized (standardized) results. *p < 0.05; **p < 0.01.

In all four conditions, the direct effect of major life events on growth was small or not significant, indicating that other supporting factors facilitate growth in addition to the impact of an event. In the U.S. sample, positive emotions had the strongest relation to growth, followed by meaning making, while relationships played a minor role. In the Indian sample, all three facilitating variables were about equally important in predicting growth, while positive emotions were especially important concerning negative events. Meaning making through counterfactual thinking was a critical predictor for growth in both populations after bad as well as good experiences. While counterfactual thinking is based on the reflection of major life events, it showed only small or no significant relation to the impact of the most severe event. Overall, the thriver model showed a good model fit in all four analyses.

2.3.4 Discussion of Study 2

Are there people who are more likely to grow than others? Study 2 aimed to answer this question and to test a novel model that unifies contributing factors to growth after good and bad experiences. The results highlight that the experience of posttraumatic and postecstatic growth are highly interrelated. Participants who reported positive changes after trauma also experienced positive development after peak experiences and could be identified as thrivers. This finding was generalizable across the investigated countries, and exemplifies the overlap of the two constructs. Future research should aim to disentangle and further elaborate on the relationship of growth after positive and negative events.

The thriver model. The current cross-sectional results support the main assumptions of the thriver model. All three factors included in the model as facilitators of positive development are related to growth processes after highly positive as well as traumatic experiences. While the extent to which the different factors explain the occurrence of growth slightly differs across countries and events, the general model showed a good fit in all four conditions. Supportive relationships and positive emotions could not be identified as moderators, but had a highly

significant direct effect on growth. Therefore, in the future, the model should be tested in longitudinal designs to verify the directionality of these relations.

Major life events. Another intriguing finding of the second study concerns the missing link between events and growth. Especially after negative experiences, the mere occurrence of a given event does not predict positive development. It seems that major life events result in a psychological disruption, which only leads to growth when they are accompanied by certain supporting factors. This finding emphasizes the critical influence of facilitating factors contributing to positive outcomes. The findings concerning relations between the number of positive and negative events and growth questions once more the prior role of negative experiences. They indicate that experiencing numerous negative events often does not lead to more growth. At the same time, even though more positive experiences might also be a consequence of growth, the positive relation between growth and positive life events might be based on the beneficial effects of positive experiences. Possibly, for long-term developmental outcomes, positive experiences are more critical than negative ones, since they facilitate growth and buffer the impact of adversarial events (Folkman and Moskowitz, 2000; Folkman, 2008). Future research should investigate the causal direction of this effect. Significant relationships between impact of an event and the occurrence of counterfactual thinking or growth could only be found for positive events in the U.S., and negative events in India. It seems that meaning making is a process which may be facilitated by means other than the character of the event itself, such as the necessity to reappraise a situation (Park and Ai, 2006). Likewise, does the mere fact that a certain event happened not automatically lead to positive development without adaptive processing of the experience. The good model fit in both countries and the fact that the path coefficients do not differ a great deal between the nations lead to the conclusion that the thriver model is generalizable across both countries and, therefore, at least to some degree independent of cultural context.

2.4 General Discussion

Major life events are an integral component of every person's life. They often not only alter one's biography, but the person as a whole. The thriver model is a new perspective on positive human development. It provides a framework to think about development as not only a continuous learning process or rapid changes, but as an interaction process between external influences, internal processing mechanisms, and psychological resources.

The current studies were the first systematic investigation of the relationship between posttraumatic and postecstatic growth. The findings suggest that both concepts are highly interrelated and that there are personal factors that drive positive changes independent of an event's valence. This raises the question of whether the good or bad character of an event is critical for the positive outcomes that may occur. Possibly, the terminologies of posttraumatic and postecstatic growth are misleading, since they limit the phenomenon of growth to the specific emotional valence of an experience. Future research should aim to disentangle the mechanisms and components of positive changes after good and bad experiences to determine which are specific to the character of an event and which are universal. Possibly, there are beneficial outcomes which are distinct for positive and negative life events. One of the main goals of future research should also be to test the model in longitudinal settings and hereby clarify how the different components of the model unfold and interact.

2.4.1 The thriver model

For this study, we developed a general model to help explain the occurrence of personal growth. The thriver model is based on the assumption of within-person factors that are critical for positive development after positive and negative life events. These factors were merged into a theoretical model, which was applied not only to varying life events but also in two different cultures. The results support the hypotheses that PTG and PEG are not only highly interrelated, they might also be facilitated by parallel psychological factors.

The thriver model aims to explain, predict, and help to enable positive changes after major life events. It complements other taxonomies of well-being, including Seligman's PERMA (2011) theory and Ryff's concept of psychological well-being (Ryff and Keyes, 1995), by adding a process perspective on the question of a well-lived life. The current studies were a first step to test the thriver model in a cross-cultural comparison approach. The key components of meaning making, supportive relationships, and positive emotions showed strong relations with self-reported growth in the U.S. and in the Indian sample. These results are supported by earlier research on turning points, which identified meaning making in times of life-altering experiences as a critical facilitator for psychological well-being (Tavernier and Willoughby, 2012). The results are also concurrent with narrative attachment research which emphasizes the prior role of close relationships and high effectance motivation in adults (Sabir, 2014). Finally, the outcomes are in accordance with Fredrickson's (2004) work on the facilitating role of positive emotions for personal development. In sum, thrivers might be described as persons with a well-developed ability to create meaning from their experiences, a secure attachment status, and a high positivity ratio.

The model was generalizable across positive and negative life events in different countries and has shown its broad applicability. The direct effects of all three key variables where highly significant. In most cases, it was not possible to clearly identify them as mediators or moderators for the occurrence of growth. An explanation for this finding might lie in the relationship between perceived distress and the occurrence of growth. In our study, we used the impact of the life event as a proxy to operationalize life events as a continuous variable. While some research finds that more distress of events (which would result in higher impact) is related to more PTG (Cordova et al., 2001), others indicate that there might be a curvilinear relationship between distress and PTG (Lechner et al., 2003). This might also explain why the direct effect of major life events on growth was either small or not significant. An alternative explanation would be that major life events are a necessary but not sufficient prerequisite for growth, which

only occurs when they are accompanied by specific psychological resources. Future research should therefore aim to disentangle the direction in which the different factors interact to enable growth processes in a longitudinal design.

2.4.2 Limitations and outlook

Design and Time Scale. The current studies aimed to test the thriver model and to determine, if longitudinal and thus more expensive future projects are justifiable. Therefore, we conducted both studies in a cross-sectional design. This approach led to shortcomings, which should be addressed in future research. The thriver model is a process model, which ultimately aims to inform interventions designed to help people grow. At the same time, it is not possible to investigate a process model exhaustively and to verify causations between observed variables without longitudinal observations. In addition, all variables were measured at the present time and did not retrospectively refer to the time of the life event. This approach was taken because we did not assume that participants would be able to recall retrospectively their meaning making mindset, positive emotions, and social relations when the life event happened. This cross-sectional approach leaves the question unanswered if a high level of positive emotions, social support, and meaning making are a consequence of or prerequisite for the occurrence of growth. It might also be possible that having a high level of all three variables at the measurement time influences how participants evaluate the life events in their past. Subsequent studies should, therefore, have different measurement time points that include pre- and post-event data as well as a follow-up measures for single events in order to disentangle the underlying mechanisms. Meanwhile, the present results indicate that it will be of value to conduct longitudinal research on these mechanisms.

Perceived Growth. The current studies were based on measures of perceived growth. Increasingly, researchers expressed their doubts if perceived posttraumatic growth actually mirrors genuine growth (Frazier et al., 2009). Park and Helgeson (2006) refer to this problem as a veridicality issue, emphasizing that some reports of growth may represent cognitive

distortions or illusions, rather than genuine growth. One provided alternative explanation is that self-reported growth experiences are motivated illusions with the inherent goal to alleviate distress through self-enhancement (McFarland and Alvaro, 2000). This approach assumes that posttraumatic growth is primarily a cognitive coping strategy, reducing the negative impact of stressful life events. However, while this explanation may be applicable to negative life events, it does not explain why people report growth after positive experiences as well. To disentangle genuine growth from perceived growth as a coping strategy, future research should measure the different domains of growth with scales that are not related to the event itself in a pre- and post-test design.

Non-Exhaustive Approach. The thriver model unifies three key factors, which showed high explanatory power for positive changes after threatening and highly positive events. However, there may be other contributing factors, which might also be considered in future research, such as an individual's personal initiative to thrive (i.e., personal growth initiative; Robitschek, 1998) or effectance motivation (Sabir, 2014). In sum, the current studies can be considered a critical first step to study the connections between posttraumatic and postecstatic growth in order to disentangle the complex mechanisms underlying positive development across the life span.

2.5 Conclusions

The thriver model unites key components that contribute to positive development independent of the life path encountered. It explains growth processes that occur after turning points in life with positive or negative valence. Drawing from beneficial processes following life's best and worst moments, it identifies three factors that might not only enable positive changes after major life events, but can also help people to make the most of the experiences they have had in their life. Taking both good and bad experiences into consideration as possible facilitators of growth may broaden our understanding of the origin of positive human

development. Following the saying: "We can't change the cards we are dealt, just how we play the hand," it may be the basis for a new line of interventions, enabling people to benefit from whatever they may encounter in life.

Acknowledgments

The authors gratefully acknowledge Martin Schultze, Johannes Eichstaedt, and the International Max Planck Research School on the Life Course for the scientific support of this research.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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2.7 Appendix

Table 6 and 7 show the factor loadings and standard error of parcels used for the thriver model.

Table 6

Factor loadings and standard error of parcels (negative events)

		India			USA		
		Estimate	S.E.	Est. /S.E.	Estimate	S.E.	Est. /S.E.
Growth (PTG)	PTGI_1	1.00	.00	999.00	1.00	.00	999.00
	PTGI_2	0.91	.05	18.41	0.91	.04	24.64
	PTGI_3	0.97	.05	19.01	0.98	.04	26.12
SR	MSPSS_1	1.00	.00	999.00	1.00	.00	999.00
	MSPSS_2	1.00	.05	20.79	1.00	.03	33.82
	MSPSS_3	0.94	.05	18.82	0.98	.03	35.50
PE	PANAS_P1	1.00	.00	999.00	1.00	.00	999.00
	PANAS_P2	0.92	.06	15.53	0.94	.04	21.65
	PANAS_P3	0.94	.05	17.32	0.94	.04	23.89
CFTI-N	CFTI-N1	1.00	.00	999.00	1.00	.00	999.00
	CFTI-N2	0.93	.14	6.77	1.01	.14	7.92
	CFTI-N3	0.97	.16	6.01	0.85	.14	6.26

Note. Growth = Posttraumatic growth (PTGI); SR = Supportive relationships (MSPSS); PE = Positive emotions (PANAS-P); CFT-N = Counterfactual thinking (CFTI, negative events); estimator = MLR.

Table 7

Factor loadings and standard error of parcels used for the thriver model (positive events)

		India			USA		
		Estimate	S.E.	Est. /S.E.	Estimate	S.E.	Est. /S.E.
Growth (PEG)	IGPE_1	1.00	.00	999.00	1.00	.00	999.00
	IGPE_2	1.02	.05	22.69	.98	.02	49.80
	IGPE_3	1.01	.04	25.38	.97	.02	49.70
SR	MSPSS_1	1.00	.00	999.00	1.00	.00	999.00
	MSPSS_2	.99	.06	16.39	1.03	.03	34.37
	MSPSS_3	.91	.06	15.99	.99	.03	35.47
PE	PANAS_P1	1.00	.00	999.00	1.00	.00	999.00
	PANAS_P2	1.02	.05	22.69	.94	.04	22.04
	PANAS_P3	1.01	.04	25.38	.94	.04	23.93
CFTI-P	CFTI-P1	1.00	.00	999.00	1.00	.00	999.00
	CFTI-P2	1.14	.15	7.63	1.27	.11	11.32
	CFTI-P3	1.05	.14	7.63	1.00	.09	11.08

Note. Growth = Postecstatic growth (IGPE); SR = Supportive relationships (MSPSS); PE = Positive emotions (PANAS-P); CFTI-P = Counterfactual thinking (CFTI, positive events).

CHAPTER 3

Brain structural associations of personal growth initiative

Mangelsdorf, J. (2017). Coping with childbirth: Brain structural associations of personal growth initiative. *Frontiers in Psychology, 8, 1-9.* doi: 10.3389/fpsyg.2017.01829[2]

http://doi.org/10.3389/fpsyg.2017.01829

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Coping with childbirth: Brain structural associations of personal growth initiative

Abstract

Major life events require psychological adaptations and can be accompanied by brain structural and functional changes. The goal of the current study was to investigate the association of personal growth initiative (PGI) as a form of proactive coping strategy before childbirth, with gray matter volume after delivery. Childbirth is one of the few predictable major life events, which, while being one of the most positive experiences for many, is also accompanied by multidimensional stress for the mother. Previous research has shown that high stress is associated with reductions in gray matter volume in limbic cortices as well as the prefrontal cortex (PFC). We hypothesized that PGI before childbirth is positively related to gray matter volume after delivery, especially in the ventromedial PFC (vmPFC). In a prospective study, 22 first-time mothers answered questionnaires about their PGI level 1 month before birth (T1) and 1 month after delivery (T2). Four months after giving birth, a follow-up assessment was applied with 16 of these mothers (T3). Structural brain data were acquired at both postpartal measurement occasions. Voxel-based morphometry was used to correlate prenatal PGI levels with postpartal gray matter volume. Higher PGI levels before delivery were positively associated with larger gray matter volume in the vmPFC directly after childbirth. Previous structural neuroimaging research in the context of major life events focused primarily on pathological reactions to stress (e.g., post-traumatic stress disorder; PTSD). The current study gives initial indications that proactive coping may be positively associated with gray matter volume in the vmPFC, a brain region which shows volumetric reductions in PTSD patients.

Keywords: personal growth initiative, structural MRI, vmPFC, proactive coping, PTSD, childbirth

3.1 Introduction

Major life events are often accompanied by high stress (Price & van Stolk-Cooke, 2015). They can disrupt our assumptions about the world in a way that requires fundamental cognitive changes to accommodate these experiences (Cann et al., 2010). One of the most impactful events across the life course of a woman is giving birth to a child (Mangelsdorf & Eid, 2015). Generally, most women consider childbirth as a positive experience (Neuhaus, Piroth, Kiencke, Göhring, & Mallman, 2002). However, it is accompanied by intense multidimensional stress for the mother (e.g., physical pain, emotional arousal, and psychological distress; Lowe, 2002) that can sometimes result in PTSD (4.6-6.3%; Dekel, Stuebe, & Dishy, 2017).

There are four psychological reactions that individuals show as an outcome of being exposed to highly stressful experiences. First, some individuals react with resilience and show nearly no psychological impairment (McFarlane & Yehuda, 1996). They bounce back to their original level of psychological functioning. Second, some people are affected by the experience to a degree, but are able to recover. They experience psychological impairment as a consequence of high stress and core belief disruption, but after a while find their way back to their original level of psychological functioning (Bonanno, 2005). In a recent study, Infurna and Luthar (2016) questioned the distinction between resilience and recovery trajectories, since depending on the analytical approach, they found less different trajectories than Bonnano (2005) using the same data. Third, the most extensively studied reaction to trauma exposure is posttraumatic stress disorder (PTSD; e.g., Foa et al., 2008; Yehuda, 2002). Individuals suffering from PTSD experience severe psychological impairment as a consequence of highly stressful events and recover very slowly, or not at all. In a meta-analysis on PTSD and childbirth, the prevalence of PTSD ranged from 1.3–2.4% at 1–2 months and 0.9–4.6% at 3–12 months

postpartum (Andersen, Melvaer, Videbech, Lamont, & Joergensen, 2012). Thus, for some women childbirth can be a highly challenging event, associated with the risk of traumatization and posttraumatic stress.

Finally, some individuals react to high stress and core belief disruption with cognitive changes that excel their original level of psychological functioning. They not only recover from high stress, but – after a period of adaptation - show posttraumatic (Tedeschi & Calhoun, 1996) or postecstatic growth (Roepke, 2013). Tedeschi and Calhoun (1996) introduced the concept of posttraumatic growth as a possible outcome of exposure to trauma. They found that some individuals report psychological benefits including deepened relationships, higher appreciation of life, more personal strengths, a stronger sense of meaning and spirituality, and more openness toward new possibilities. For a long time, this unidirectional approach established the idea that suffering might be a prerequisite for growth. Roepke (2013) revised this assumption by investigating the psychological consequences of life events with positive emotional valence. She found that also positive emotional peak experiences can be a catalyst for beneficial developments, especially in the areas of relationships, self-esteem, meaning and spirituality. Roepke (2013) framed this psychological reaction to major life events with positive valence postecstatic growth.

Most studies that investigate posttraumatic as well as postecstatic growth were based on measures that rely on the retrospective self-perception of change (e.g., Roepke, 2013; Tedeschi & Calhoun, 1996; 2004). This circumstance has been identified by influential researchers in the field as one of the most critical methodological aspects in growth research since it entangles genuine growth with cognitive illusions (Frazier et al., 2009; Jayawickreme & Blackie, 2014; 2016; Tennen & Affleck, 2009). Thus, a critical question is how to measure the outcomes of stressful life events with other approaches but self-reports.

Whether individuals react to a stressful experience with resilience, recovery, PTSD or growth depends on multiple factors, which all influence psychological reactions to stress.

3.1.1 Moderators of stress

Various psychological, medical, and situational moderators that alter the stress level during labor, and consequently its psychological outcomes, have been investigated. De Schepper et al. (2015) examined obstetric, midwifery team care and personal risk factors for the development of PTSD after childbirth. They found that an external locus of control during labor, as well as low socio-economic status, were associated with higher PTSD scores, while spontaneous vaginal birth, the perception of the midwife being in control of the situation, and the possibility to ask questions, were important preventive factors. In accordance with these findings, Cipolletta and Sperotto (2012) found in a qualitative study that further humanization in hospital settings (e.g., less machines in the room and a close relationship to the midwife) and the possibility of more personal agency improve women's experiences during childbirth.

Moreover, active coping has been identified as a critical mediator of exposure to highly stressful events, neuroendocrine regulation, and development of psychopathology in general (Olff, Langeland, & Gersons, 2005). It is associated with good adaptation to stress, and thus can prevent psychological disorder (North, Spitznagel, & Smith, 2001; Olff, Langeland, & Gersons, 2005) and may foster positive outcomes of stressful experiences. Schwarzer and Knoll (2003) distinguish four coping strategies: reactive coping (alluding to harm or loss), anticipatory coping (pertaining to imminent threat in the near future), preventive coping (focusing on uncertain threat in the distant future), and proactive coping (involving upcoming challenges that are self-promoting). They highlight the critical role of proactive coping as the prototype of positive coping that does not require negative appraisal, threat, or loss, but includes all efforts to develop general resources that facilitate processes striving for personal growth (Schwarzer & Knoll, 2003). Following this definition, one important proactive coping strategy and positive resource that can help people to cope and function successfully facing adverse events is personal growth initiative (PGI; Robitschek, 1998; Robitschek et al., 2010), which we have addressed in this research.

Previous neuroimaging studies mainly focused on brain structural differences relating to negative (traumatic) life events and possible negative consequences, including mental disorders (see Karl et al., 2006; Kühn & Gallinat, 2013; Smith, 2005). In contrast, structural MR studies related to the above-mentioned protective buffering factors, such as proactive coping mechanisms to brain structure, are lacking. The current study investigated the association of personal growth initiative, as a skill set that supports proactive coping, with the brain structure of young mothers.

3.1.2 Personal growth initiative

Critical life events such as childbirth pose a challenge to the individual. Schwarzer and Knoll (2003) distinguish the four different, above-mentioned coping strategies depending on two dimensions: (a) certainty of the event and (b) timing of the coping strategy. Reactive coping describes coping processes following the event. Meanwhile, anticipatory coping, preventive coping, and proactive coping are prospective coping strategies, which are built and used before the event takes place. The authors define proactive coping as all efforts that a person undertakes in order to build universal resources which promote the advancement of personal growth and the accomplishment of critical goals (Schwarzer & Knoll, 2003). In contrast to reactive coping, proactive coping summarizes coping strategies which are developed and used before a challenging event occurs and are independent from the valence of the event encountered.

Robitschek (1998) introduced the concept of Personal Growth Initiative (PGI) as a critical antecedent for coping effectively with life challenges. PGI can be defined as a developed skill set for self-improvement that includes cognitive and behavioral aspects (Meyers, Van Woerkom, De Reuver, Bakk, & Oberski, 2015; Robitschek et al., 2012).

PGI is a multidimensional concept that encompasses four subdomains: readiness for change, planfulness, using resources, and intentional behavior (Robitschek et al., 2012). Individuals with high PGI levels strive for personal growth, set realistic goals for their change processes, ask for help, and actively work on themselves to realize their goals. Individuals who

display high levels of PGI experience more emotional, social, and psychological well-being (Robitschek & Keyes, 2009) and are less likely to suffer from depression, anxiety, and emotional distress (Robitschek & Kashubeck, 1999).

The main assumption underlying the concept is that individuals have an active and intentional role in their personal change processes (Robitschek et al., 2012). The PGI concept is based on the premise that effective coping and positive development following psychological challenges are at least partially based on intentional and motivational aspects. In summary, positive development does not happen by chance, but can be the result of intentionally striving for self-improvement.

Robitschek and colleagues (2012) state that PGI is expected to prevent psychological distress by providing a mindset that facilitates effective handling of difficulties. They argue that individuals with high PGI are more likely to perceive stressful events as opportunities for growth instead of threats. PGI encompasses cognitive and behavioral skills that include the belief that one can change one's circumstances, active planning, and goal-setting strategies directed toward attaining improvement (Robitschek et al., 2012). PGI enables individuals to assert some psychological control over their lives even under otherwise uncontrollable conditions. It may therefore represent a particularly adaptive mindset in adverse situations, which is conceptually similar to the construct of hope (Blackie, Jayawickreme, Forgeard, & Jayawickreme, 2015; Shorey, Little, Snyder, Kluck, & Robitschek, 2007) and might therefore even go beyond the scope of a mere prospective coping strategy. Thus, possessing the skill set of personal growth initiative before stress exposure might prevent the development of high stress levels after major life events, and by this means buffer stress-related physical consequences.

It is important to distinguish psychological growth, as referred to in the concept of personal growth initiative, from growth concepts such as posttraumatic (Tedeschi & Calhoun, 1996; 2004) or postecstatic growth (Roepke, 2013). While PGI implies an ongoing process,

thriving for self-improvement (Robitschek et al., 2012), posttraumatic and postecstatic growth can be defined as multidimensional psychological change processes caused by disruptive cognitive processes through major life events.

3.1.3 Brain structural changes after highly stressful life events

Most research on brain structural consequences of major life events focused on traumatic experiences, especially in individuals suffering from PTSD. Traumatic experiences are extraordinarily stressful events, and thus the research concerned dealt with the effects of high stress on the brain. Basic knowledge about the brains' response to stress comes from functional neuroimaging studies. These studies revealed that four brain areas are fundamentally involved in processing and regulating stressors in humans, namely hippocampus, prefrontal cortex (PFC), amygdala, and brainstem (cf., Dedovic, Duchesne, Andrews, Engert, & Pruessner, 2009).

Structural alterations in highly stressed populations (i.e., PTSD patients) are localized in similar areas: Patients suffering from PTSD have smaller gray matter volume in cingulate, frontal, temporal and limbic cortices (including the hippocampus and amygdala) compared to trauma-exposed and non-trauma-exposed healthy participants (Karl et al., 2006; Kühn & Gallinat, 2013; Smith, 2005). In a recent meta-analysis by Kühn and Gallinat (2013), four regions were found to show smaller volumes in PTSD patients compared to trauma-exposed controls: The anterior cingulate cortex, the ventromedial PFC (vmPFC), the hippocampus and the temporal pole/temporal gyrus. Since most of these studies were cross-sectional, the question remains unanswered, if smaller gray matter volumes are an antecedent or consequence of PTSD.

Longitudinal data from animal studies depict various neurobiological effects of stress exposure on the function and structure of different brain regions such as the hippocampus and PFC (e.g., McEwen & Morrison, 2013; Magarinos & McEwen, 1995). Mediated amongst others by cortisol, stress exposure leads to cell atrophy and consequent decrease in brain volume

in the affected regions (Magarinos & McEwen, 1995). Animal data indicate that volumetric differences observed in PTSD patients might reflect volume reductions due to psychopathological development following traumatic events.

In contrast to literature focusing on traumatic events and highly stressed populations, few studies explored neuronal association of successful coping with stressful life events (e.g., Rabe, Zöllner, Maercker, & Karl, 2006). Rabe and colleagues (2006) investigated the relationship between posttraumatic growth and frontal brain asymmetry in survivors of motor vehicle accidents. They found that increased relative left frontal activation was positively associated with PTG. Meanwhile, no study has measured structural brain correlates of coping or resilience.

3.1.4 Aims of the current research

Major life events often cause high stress for the affected individual, which in turn requires effective coping and adjustment (Mangelsdorf & Eid, 2015). One of the main challenges of research which investigates the outcomes of major life events is the unpredictability of many of these events. Giving birth is an exception in this regard, given that it is a relatively predictable life event associated with intensive multidimensional stress for the mother.

The present study investigates the association of personal growth initiative and brain structure in pregnant women transitioning into motherhood. The current investigation is the first study known to the authors that systematically investigated the association of personal growth initiative as a preventive coping strategy with gray matter volume.

Previous research on brain structural correlates of major life events has mainly focused on neural change relating to pathological development, such as PTSD (e.g., Karl et al., 2006; Kühn & Gallinat, 2013; Smith, 2005). In contrast, research into preventive factors that may buffer stress and counteract brain volume reductions is scarce. We hypothesized that prenatal proactive coping as a preventive factor for pathological reactions to stress is particularly

associated with PFC volume. The prefrontal cortex plays a critical role in the perception of controllability of stressful experiences (Maier & Watkins, 2011; Maier & Seligman, 2016; Salomons, Johnstone, Backonja, Shackman, & Davidson, 2007). Activation of the PFC enables top-down inhibitory control over limbic and brainstem responses to stressful situations (e.g., pain), while perceived controllability extenuates experienced stress (Maier & Watkins, 2011). Maier and colleagues exposed rats to uncontrollable shocks in a shuttle box escape task (Maier, Amat, Baratta, Paul, & Watkins, 2006). These rats were not able to learn to escape shocks in a different situation that was controllable. Seligman and Maier (1967) termed this effect of inactiveness in the face of traumatic shock learned helplessness (Maier et al., 2006). Interestingly, Maier and colleagues (2006) added an experimental group that was also exposed to uncontrollable shock but received picrotoxin to activate vmPFC during experimental treatment. This group, even though previously exposed to high stress through inescapable shock, did not react with learned helplessness, but actively escaped the shock.

The prospective coping strategy PGI can be linked to the concept of controllability of stressful situations. Individuals with high levels of PGI should in theory have a stronger feeling of control over stressful situations. Hence, we hypothesized that prenatal PGI might be positively associated with brain volume in the PFC after childbirth.

3.2 Methods

3.2.1 Participants

The participating women were a subsample of a larger study focusing on cognitive and neural changes throughout pregnancy and childbirth (peripartum period). Women who participated in the original study were invited to take part in the psychological online assessment in addition to the on-site tests and MR scans. Only healthy pregnant women who had never been pregnant previously beyond 8 weeks were enrolled. None of the participants had a history of neurological or psychiatric conditions. The study was conducted according to

the Declaration of Helsinki, with approval from the Ethics Committee of the German Society for Psychology and the ethics commission of the Max Planck Institute for Human Development. The initial sample of the present investigation consisted of 22 women (age: *M* = 28.09, *SD* = 3.15). One subject had not only an outlier PGI score exceeding the 75 percentile by 1.5 times the interquartile range but had also a conspicuous response style. The person answered nearly all items of the provided questionnaires with the highest possible option, with nearly no variance between the different items and finished the online questionnaire in a very short time. Therefore, this subject was excluded from further analyses. The results of the full sample including the outlier are provided in the supplementary material for comparison. The final sample that took part in the prenatal online assessment (T1) and in the postpartal MR scans consisted of 21 women (age: *M* = 28.19 years, *SD* = 3.19). Some women (*n* = 5) dropped out after the first MR scan and did not take part in the follow up assessment.

3.2.2 Design and procedure

The present investigation was embedded in a longitudinal study assessing neural and cognitive change during the peripartum period (Lisofsky et al., submitted). Within that study, women underwent cognitive and psychological assessment in the last weeks of pregnancy (T1). Structural imaging data was acquired from the same women about one to two months (T2) and about four months (T3) after childbirth. MR scans took place solely after delivery, due to medical concerns over scanning pregnant women. Participants who agreed to take part in the online-questionnaire assessment and underwent an MR scan in the first months after delivery were included in the present investigation. For these participants, PGI scores accessed before childbirth (T1) were correlated with postpartal gray matter volume (T2) in a whole-brain regression analysis. Additionally, PGI scores before childbirth were correlated with gray matter volume in the same area at T3. The online assessment at T1 was carried out about 20 days before delivery (*M* = 19.69, *SD* = 10.66). The imaging session at T2 was carried out 39 days

after delivery (*M = 38.68, SD* = 13.67), while the imaging session with the reduced sample at T3 was carried out about four months after childbirth (*M* = 135.59, *SD* = 29.17).

3.2.3 Questionnaires and online assessment

Participants who took part in the psychological assessment were contacted via email and provided with a link to the online questionnaire, which was hosted on the survey software site Qualtrix. All questionnaires in German. For that we used a translation–retranslation approach.

Personal growth initiative - Personal Growth Initiative Scale - II (PGIS-II; Robitschek et al., 2012)

The PGIS-II is a multidimensional 16-item scale that measures the degree to which individuals actively show initiative to thrive for personal growth. It includes four subscales: readiness for change (e.g., "I can tell when I am ready to make specific changes in myself."), planfulness (e.g., "I set realistic goals for what I want to change about myself.", using resources (e.g., "I ask for help when I try to change myself."), and intentional behavior (e.g., "I actively work to improve myself."; Robitschek et al., 2012). Participants indicated to which extent they agree with each of the 16 statements (Likert scale ranging from 0 "disagree strongly" to 5 "agrees strongly"). With α = .91, the scale had a good internal consistency, which is comparable to the results of other studies (e.g., Thoen and Robitschek, 2013; α = .90 and 91). The stability coefficient of the PGIS-II between T1 and T2 was *r* = .64 and *r* = .74 between T1 and T3.

As described above, one outlier PGI score was excluded before further analysis due to extreme data in all questionnaires and PGI scores exceeding 75th percentile by more than 1.5 times the interquartile range. The results of all analyses including the outlier can be found in the supplementary material.

3.2.4 MRI data acquisition

MRIs were acquired using a 3T Magnetom Tim Trio MRI scanner system (Siemens Medical Systems, Erlangen, Germany) using a 12-channel radiofrequency head coil. High-resolution anatomical images were collected using a T1-weighted 3D MPRAGE sequence (TR

= 2500 ms, TE = 4.77 ms, TI = 1100 ms, acquisition matrix = 256×256×192, sagittal FOV = 256 mm, flip angle = 7°, voxel size = 1.0×1.0×1.0 mm^3).

3.2.5 MRI data analysis

Anatomical data were processed by means of the VBM8 toolbox (http://dbm.neuro.uni-jena.de/vbm.html) with default parameters by Gaser and the SPM8 software package (http://www.fil.ion.ucl.ac.uk/spm). The VBM8 preprocessing involves bias correction, tissue classification and registration. The 'nonlinear only' modulation was applied in order to preserve the volume of a particular tissue within a voxel by multiplying voxel values in the segmented images by the Jacobian determinants derived from the spatial normalization step. Images were smoothed with a full-width half-maximum kernel of 8 mm. Statistical analysis was carried out by means of whole-brain regression implemented in SPM 8. Age and total intracranial volume were entered as covariates of no interest. The resulting maps were thresholded with $p < 0.001$ and a statistical extent threshold (k > 1000 voxels), correcting for non-stationary smoothness (Hayasaka & Nichols, 2004).

3.3 Results

3.3.1 Descriptive statistics

Table 8 displays the descriptive statistics of the different scales and the MR results at each time point. Further analyses focused on the PGI results of T1 in order to measure personal growth initiative as a preventive proactive coping strategy.

Table 8
Descriptive statistics

PGIS-II T1		**PGIS-II T2**		**PGIS-II T3**		**vmPFC T2**		**vmPFC T3**	
M	SD	M	SD	M	SD	M	SD	M	SD
4.11	0.37	4.12	0.46	4.15	.42	.5036443116	.0517414991	.5063973605	.0510023263

Note: PGIS-II = Personal Growth Initiative Scale – II, [1-6]; vmPFC = gray matter volume in the vmPFC.

3.3.2 MRI results

Due to the small sample size and the occurrence of tied ranks, Kendall's tau-b correlation coefficient (τ_b; Howell, 1997) was used to estimate the association of prenatal PGI level and postpartal gray matter volume. A whole-brain VBM regression analysis revealed a cluster in the left ventromedial prefrontal cortex (vmPFC) with a significant positive correlation with PGI scores at T1 (τ_b = .38, p = .02; brain data acquired at T2; $p < 0.001$, k > 1000 voxels corrected for non-stationary smoothness; see Figure 6). No other regions were found to correlate positively or negatively with PGI. This effect also remained significant after Bonferroni correction.

In a confirmatory approach, the same vmPFC cluster, revealed in the whole-brain VBM regression with brain data acquired at T2, was used to estimate the association of PGI and vmPFC volume at T3. One-tailed Kendall's tau-b correlation confirmed a positive relation of prenatal PGI and vmPFC volume, but failed to meet statistical significance (τ_b = .20, p = .13) in the reduced sample assessed four months after delivery.

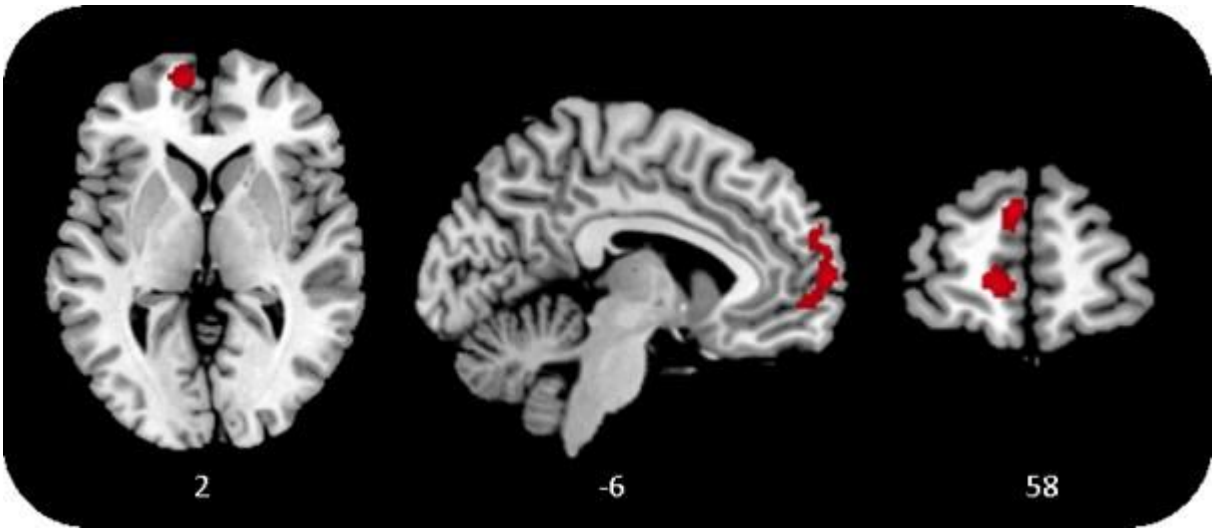

Figure 6. Gray matter (GM) in the ventromedial prefrontal cortex (vmPFC) correlates positively with personal growth initiative (PGI), p < 0.001, k > 1000 voxels, corrected for non-stationary smoothness.

3.4 Discussion

The current study systematically investigated the relationship between prenatal personal growth initiative and postpartal brain structure. Mothers-to-be were provided with an online assessment approximately one month before birth, one to two months after delivery and three months later. At the latter two time points, complementing MRI scans were realized. Individual differences in PGI scores were associated with gray matter volume in the vmPFC. Women with higher PGI scores before childbirth had larger vmPFC gray matter volume after delivery than those with lower PGI scores. The relation of prenatal PGI level and postpartal vmPFC volume was significant directly after delivery. However, it failed to meet significance at the follow-up assessment. This difference might be caused by participants dropping out, and consequently the diminished power of the analyses at T3. It is important to note that the correlational approach of this study does not allow assumptions about within-subject associations or causal relationships. However, the current findings give an initial indication of a positive connection between proactive coping and vmPFC volume, a brain region that is known to be impaired in individuals suffering from PTSD (Kühn & Gallinat, 2013).

The results allow different explanations, which will be addressed in more detail below. PGI, as a proactive coping strategy, might buffer the effects of exposure to high stress. This explanation is supported by psychological and neural evidence found in other studies. Proactive coping includes all efforts to build resources that promote successful mastering of future challenges and personal growth (Schwarzer & Knoll, 2003). Individuals with a high PGI level perceive potential stressors as opportunities for growth and cope with them by applying goal-directed and self-regulatory behaviors (Robitschek et al., 2012). This ensures a constructive path of action and increases the quality of functioning in the face of future challenges (Schwarzer & Knoll, 2003). Hence, individuals with higher PGI might be more resilient and experience less stress in critical and demanding situations, due to the resources and assets they have built.

The vmPFC is known to play a critical role in coping and resilience (Maier & Watkins, 2011). Studies on fear extinction in humans have found that the amygdala and vmPFC play a critical role in the acquisition and extinction of fear (e.g., Milad & Quirk, 2012; Phelps, Delgado, Nearing, & Ledoux, 2004). While amygdala activation is associated with acquisition and early extinction of conditioned fear, the vmPFC is related to the long-lasting retention of extinction (Phelps et al., 2004). In their recently published article, Maier and Seligman (2016) introduced their revised theory of learned helplessness. They state that passivity in response to inescapable prolonged stress is the default reaction to stressful events. This automated response is mediated by the serotonergic activation of the dorsal raphe nucleus (DRN), which can be turned off by the vmPFC when a stressor is detected as controllable. Maier and Seligman (2016) conclude that the key mechanism in response to inescapable stressors is not learned helplessness but learned controllability, which is detected and exerted by the vmPFC. Hence, proactive coping strategies, such as PGI, may lead to vmPFC activation in the face of stressful experiences by increasing perceived controllability. Since brain function can shape the brain structure within the same region (May, 2011), it is likely that this process also influences vmPFC volume. Maier and Seligman (2016) identified the presence of control confronted with stressors as "the active ingredient, leading to the inhibition of threat-induced changes in limbic and brainstem structures." (*p.* 361). Since (chronic) high stress levels possibly cause structural changes (i.e. dendritic shrinkage) in the PFC (McEwen, Bruce, & Morrison, 2013), perceived control and resulting lower stress could mediate the association of PGI and vmPFC volume. Maier et al. (2006) found that preceding experiences with behavioral control over stress changes the vmPFC response to later stressors by also activating the vmPFC when the subsequent experience is uncontrollable. Maier and Watkins (2011) report that the experience of control over stressors alters the function of the vmPFC and associated brain regions: The changed activity of the vmPFC than inhibits stress-responsive structures and leads to stress resistance. Possibly, successful proactive coping that provides individuals with a sense of control over

stressful experiences changes the vmPFC activation and consequently, in the long run, causes larger gray matter volume in this area. Hence, successfully coping with life challenges could influence their impact on the brain. From this explanation, PGI can be seen as a resilience factor, preventing stress and consequent neural losses.

An alternative explanation for the finding is that interpersonal differences in vmPFC gray matter volume are associated with cognitive and psychological functions that allow for a different extent of PGI. Yehuda and colleagues proposed that less gray matter volume could make individuals more vulnerable to the development of PTSD (Yehuda, Flory, Southwick, & Charney, 2006). The mPFC plays an important role in counterfactual representations for future planning (Barbey, Krueger, & Grafman, 2009). Hence, larger volumes might relate to differences in cognitive functions that are part of the PGI construct such as planfulness and intentional behavior. Participants who have greater PFC volume in the first place might - because of this biological asset - also have a greater capability for PGI. Following that explanation, PGI might not prevent individuals from losing brain volume under stress, but vmPFC volume might drive PGI levels, independently of the effects of stress.

3.4.1 Personal growth initiative and resilience

The stability coefficients of the PGIS-II, which were lower for the second measurement time point than for the third, suggest that the birth experience has a short-term influence on PGI level. The data indicate that some mothers show increased PGI scores directly after birth, while others react with a drop in the PGI level or maintained their PGI scores. These transitions can be explained by the challenging character of the childbirth experience and the resulting short-term effects on coping strategies. The majority of young mothers consider their delivery retrospectively as a very positive (65.5%) experience (Neuhaus et al., 2002). Meanwhile, in some cases, the birth process itself is connected to high stress for the mother and in the worst case might be experienced as traumatic. In a prospective study with pregnant women, about 5.6% of young mothers experienced acute postpartum trauma symptoms that met the DSM-IV

criteria for PTSD (Creedy, Shochet, & Horsfall, 2000). The large range of possible birth experiences and following psychological reactions, such as resiliency, recovery, PTSD, or growth, might explain why PGI measured shortly after childbirth drops, increases, or maintains its former level. It is likely that women who experience recovery or PTSD react with impaired PGI, while resilient mothers or those who experience growth might show no changes or increased PGI scores. At the same time, it would not be likely that these short-term psychological changes in PGI are instantly accompanied by changes in brain volume. Therefore, only PGI scores assessed before childbirth were included in the analyses, which mirror proactive coping strategies and not reactions to stress exposure. Since we cannot test these explanations in the current sample, because of the small sample size and its cross-sectional MRI design, these associations should be investigated in future studies with larger samples that have the power to measure the impact of different childbirth experiences and its outcomes on proactive coping in the form of personal growth initiative.

3.4.2 Limitations

Cross-sectional MRI data. Even though the current study had a longitudinal design, ethical considerations prohibit scanning women during pregnancy. Therefore, it was not possible to acquire neural pre- and post-event MRI data (i.e., before and after childbirth). This methodological limitation prevents us from drawing definite conclusions about the causal relationship of the association between brain and PGI. Future longitudinal studies should aim to disentangle the association of PGI and vmPFC, as well as further investigate the association of both variables to the effects of stress.

Small sample size. An additional limitation of the study is its small sample size. Since childbirth is a highly stressful experience, emotionally and physically, for many women, recruitment for post-event MRI research is a challenge. However, the described effects were found despite of the small sample size and the subsequent reduced power of the analyses. Future studies should aim to replicate the findings.

Selectivity and dropout. For this study, we recruited women who took part in the postpartum MRI scan. It can be assumed that this group is selective, since women who suffered from very high stress levels after birth or were longer hospitalized might not be included in this sample. The variance of the results might be limited by this fact. The additional dropout of 5 women might be responsible for the insignificant result at T3. Future studies should involve the hospitals in which the women give birth in order to reduce attrition rate and trace back systematic drop out.

3.4.3 Outlook

The current findings complement studies investigating how vulnerability and resilience after trauma exposure affect the brain. While the present study does not allow to draw causal conclusions, the possibility that PGI might be a buffer against stress caused by major life events and a source of gray matter changes in the vmPFC should be further explored. It might be possible that enhancing personal growth initiative before highly stressful life events, such as childbirth, enables individuals to cope more effectively, influences stress as well as vmPFC volume, and decreases the risk of developing PTSD symptoms. These possibilities must be further investigated in appropriately-designed studies in order to draw final conclusions.

The effect of specific trainings that aim to promote PGI, such as the intentional growth training (Thoen & Robitschek, 2013), should be investigated in longitudinal neuroimaging studies. Thoen and Robitschek (2013) developed the Intentional Growth Training (ITG) with the goal to enhance PGI and thus enable cognitive and behavioral self-change, leading to better mental health. Future research should investigate not only the psychological benefits of such training but systematically assess its effect on coping with high stress and its effect on the brain. PGI might be a valuable resiliency factor, especially for normative life events where preparation is possible.

While childbirth is a life event with high stress, it is also connected to various other hormonal, psychological, and physical changes which might also influence gray matter

plasticity. Therefore, the association of PGI and gray matter volume after major life events should also be studied in other contexts (e.g., military deployment, natural disaster, or severe illnesses).

Finally, future research should explore the relationship of PGI and PTSD, since both might relate to the same neural structure. Assessing PGI, brain volume and PTSD prevalence in a longitudinal study design would allow the investigation of potential causal relationships between the three variables. This could help to discover preventive mechanisms for PTSD development and thus be of high clinical relevance.

3.4.4 Conclusion

The current study set out to investigate how PGI and gray matter volume after childbirth are interrelated. PGI before birth was positively associated with postpartal gray matter volume in the vmPFC. This relation was significant in the larger sample assessed directly after delivery, and positive but not significant in the smaller sample four months later. Therefore, the current study should be seen as an initial indication and critical first step in broadening our understanding of neural correlates of proactive coping. Since a smaller volume of gray matter in this region is known to be related to high stress and PTSD, the finding suggests a new perspective on neural correlates of stress, focusing on coping and resilience. A broad body of research described the relation of small gray matter volume and potential neural losses after trauma exposure. Starting from our findings, future research should in addition consider the possibility of psychological and neural protection factors concerning major life events. The skill set of PGI is not specific to childbirth, but rather a universal tool. Hence, it can be presumed that it would also be beneficial in various other contexts. Investigating coping and protective psychological factors might not only inform research on PTSD prevention, but also unveil how to foster positive development across the life span.

Acknowledgments

The author gratefully acknowledges Dr. Nina Lisofsky, Dr. Michael Eid, Dr. Simone Kühn, and Dr. Ulman Lindenberger for their scientific support of this research and the shared data. They contributed tremendously to the success of this study. Furthermore, I am grateful for the assistance of the MRI team at the Max Planck Institute for Human Development Berlin consisting of Sonali Beckmann, Nils Bodammer, Thomas Feg, Sebastian Schröder, Nadine Taube, and I thank the student assistants for their help with data collection and preparation. In addition, I would like to thank the International Max Planck Research School on the Life Course (LIFE, www.imprs-life.mpg.de) for the scientific support of this research.

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3.6 Supplementary material

Results including outlier (ID 1009)

Table 9

Descriptive statistics including the outlier score

PGIS-II T1		vmPFC T2		vmPFC T3	
M	*SD*	*M*	*SD*	*M*	*SD*
4.18	.49	.5036391345	.0504945386	.5081007672	.0500045201

Note: PGIS-II = Personal Growth Initiative Scale – II, [1-6]; vmPFC = gray matter volume in the vmPFC.

MRI results

Kendall's tau-b correlation coefficient of PGI at T1 and vmPFC volume at T2: $\tau_b = .35$, $p = .03$

One-tailed Kendall's tau-b correlation coefficient of PGI at T1 and vmPFC volume at T3: $\tau_b = .22$, $p = .10$

CHAPTER 4

Does growth require suffering?

Mangelsdorf, J., Eid, M., & Luhmann, M. (2017). Does growth require suffering? A meta-analysis and systematic review on genuine posttraumatic and postecstatic growth. *Mansucript submitted for publication.*

Does growth require suffering? A meta-analysis and systematic review on genuine posttraumatic and postecstatic growth

Abstract

Potentially traumatic life events are not only a source of suffering, but also provide the opportunity for personal growth. Over the last two decades, a large body of research has investigated the phenomena of posttraumatic growth and benefit-finding. Most literature on psychological benefits of negative and positive life events operationalized personal growth with measures that rely on the post-hoc self-perception of change. Since this method is only marginally reliable and valid, one question has become increasingly more controversial: Is there genuine growth after major life events?

This meta-analysis includes studies that investigated the effects of a major life event on at least one subdomain of psychological well-being, posttraumatic, or postecstatic growth. Studies needed to have a longitudinal design, assess changes through independent measures over time, and provide sufficient data to estimate change scores. This meta-analysis is the first synthesis of longitudinal research on personal growth after major life events. It comprises 364 effect sizes derived from 154 independent samples (total N = 98,436) in 122 longitudinal studies.

The results provide strong empirical evidence for lasting genuine personal change after major life events in the areas of social relationships, environmental mastery, and self-esteem. Moreover, the results indicate that the widespread conviction that negative life events have a stronger impact on our lives than positive experiences seems not to be true. Overall, the meta-analysis provides a systematic overview of the state of life event research and growth and shows that genuine personal growth can stem from life's best and worst experiences.

Keywords: posttraumatic growth, postecstatic growth, major life events, psychological well-being

4.1 Introduction

"What doesn't kill us makes us stronger." This famous aphorism of the philosopher Friedrich Nietzsche (1997) emphasizes the fundamental conviction that people might thrive in the face of trauma. A growing body of clinical and personality research supports this understanding of human development and explores the phenomena of benefit-finding and posttraumatic growth (e.g., Joseph & Linley, 2004; Park, Cohen, & Murch, 1996; Park & Helgeson, 2006; Tedeschi & Calhoun, 1996). In this meta-analysis, we define posttraumatic growth as an umbrella term for multidimensional positive personality changes that stem from the integrational processes following traumatic life events and go beyond regular change. This definition highlights three critical elements of posttraumatic growth. First, posttraumatic growth can occur in one or more different psychological areas (Joseph & Linley, 2004) and is therefore multidimensional. Tedeschi and Calhoun (1996) proposed five specific areas in which posttraumatic growth occurs. Notwithstanding, we suggest that posttraumatic growth is not limited to these dimensions. Second, growth occurs not as a consequence of the event, but as a consequence of integrating the diversifying experience (Damian & Roberts, 2016). Finally, since personal growth can also stem from daily experiences, posttraumatic growth describes only those changes that occur as a direct effect of the life event and go beyond regular developmental processes (Luhmann, Orth, Specht, Kandler, & Lucas, 2014). It is important to distinguish posttraumatic growth from adaptation to stressful life events. Only those positive changes can be classified as posttraumatic growth that excel the original level of psychological functioning (Jayawickreme & Blackie, 2016). Positive changes that mirror the adjustment to a stressful experience and are limited to the compensation of the initial impairment of psychological functioning are called adaptation.

An often-discussed key mechanism underlying posttraumatic growth is the disruption of core beliefs (Cann et al., 2010). The traumatic event leaves us with a fundamental shattering of our basic convictions, which might lead to negative psychological effects and end in

posttraumatic stress (Cann et al., 2010). At the same time, successful coping and reconstruction of core beliefs might lead to a new understanding of the world and, through that process, result in posttraumatic growth. For a long time, these theoretical underpinnings have led to the perception that only a potentially traumatic experience might result in personal growth.

Meanwhile, very few studies have been conducted on postecstatic growth (Roepke, 2013), which can be defined as multidimensional personality development following highly positive experiences. Publications that have studied life's best experiences, such as falling in love, having a child, or achieving a crucial long-term goal, indicate that growth might also occur as a consequence of life events that are positively valenced (e.g. Roepke, 2013, Taubman-Ben-Ari, 2014, Taubman-Ben-Ari, Findler, & Sharon, 2011). Thus, one of the unanswered key questions of research on major life events is: Does growth require suffering?

4.1.1 Growth after adversity

In 1996, two studies were published that revolutionized the psychological perspective on traumatic experiences. Park et al. (1996) introduced the concept of stress-related growth, while Tedeschi and Calhoun (1996) authored an article in which they presented the concept of posttraumatic growth. Each of these publications comprised the existing research on the perception of growth after adversity into a single model and scale. Until this point, the possibility of positive development after adversity had rarely received any attention (e. g., Affleck, Tennen, & Gershman, 1985; Joseph, Williams, & Yule, 1993; Malinak, Hoyt, & Patterson, 1979). Two decades later, researchers have cited these articles, which significantly shaped the understanding of the phenomenon of posttraumatic growth, over 5000 times.

In order to study posttraumatic growth, Tedeschi and Calhoun (1996) developed the Posttraumatic Growth Inventory (PTGI). This questionnaire asks participants about their perception of benefits following adverse events. On a Likert scale ranging from 0 (no change) to 5 (very large degree of change) participants indicate how much they agree with items such as "As a result of the disaster, I have a greater sense of closeness with others". The PTGI is

based on the observation of a common theme reported by persons who have lived through rape, incest, bereavement, HIV infection, cancer, heart attacks, and other potentially traumatic experiences. Consistently, they reported that a consequence of the traumatic event was a new philosophy in life, a deepening of their social relationships, and a change in self-perception (Tedeschi & Calhoun, 1996). The PTGI is the most frequently used instrument to measure psychological benefits of trauma (Jayawickreme & Blackie, 2016). It retrospectively assesses perceived changes in the five domains: relationships, openness for new possibilities, personal strengths, spirituality, and appreciation of life (Park & Helgeson, 2006; Tedeschi & Calhoun, 1996). The PTGI relies on the conviction that growth can occur in psychological domains which are not directly associated with the coping process, such as openness for new possibilities or priorities in life.

Meanwhile, the concept of stress related growth (Park et al., 1996) suggests that growth occurs in those psychological domains that are directly needed to cope with the event. Therefore, the Stress-Related Growth Scale (SRGS; Park et al., 1996) assesses perceived changes in coping skills, as well as personal and social resources, with items such as "I learned to work through problems and not just give up".

It is important here to point out the similarities and differences between both concepts. Both scales assess growth retrospectively, measure perceived benefits after adversity, and include social relationships as an integral part of growth. However, the subdomains of stress-related growth are psychological resources that are closely connected to coping with the event, while posttraumatic growth suggests perceived changes in psychological domains that are not directly associated with the potentially traumatic experience. Additionally, while Park et al. (1996) suggest that stress-related growth mirrors actual changes, Tedeschi and Calhoun (1996) only wrote about the perception of benefits. This changed in later publications in which the authors write: "posttraumatic growth refers to positive psychological change experiences as a result of the struggle with highly challenging life circumstances." (Tedeschi & Calhoun, 2004,

p. 1). In the last two decades since its introduction, a large body of research has evolved which explores the phenomenon of posttraumatic growth. Posttraumatic growth has now been studied in thousands of articles investigating positive consequences of trauma.

4.1.2 Growth after positive life events

The understanding that trauma might have a silver lining has been acknowledged by a large number of researchers. Meanwhile, the idea that not only life's worst but also its best experiences could lead to lasting beneficial changes has hardly received any scientific attention. Damian and Roberts (2016) pointed out that any unusual event, independently from its valence, might provide the possibility to break boundaries and thereby change cognition. They emphasized that research should therefore also investigate positive experiences as a possible catalyst for growth.

Pioneering research in the field of growth after positive life events has come from the Bar-Ilan University in Israel. The research teams used an adapted version of the PTGI to investigate personal growth through childbirth, grandmother-, and grandfather-hood (Taubman-Ben-Ari, Findler, & Sharon, 2011; Taubman-Ben-Ari, Findler, & Shlomo, 2012; Taubman Ben-Ari, Shlomo, Sivan, & Dolizki, 2009). Taubman-Ben-Ari et al. (2011) found that after these (for most people) highly positive events, participants also perceived that they had grown from the experience. Her research has been complemented by the groundbreaking work of Roepke (2013), who introduced the notion of postecstatic growth. In focus groups, she asked participants about the best things that happened to them in their lives and about the psychological changes they experienced. Participants reported to have more self-esteem, deeper relationships, more meaning in life, and enhanced spirituality, because of the event. Roepke (2013) comprised these insights into the Inventory of Growth after Positive Experiences (IGPE), which assesses self-perceived change following positive life events, with items such as "[Because of the positive experience,] there is more meaning in life".

Previous cross-sectional research (Mangelsdorf & Eid, 2015) has shown that perceived posttraumatic and postecstatic growth are highly interrelated. These findings raise the question of how similar or different posttraumatic and postecstatic growth really are.

4.1.3 The necessity of independent measures of growth

Most research which has investigated benefits of major life events operationalized growth with measures that retrospectively assessed perceived change. At the same time, an increasing number of studies, which investigated the phenomenon of growth after adversity, began to question the genuine nature of perceived posttraumatic growth (Frazier, Tennen, Gavian, Park, Tomich, & Tashiro, 2009; Jayawickreme & Blackie, 2016; Maercker & Zoellner, 2004; McFarland & Alvaro, 2000; Park and Helgeson, 2006). Different reasons were highlighted which cast doubt on the validity and reliability of measures of self-perceived growth. Maercker and Zoellner (2004) observed in their work with former political prisoners that there are two sides to PTG: one connected to active mastery and one connected to reappraisal and self-enhancement that does not necessarily mirror genuine growth. This problem has also been referred to as a veridicality issue, arguing that at least some reports of posttraumatic growth represent cognitive distortions (Park & Helgeson, 2006).

Even though the problematic entanglement of perceived and genuine growth has been known for over a decade, few studies have addressed this issue. Frazier et al. (2009) prospectively investigated the association of the subdomains of posttraumatic growth assessed with the PTGI and independent measures of actual change in these domains. They found a significant association between perceived and genuine change for spirituality only. In addition, Frazier and colleagues (2009) found that people tend to overestimate personal development when directly asked. Jayawickreme and Blackie (2014) argued that in order to determine to which extent an individual has changed because of a past life event, multiple cognitive steps have to be made. First, in order to give a correct estimation of personal change, the person has to evaluate the current standing of the domain, for example, the current quality of their

relationships. They then have to recall themselves standing on the domain before the major life event, and compare the current and the past standing in order to estimate the degree of change. Importantly, many studies on major life events have their first measurement time point months or even years after the event. In the last step, the person has to estimate how much of the change between these two time-points can be attributed to this specific life event, versus other experiences in that time. Taken together, the complexity of post-hoc ratings of psychological change makes it unlikely that individuals are able to provide a reliable estimate of the actual amount of change they have experienced.

Finally, the growing number of studies that show positive associations of self-reported growth to anxiety (Carboon, Anderson, Pollard, Szer, & Seymour, 2005), intrusive rumination (Danhauer et al., 2013; Lowe, Manove, & Rhodes, 2014), and posttraumatic stress (Lowe et al., 2014) cast doubt on the existence of beneficial changes after trauma. As early as 2006, Park and Helgeson (2006) concluded that an important endeavor for future research would be to clearly distinguish the perception of growth from actual change. However, since most research in this field still relies on self-perceived changes, a critical question has remained unanswered until now: Is there genuine growth after major life events?

Coyne and Tennen (2010) urged researchers in the field to step back from bad research practices and to underpin their claims with appropriate methodological approaches. In order to measure growth independently from self-perception and to widen the scope of possible growth domains, we took into account one additional psychological construct: psychological well-being (PWB; Ryff, 1989). PWB is a well-investigated taxonomy of human thriving in the context of crises, including the six domains: self-acceptance, environmental mastery, autonomy, positive relations with others, purpose in life, and personal growth (Joseph et al., 2012). Joseph and Linley (2005) proposed that posttraumatic growth can be conceptualized as increases in psychological well-being that occur as a consequence of adjusting to threatening

events. It would be likely to assume that if genuine growth does exist apart from the subdomains of posttraumatic or postecstatic growth, it would be in the domains of PWB.

4.1.4 The present meta-analysis

For more than two decades, research has been conducted with the goal of understanding positive consequences of major life events. However, most of this research has had a cross-sectional design and a post-hoc approach, in which the first assessment was applied after the event took place. In addition, even the few longitudinal studies mostly relied on measuring self-perceived change.

Previous meta-analyses on posttraumatic growth were exclusively based on cross-sectional research (Prati & Pietrantoni, 2009; Vishnevsky, Cann, Calhoun, Tedeschi, & Demakis, 2010) and some even actively excluded longitudinal studies (Sawyer, Ayers, Young, Bradley, & Smith, 2012). With this approach, important aspects, such as the timing of the on-set of growth and its degree of change over time, were not investigated. Additionally, all existing meta-analyses were based on studies that operationalized growth mainly through instruments which rely on self-perception, or even excluded studies that did not use the PTGI or SRGS to assess psychological change (e.g., Vishnevsky et al., 2010). Hence, the necessity to distinguish between actual change and cognitive distortions, as suggested by Park and Helgeson (2006), has not been addressed.

The present meta-analysis is the first large-scale systematic review of longitudinal studies on genuine posttraumatic, as well as postecstatic, growth. In order to distinguish authentic from illusionary change, it only includes studies that investigated major life events, with the target outcomes measured repeatedly over time and which did not rely on post-hoc self-perception.

It addresses multiple open questions in the study of beneficial changes that follow major life events. First, it tries to answer the general question of whether there is genuine growth after life events. Jayawickreme and Blackie (2016) reviewed the literature on the prevalence of PTG

and found that the experience of self-perceived PTG is fairly common, with 58% to 83% of participants reporting growth. It should therefore be possible to investigate growth with a between-person approach, since positive changes experienced by the majority of people should lead to increases of sample means over time.

Second, since all meta-analyses on growth focused exclusively on traumatic experiences, the question of whether beneficial psychological change can also occur after positive and ambivalent experiences remains unanswered. Baumeister, Bratslavsky, Finkenauer, and Vohs (2001) argued that negative life events have a stronger impact on our lives than positive life events. Meanwhile, there is no comprehensive meta-analysis known to the authors that has tested this assumption across life events. Therefore, we systematically investigated whether negative, positive, and ambivalent events differ in the extent to which they lead to beneficial change.

Finally, models of posttraumatic and stress-related growth comprised subdomains that were extracted from the existing literature and clinical experiences of the authors. Therefore, later research focused primarily on these psychological factors. The present meta-analysis aims to investigate whether psychological growth is limited to the known subdomains of posttraumatic and postecstatic growth, or whether it also occurs in other psychological areas.

4.2 Materials and methods

4.2.1. Literature search strategy

Research on major life events and their impact on human development is conducted in various fields, including psychology, sociology, and medicine. In order to retrieve as many studies as possible, a variety of different databases was used for the literature search, namely: Psycinfo, Pubmed, Academic Search Premier, ERIC, Medline, and SocINDEX. These databases were either searched one by one or via the EBSCO platform to allow a simultaneous search in multiple databases at a time. Titles and abstracts of manuscripts were examined to

determine if the consequences of major life events were investigated. For those studies that investigated changes after major life events, full text versions were obtained and checked for eligibility.

We conducted an additional hand search in various forms. First, reference lists of included articles were checked. Second, during the general coding process 1752 authors were asked to provide missing data of their studies. An additional 73 authors received up to three emails if the missing data were necessary in order to include the publication. In all emails, we also asked for additional published or unpublished research that might fit into our work. Through these processes, 124 additional studies could be retrieved. Despite the intensive efforts to obtain unpublished research, only two unpublished studies could be included.[3] This number is comparable to the findings of other meta-analyses that were based on longitudinal studies (e.g., Luhmann, Hofmann, Eid, & Lucas, 2012) and explainable by the fact that costly and time-consuming long-term studies are more likely to be published than cross-sectional data.

In addition, the study had to be in the English or German language in order to be included in the coding process. The literature search started in September 2013, included publications from 1990 onwards, and was completed in December 2014[4]. Figure 7 shows a flow chart of the literature search and its outcomes.

[3] In order to estimate possible publication bias, which would suggest that statistically significant results are more likely to be published than not significant results, a regression of effects sizes on the sample size was conducted and controlled for the time lag of event and measurement time point (see Egger, Smith, Schneider, Minder, 1997). The relation of effect size and sample size was not significant for most outcomes. Significant regression coefficients were found for the outcome meaning (post-hoc), mastery (prospective), and self-esteem (prospective). Hence, the results for these three cases might be biased. Detailed results can be obtained from the first author.

[4] Even though a meta-analysis should also aim to include the most recent studies, the very time-consuming methodological approach of the present meta-analysis made this impossible. Only a few studies directly investigated posttraumatic and postecstaticgrowth or psychological well-being longitudinally with independent measures. Hence, we could not limit the literature search to these terms, but had to review every study that investigated one of the 12 subdomains, including self-esteem and social relationships. This led to over 200,000 initial hits that had to be checked in the following years, in which, of course, thousands of new articles were published.

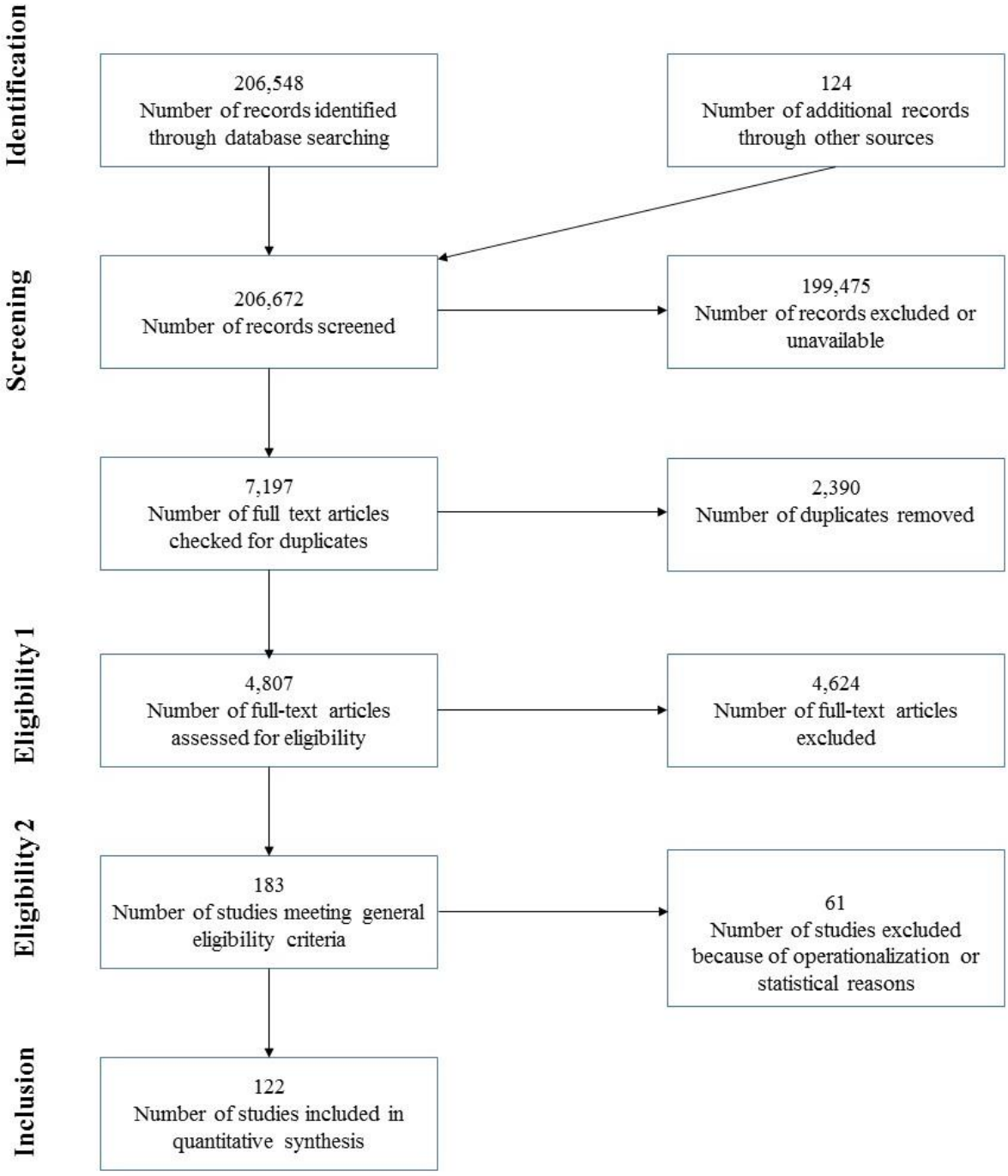


Figure 7. Flow chart of literature search.

4.2.2 Search terms

The literature search aimed to identify research which investigated positive consequences of major life events, which can be defined as critical experiences that mark a transition (Elder, 1977) or turning point (Tavernier & Willoughby, 2012) in one's life course. A comprehensive list of life events was combined with the terms "posttraumatic growth", "postecstatic growth", and "PWB" as well as the subdomains of these three key constructs. In the search process, the list of life events separated by <or> was combined with <and> with each outcome variable. A list of all search terms is included in the supplementary material. Table 10 provides a comprehensive overview of all life events reported in studies that were found in the search process, sorted by valence. Table 11 shows the outcome variables with synonyms. Please note that the list of life events in Table 10 is more extensive than the initial search list, since the literature search revealed studies investigating a broader array of events.

Table 10

Identified life events sorted by valence and life domain

Event cluster	Positive	Ambiguous	Negative
General	1 = Positive life event 2 = Falling in love 3 = Marriage, wedding	14 = Major life event	21 = Negative event
Family related events	4 = Childbirth, birth, delivery, labour confinement	15 = Child leaving home	22 = Divorce, marital separation 23 = Dying, death, end of life 24 = Bereavement 25 = Death of a family member 26 = Parental bereavement by suicide 27a = Parental bereavement through sudden illness 27b = Parental bereavement through long-term illness 28 = War related bereavement 29 = Accident-related bereavement 30 = Parental bereavement 31 = Sexual sibling abuse 32 = Psychological sibling abuse 33 = Physical sibling abuse 34 = Partner of cancer victim 35 = Emotional child abuse 36 = Child neglect 37 = Failed attempt at in vitro fertilization
Friendship related events	5 = Meeting an inspiring person/ soul mate/ Idol		38 = Death of a friend
Physical events			39 = Rape 40 = Sexual molestation, physical assault, abuse 41 = Accident 42 = Physical attack, robbery 43 = War, combat, battle, deployment 44 = Prisoner of war 45 = Chronical illness 46 = Cancer 46a = Breast cancer 46b = Cancer treatment or surgery
Physical events			46a = Breast cancer 46b = Cancer treatment or surgery 47 = Stroke 48 = Being spouse of a stroke victim

Event cluster	Positive	Ambiguous	Negative
Physical events	6 = Aesthetic surgery	16 = Bone marrow transplantation 17 = Stem cell transplantation 18 = Disclosure of traumatic life event 19 = Cancer remission	49 = Heart attack 50 = HIV 51 = Acquired brain injury 52 = Spinal cord injury 53 = Ilizarov limb surgery 54 = Abortion
Natural events			55 = Natural disaster (not specified) 56 = Earthquake 57 = Flood 58 = Volcanic eruption 59 = Tsunami 60 = Tornado, hurricane
Work related events	7 = Graduation, graduating 8 = Employment, being hired 9 = Reemployment 10 = Goal achievement, achievemen achieving a long-term goal	20 = Retirement	61 = Unemployment, being laid off
Unclassified events/ Other	11 = Spiritual experience, spiritual Awakening 12 = Living a dream, life dream 13 = Lottery win		

Table 11
Outcome variables and synonymes

Posttraumatic growth (PTG)	**Psychological well-being (PWB)**
1 = Positive relationships	1 = Positive relationships
2 = Sense of Spirituality	3 = Purpose in life/ meaning
4 = Personal strengths	7 = Self-acceptance
5 = Priorities in life / New possibilities	8 = (Environmental) mastery
6 = Appreciation of life	9 = Personal growth
	10 = Autonomy
Postecstatic growth (PEG)	11 = Psychological well-being (general)
1 = Positive relationships	
2 = Sense of spirituality	
3 = Meaning in life	
12 = Self-esteem	

The search and coding was realized by one of the authors and six student assistants. The student assistants received special training by the first author based on a comprehensive coding manual prior to the search process. This process was accompanied by meetings in which uncertainties could be discussed.

Alterations of the search process. Due to the vast number of hits found with the original search terms, some alterations were applied to specify the results. The original command was specified to not show studies that only included the search terms in the form "purpose of the study", "strengths of the study", and "meaning of the results".

4.2.3 Study eligibility

Study eligibility was verified to ensure the appropriateness and relevance of studies found in the search process. Initially, all files that were positively evaluated through title and abstract screening (n = 4,289) were checked for meeting the inclusion criteria 1-7.

1. **Quantitative data.** Books, qualitative publications, or purely theoretical manuscripts were excluded from the meta-analysis, since they did not provide the necessary data to calculate effect sizes.

2. **Longitudinal studies that provide estimates of genuine change.** One of the major disagreements in the research field of post-event growth evolves around the question of whether self-reported perceived growth reflects genuine growth or a mere coping strategy (Frazier et al., 2009; Maercker & Zoellner, 2004; McFarland & Alvaro, 2000; Park & Helgeson, 2006). To account for the potential distortion caused by retrospective evaluations, which rely on self-perceived change, only longitudinal data of independent measures were included in the meta-analysis.
3. **Single major life event.** Studies were only included if they investigated one single life event. This inclusion criterion was applied to allow the comparison of different life events and to ensure that multiple events had not contributed to the assessed psychological changes. Studies that investigated multiple events, without asking for specifications, were excluded.
4. **Positive change.** Only studies that assessed positive outcomes of major life events were eligible. Research on traumatic or highly positive experiences which focused solely on possible negative outcomes, such as depression or posttraumatic stress, were not included. To narrow the scope of our meta-analysis, positive outcomes were restricted to PTG, postecstatic growth, and psychological wellbeing, as well as the respective subdomains of these variables. Other possible positive consequences of major life events, such as self-efficacy, were not included.
5. **Statistical sufficiency.** In order to calculate effect sizes, sufficient descriptive statistics were needed. This included means, the standard deviation of the first measurement time point, the number of participants, and the retest correlation between time points. When these data were not provided in the article, authors were contacted via email and asked to send the missing information. The minimum requirements for inclusion were the number of participants and means for all time points. If authors did not answer, or were

not able to provide the sufficient statistical information, the studies had to be excluded, even if they met the other criteria.

6. **No professional interventions.** Studies which investigated professional interventions, such as trauma therapy or other interventions that might influence the occurrence or extent to which participants experience psychological changes, were excluded from the meta-analysis. This criterion was applied in order to disentangle the effects that were based on specific interventions from those that were a direct consequence of the life event.
7. **Unduplicated data.** When the coding process was finished, we checked the remaining articles for duplicated data. Some studies that were based on longitudinal panels had to be excluded, since they used the same data. If more than one publication used the same data, the study that included more time points was prioritized. If two or more of these studies reported the same number of time points, the publication with the largest sample size was included.

Studies which met all criteria (n = 122) were coded according to the coding manual. Manuscripts that failed to meet at least one of the criteria provided below were excluded from further coding and following analyses.

4.2.4 Coding

Before coding, a standardized coding manual and coding sheet were developed and tested to ensure that the coding process was sufficiently standardized. Due to the large number of records identified through initial database searching (N = 206,548), the first author and six student assistants worked over the course of two years to screen all records, check for eligibility criteria, and code the remaining studies. A large range of publication characteristics were coded, including specific information about the study, the event investigated, the sample, and the outcome (see Table 11). Forty-seven randomly chosen studies were double-coded to calculate the interrater reliability between different raters. The interrater agreement of categorical

variables was computed with the Kappa coefficient (Cohen, 1960). The interrater reliability of continuous variables was estimated using an intraclass correlation coefficient (ICC, agreement; Fleiss & Cohen, 1973) with total agreement of both raters (see Table 12). Most coded characteristics showed a good interrater reliability. Single items which showed a sufficient, but not good, interrater reliability and that were critical for the meta-analytical process (e.g., timing of the event) were triple checked in all publications by the first author. The item 'data source' showed the lowest interrater agreement with $\kappa = .60$. This estimate was also found in other meta-analyses (e.g., Luhmann et al., 2012) and is usually attributed to an inconclusive distinction between self-report questionnaire and self-report interview in the study descriptions.

To examine whether negative and positive life events differ in their psychological impact, the valence of each life event was coded. We distinguished three valence categories: positive (e.g., marriage), negative (e.g., cancer diagnosis), and ambiguous (e.g., birth of a child with Down syndrome). The coding was done by two independent raters and showed good interrater reliability ($\kappa = .92$). A list of all life events and their complementary emotional valence is provided in Table 10. Note that, whereas there is a general perception of a certain event as desirable (positive) or undesirable (negative), the individual judgment of persons might differ.

Table 12

Interrater agreement and missing data of coded characteristics

Level	Variable	Coding options	Missing%	IA
Publication	Year of publication	Metric	0%	1.00
Publication	Nationality of participants	Categorical	0%	.97
Publication	Country in which the study was conducted	Categorical	0%	.97
Event	Type of event	Categorical (see Table 10)	0%	.95
Event	Timing of event	1 = T1 before event 2 = T1 after event	0%	.73
Event	Valence	1 = Positive event 2 = Negative events 3 = Ambiguous	0%	.92
Sample	Type of sample	1 = Representative panel 2 = Convenient sample 3 = Students 4 = Clinical 5 = Children and adolescents 99 = Other	1.6%	.78
Sample	Number of participants with full data	Metric	6.3%	.99
Sample	Attrition	Metric (range: 0 - 1)	3.2%	.99
Sample	Proportion of men	Metric (range: 0 - 1)	3.2%	.98
Sample	Age *(M)*	Metric	14.3%	1.00
Sample	Age *(SD)*	Metric	46.0%	1.00
Sample	Predominant ethnicity	1 = Caucasian 2 = Black 3 = Hispanic 4 = Native, Inuit 5 = Asian 6 = Mixed 99 = Others	39.7%	1.00
Variable	General outcome structure	1 = Posttraumatic growth 2 = Psychological Wellbeing 3 = Only components were investigated	1.1%	1.00
Variable	Specific outcome variable	Categorical (see Table 10)	14.7%	.88

Level	Variable	Coding options	Missing%	IA
Variable	Data source	1 = Self-report Questionnaire 2 = Self-report interview 3 = Self-report via ambulatory assessment 4 = Self-report day reconstruction method 5 = Observation 6 = Peer report 7 = Analysis of written reports 99 = Other data source	4.2%	.60
Variable	Scale	Categorical	22.1%	.96
Variable	Source of reliability estimate	0 = Not reported 1 = Reference to another publication 2 = Calculated for sample of this study 3 = Calculated for sample of another study	4.2%	.65
Variable	Reliability estimate	Metric (range: 0 - 1)	6.3%	.97
Variable	Number of items in measure	Metric	14.7%	1.00
Time point	Time point number	Metric	4.2%	.98
Time point	Design	1 = Prospective 2 = Post hoc	2.1%	.73
Time point	Time between baseline measure and event (Mean)	Metric	31.3%*	1.00
Time point	Time between baseline measure and event (lower range)	Metric	56.3%*	.82
Time point	Time between baseline measure and event (upper range)	Metric	70.8%*	.97
Time point	Sample size	Metric	2.0%	1.00
Time point	Mean independent variable	Metric	9.3%	1.00
Time point	Standard deviation independent variable	Metric	24.0%	1.00

Note. IA = Interrater agreement. The reported values are intraclass correlation coefficient for metric variables and Cohen's kappa correlation coefficient for categorical variables. *The time lag of events and measure was either provided as mean or range. While some studies reported only mean or range, others provided multiple information.

4.2.5 Computation of effect sizes

To estimate how effect sizes change as a function of time, we computed pairwise effect sizes which express the difference of the baseline assessment and each following time point (cf. Luhmann et al., 2012). The included studies varied in the timing of the first measurement time point. Two different study designs will be distinguished in all further analyses: prospective studies and post-hoc studies.

Prospective studies first assessed the target variables before participants were confronted with the event. This study design allows investigating the direct effect of the life event on the outcome variable. However, since most major life events are unpredictable, only some studies are able to provide pre-event data. Therefore, we also included longitudinal post-hoc studies that first measured the target variable after the event took place. While post-hoc studies do not allow conclusions about the immediate change processes caused by the life event, they do provide insights about long-term progression.

For each sample, multiple effect sizes (number of time points – 1) were computed. As the standardized effect size, we chose the standardized mean difference. In contrast to the standardized mean gain it does not confound individual differences in change with mean-level change and tends to be more conservative (Morris & DeShon, 2002). To control for sampling bias, we adjusted the effect following the approach by Hedges and Olkin (1985). We abstained from adjusting effect sizes for (un)reliability (Hunter & Schmidt, 1990), since only some studies included sample-specific reliability estimates.

Table 13
Number of publications with specific target outcome sorted by valence

Outcome variable	Positive valence	Negative valence	Ambiguous valence	Total
1 = Positive relationships	13	21	4	38
2 = Meaning in life	1	17	4	22
3 = Sense of spirituality	0	21	3	24
4 = Personal strengths	0	3	0	4
5 = Priorities in life	0	0	0	0
6 = Appreciation of life	0	0	0	0
7 = Self-acceptance	1	1	0	2
8 = Environmental Mastery	3	4	2	9
9 = Personal growth	0	1	0	1
10 = Autonomy	1	1	2	5
11 = Self-esteem	17	32	12	61
12 = Psychological well-being	1	1	1	3

Note: The summed number of studies in Table 13 exceeds the total number of included publications in the meta-analysis since some publications reported data on more than one target outcome.

4.2.6 Missing data

During the coding process, 1,752 authors were asked to provide missing information about their studies, such as age, ethnicity, or percentage of male participants. If authors were not able to provide the data, they were coded as missing. Three statistics are mandatory to calculate effect sizes and sampling variance: means or mean differences, standard deviations, and retest correlations. Some studies did not report sufficient statistics to calculate the mean-level change or the sampling variance. First, the authors of these studies (n = 73) were contacted via email and asked if they could provide the missing information. If authors did not respond, reminding emails were send 4 and 8 weeks after the first request. If the corresponding author was not able to provide the data, we contacted co-authors in order to collect the missing information. Some authors (n = 9) did not reply to our requests at all. About half (n = 38) of the contacted authors were unable to provide or unwilling to share the missing data. For the remaining 26 studies (35.62%), we received answers containing all requested information.

If the authors were not able to provide this missing information or did not respond, we tried to substitute or estimate the missing values needed for effect size calculation. To substitute

a missing standard deviation, we searched for a comparable study that (a) investigated the same life event longitudinally, (b) assessed the same outcome variable using the same measure, and (c) investigated a comparable population. A list of all included studies for which standard deviations had to be substituted through estimates obtained through other studies is included in the supplementary material. If the retest correlation was not reported in the study, provided by the corresponding author, or calculated through other given statistical information, it had to be estimated. Borenstein, Hedges, Higgins, and Rothstein (2009) suggested replacing missing retest correlations with the median correlation of the studies with full data (for a comparable meta-analytic approach, see Luhmann et al., 2012). For 48.4% of the effects, the retest correlation was substituted with r = .67 which is the median correlation in all complete datasets. In order to control for possible effects of substitution and estimation of missing values on the meta-analytic models, we conducted a series of systematically varied sensitivity analyses[5].

4.2.7 Weighting of effect sizes and study quality.

Lipsey and Wilson (2001) proposed to weight effect sizes with the inverse of the sampling variance. The sampling variance was calculated by Formula 1. It includes the number of paired observations (n), retest correlation (ρ), the bias function $c(df)$[6], which is shown in Formula 2, and the population effect size (δ_{IG}; Morris & DeShon, 2002).

$$\left[\frac{2(1-\rho)}{n}\right]\left(\frac{n-1}{n-3}\right)\left[1+\frac{n}{2(1-\rho)}\,\delta_{IG}^2\right]-\frac{\delta_{IG}^2}{[c(df)]^2} \qquad (1)$$

[5]In order to investigate if the substitution of standard deviations (SD_s) and the estimation of retest correlations (r_e) had an influence on the results, we included dummy variables in the meta-analytic models. The regression coefficients for most outcomes showed that the substitution of standard deviation and the estimation of rest-correlations had no significant influence. Significant negative regression coefficients were found for meaning prospective (SD_s) and self-esteem prospective (r_e). Significant positive regression coefficients were found for social relations post-hoc (SD_s) mastery post-hoc, and meaning prospective (r_e). Thus, the results of these cases might be biased due to the missing data of included studies. The detailed results can be obtained from the first author.

[6] *df* = degrees of freedom. In the described meta-analytic model *df* equals n-1.

$$c(df) = 1 - \frac{3}{4df - 1} \qquad (2)$$

If sample sizes differed across time points, the smallest sample size was taken into account. Only longitudinal studies, which investigated at least one of the target outcome variables, focused on one specific event, and assessed change through independent measures were included. Because of these strict eligibility criteria, lower-quality studies were a priori excluded from the meta-analysis. Therefore, we abstained from further artificial quality ratings. The main quality difference was given by the sample size at each time point, which is already considered in the weighting through sample variance and bias function.

4.2.8 Description of meta-analytical methods

Random effect model. This meta-analysis unites studies which investigate different life events. Even if these events shared the same valence, we could not assume that all studies estimate the same true effect size (Borenstein et al., 2009). Hence, we analyzed the data with random-effects models. Specifically, we applied a random-effects structural equation model (Cheung, 2008) which allowed us to use the Mplus cluster option (Type = complex) to account for dependencies among effect sizes stemming from the same studies (see Luhmann et al., 2012 for a comparable statistical approach and model equations).

Due to the large number of different events, it was not possible to conduct separate analyses for every single event. In order to account for possible variations in the effects of different kinds of life events, we included 'kind of event' as a covariate in the analytical models and distinguished between family-related, work-related, physical, natural, and other events.

Interpretation of model parameters. In the meta-analytic model, the effect sizes were regressed on the time since the event (unit = 1 month). Slope coefficients represent the rate of change of effect sizes over time, and the intercept reflects the predicted effect when all predictors equal zero (for a similar meta-analysis see Luhmann et al., 2012). Since it is likely that people show the strongest reaction to a major life event directly afterwards and that growth

is not linear, but stabilizes at a certain level, a natural log model was chosen (time = log(months+1)) in which time was logarithmically transformed.

Coefficients of prospective studies are denoted with b, while coefficients of post-hoc studies are denoted with c. Figure 8 depicts a prototypical course of effect sizes for a prospective study. On the left side, a logarithmic curve is depicted that exemplifies growth. After a negative initial reaction b_0 a positive slope b_1 follows. The positive change curve exceeds the previous level of the outcome variable. On the right side of Figure 8 the prototype of an adaptation curve is depicted. The initial reaction to the event is negative as well, and followed by an increase of psychological functioning. However, the effect sizes do not exceed the pre-event level and would therefore be interpreted as adaptation and not growth.

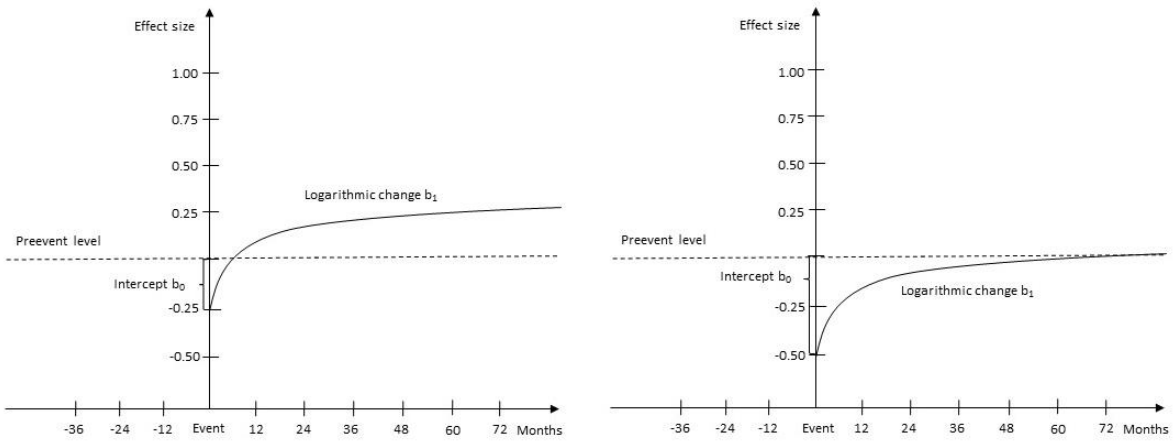


Figure 8. Prototypical course of effect sizes in prospective studies. The left change curve depicts personal growth the right change curve adaptation.

It is important to clearly distinguish the interpretation of the parameters of prospective and post-hoc studies. In post-hoc studies, the intercept c_0 does not indicate the initial effect of the event. Thus, only the slope of post-hoc studies can be interpreted and provides insights into the sustainability of effects found in prospective studies.

In addition to time since the event, other variables were included. First, we introduced two dummy variables reflecting the valence of the event (X_2: 0 = negative, 1 = positive, 0 = ambiguous; X_3: 0 = negative, 0 = positive, 1 = ambiguous; negative was the reference category).

These dummy variables reflect the extent to which the intercept of positive and ambiguous events, respectively, deviates from the intercept of negative events. In addition, the interaction between time and these dummy variables was estimated to test whether the rate of change differed among events of different valence.

Second, we included dummy variables that reflected the life domain of each event: family related events (X_6), natural events (X_7), work related events (X_8), and unclassified events (X_9). Physical events were chosen as the reference category because they were most common.

Table 14

Descriptive statistics of included studies

	Positive relationships			Meaning			Spirituality			Strengths			Priorities in life			Self-acceptance		
	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A
N of studies	13	21	4	1	17	4	-	21	3	-	3	-	-	-	-	1	1	-
N of samples	26	25	5	2	18	4	-	25	3	-	3	-	-	-	-	2	1	-
N of effects	35	36	8	6	31	4	-	61	3	-	5	-	-	-	-	2	1	-
Publication year (median)	2010	2006	2004	2012	2012	2010.5	-	2011	2012	-	2011	-	-	-	-	2011	2009	-
Studies conducted in the US (%)	38.5	57.1	50.0	0.0	82.4	50.0	-	81.0	100.0	-	100.0	-	-	-	-	0.0	100.0	-
Medical studies (%)	0.00	77.3	75.0	0.0	76.5	75.0	-	85.7	100.0	-	33.3	-	-	-	-	0.0	100.0	-
N of time points (mean)	2.46	2.43	2.75	4	2.53	2.0	-	3.19	2.00	-	2.67	-	-	-	-	2.0	3.0	-
Prospective studies (%)	84.6	28.6	100.0	1	23.5	100.0	-	28.6	66.7	-	33.3	-	-	-	-	0.0	100.0	-
Timing of T1 (mean in months)	-11.52	-17.34	-6.02	-0.3	-19.75	-1.76	-	-14.09	-9.02	-	-1.00	-	-	-	-	-	-48.00	-
Posthoc studies (%)	15.4	71.4	0.0	0.0	76.5	0.0	-	71.4	33.3	-	66.7	-	-	-	-	100.0	0.0	-
Timing of T1 (mean in months)	1.50	29.96	-	-	27.67	-	-	17.63	0.03	-	4.00	-	-	-	-	2.00	-	-
N of participants at T1	68,954	8,754	274	384	4,502	870	-	4,430	2,035	-	372	-	-	-	-	198	207	-
1 - Attrition rate	86.75	83.85	76.87	88.35	91.43	100.0	-	83.8	87.72	-	64.41	-	-	-	-	100.00	100.0	-
Men (%)	42.8	35.2	66.7	35.9	30.3	48.4	-	27.05	34.4	-	50.0	-	-	-	-	0.0	37.4	-
Age (mean)	36.32	53.11	46.5	27.48	46.53	48.16	-	50.52	57.39	-	56.45	-	-	-	-	-	63.00	-
N of items in scale (mean)	7.75	23.71	5.75	9.00	8.57	25.00	-	11.13	12.00	-	3.00	-	-	-	-	126	-	-
Reliability estimate based on current sample (%)	72.7	54.5	.25	100.0	70.6	50.0	-	47.6	33.3	-	100.0	-	-	-	-	100.0	100.0	-
Reliability estimate T1	.81	.81	.86	.79	.81	.87	-	.79	.86	-	.62	-	-	-	-	.88	.54	-

	Positive relationships			Meaning			Spirituality			Strengths			Priorities in life			Self-acceptance		
	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A
N of family related events	7	2	1	-	3	-	-	2	1	-	2	-	-	-	-	-	-	-
N of physical events	2	15	2	-	12	3	-	18	2	-	1	-	-	-	-	-	1	-
N of natural events	-	2	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
N of work related events	4	-	1	1	-	1	-	-	-	-	-	-	-	-	-	1	-	-
N of unspecified events	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. P = positive event; N = negative event; A = ambiguous event. Some studies provided data of different samples or measured more than one outcome variable. That is why the total number of samples and participants is lower than the cumulative number across all outcome variables. Number of participants included in the meta-analysis N = 98,436.

Table 15

Descriptive statistics of included studies

	Mastery			Growth			Autonomy			Self-esteem			Psychological wellbeing		
	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A
N of studies	3	4	2	-	1	-	1	1	-	17	32	12	1	1	1
N of samples	7	5	3	-	1	-	2	1	-	24	39	12	1	1	1
N of effects	8	13	3	-	1	-	6	1	-	47	68	21	1	2	1
Publication year (median)	1997	2006	2008	-	2009	-	2012	2012	-	2000	2004	2005	2011	2004	2013
Studies conducted in the US (%)	66.6	75.0	100.0	-	100	-	0.0	0.0	-	52.9	50.0	25.0	100.0	0.0	0.0
Medical studies (%)	0.0	50.0	0.0	-	0.0	-	0.0	100.0	-	0.0	59.4	46.2	0.0	100.0	0.0
N of time points (mean)	2.33	3.5	2.0	-	2.0	-	4.00	2	-	2.47	2.78	2.67	2.00	3	2.00
Prospective studies (%)	100.0	75.0	100.0	-	100.0	-	100.0	0.0	-	70.6	18.8	91.7	100.0	0.0	100.0
Timing of T1 (mean in months)	-7.01	-20.01	-20.05	-	-48.00	-	-0.03	-	-	-9.66	-12.43	-1.43	-72.0	-	-6.00
Posthoc studies (%)	0.0	25.0	0.0	-	0.0	-	0.0	100.0	-	29.4	81.2	8.3	0.0	100.0	0.0
Timing of T1 (mean in months)	-	.85	-	-	-	-	-	.03	-	.41	25.16	42.7	-	.30	-
N of participants at T1	797	380	192	-	207	-	384	194	-	6,465	7,242	1,974	1,728	66	90
1 - Attrition rate	100.0	100.0	87.5	-	100.0	-	88.4	64.0	-	95.1	87.9	87.4	100.0	100.0	100.0
Men (%)	25.77	44.35	14.7	-	37.4	-	35.88	66.0	-	30.52	45.84	34.03	53.6	30.0	73.3
Age (mean)	40.31	51.68	74.15	-	63.0	-	27.48	-	-	25.79	50.34	35.13	53.70	57.0	57.90
N of items in scale (mean)	7.33	9.33	8.5	-	18	-	9.00	3.0	-	10.00	14.35	10.08	20.00	4.0	24.00
Reliability estimate based on current sample (%)	100.0	80.0	50.0	-	.100	-	100.0	-	-	46.7	53.1	69.2	100.0	0.0	100.0
Reliability estimate T1	.83	.71	.71	-	.54	-	.79	-	-	.81	.81	.81	.88	-	.90

	Mastery			Growth			Autonomy			Self-esteem			Psychological wellbeing		
	P	N	A	P	N	A	P	N	A	P	N	A	P	N	A
N of family related events	6	-	1	-	-	-	-	-	-	5	7	4	-	1	-
N of physical events	2	4	2	-	1	-	-	1	-	-	22	5	-	-	-
N of natural events	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
N of work related events	3	-	1	-	-	-	1	-	-	11	2	3	1	-	1
N of unspecified events	0	1	-	-	-	-	-	-		1	1	-	-	-	-

Note. P = positive event; N = negative event; A = ambiguous event. Some studies provided data of different samples or measured more than one outcome variable. That is why the total number of samples and participants is lower than the cumulative number across all outcome variables. Total number of participants of all included studies N = 98,436.

4.3 Results

In total, 122 studies yielding 364 effect sizes with a total of $N = 98,436$ participants were included. Descriptive statistics are provided in Tables 14 and 15. Due to the large number of studies and effects across time, a comprehensive list of all studies and their descriptive details is provided in the supplementary material and not in the article.

4.3.1 Descriptive overview

In this section, we provide a cumulative overview of the characteristics of all included studies, followed by specific analyses for the different outcome variables.

Study characteristics. About half of the included publications (n = 60, 49.2%) had a prospective design, providing pre- and post-event data. The effect sizes of these studies represent the direct effect of the event on the outcome variables and allow conclusions about posttraumatic and postecstatic growth. The remaining n = 62 studies (50.8%) had a post hoc design and quantified the change processes following the event. These studies give additional information about long-term trends, but do not allow conclusions of increases or decreases that go beyond the pre-event level.

The majority of the publications came from the US (n = 66; 54.1%). Hence, results should be interpreted while considering that the majority of the effect sizes relied on Western, mostly American samples. Half of the included articles were medical studies investigating life changes after severe accidents, childbirth, or life-threatening illnesses in a clinical setting. On average, each study yielded 2.27 (SD = 1.74) effects, comprised 1.26 (SD = .56) samples, and had M = 2.68 (SD = 1.32) measurement time points. On average, the first measurement time point of prospective studies was about 11 months (M = 10.88, SD = 17.66) before the event took place. In post-hoc studies the first measurement was on average one and a half years (M = 19.14, SD = 28.65) after the event. 25.5% of all effect sizes (n = 93) referred to positive life events, 63.7% (n = 232) were based on negative life events, and 10.7% (n = 39) on ambiguous

life events. Therefore, the findings for posttraumatic growth are somewhat more comprehensive than those for postecstatic growth. Most studies (n = 60) focused on the effects of physical life events such as accidents or severe illnesses. Family related events (n = 32), such as marriage, work related (n = 23), and natural events (n = 4) were less often investigated. Three studies were included that did not belong to any of the categories mentioned above. In addition, the subdomains of posttraumatic and postecstatic growth have not been studied equally. Sufficient data for meta-analytic computations were available for five outcome variables, namely positive relationships, meaning in life, spirituality, mastery, and self-esteem. Descriptive analyses are provided for the remaining subdomains.

Sample characteristics. The meta-analysis included 9 publications which were based on panels that aimed to provide representative results. The effect sizes from these studies comprised the data of 70,218 persons (71.3% of all participants included in the meta-analysis). A relatively small percentage of the publications was based on convenience samples, which otherwise represent the majority of psychological studies. The average attrition rate was relatively low, with 12.22%. This circumstance has to be accounted for by the fact that many studies only reported data of participants who took part at all time points. Meanwhile, in most cases, the dropout was not systematic when reported. It is important to mention that in publications which investigated the psychological consequences of cancer or other life-threatening illnesses, dropout most frequently occurred due to severe worsening of the illness or death. In total, 10.7% (n = 13) of the publications were based on ad hoc adult samples, and 6.6% (n = 8) presented student samples. Meanwhile, many of the studies that investigated life events with negative emotional valence, stem from clinical samples (n = 59, 48.4%). The mean age of the participants was 44.85 (SD = 18.62) years. Due to the large number of studies investigating motherhood and breast cancer, women are somewhat overrepresented (63.98%). In addition, the predominant ethnicity in the studies which provided data on the race of participants was white (47.5%). Despite the large number of samples (n = 154) and participants,

men (36.02%) were somewhat underrepresented in the included studies. The average age of participants was 45 years (M = 44.85, SD = 18.62).

Graphical overview. Figure 9 shows the effect sizes and the change curves sorted by outcome. Some key constructs, such as relationships and self-esteem, have been studied in prospective as well as post-hoc designs and provide data for life events with different emotional valences. However, no or few longitudinal studies were available for other constructs such as priorities in life, personal strengths, self-acceptance, personal growth, autonomy, and PWB

In addition, the constructs differ in the time frames in which they have been studied. Autonomy, personal strengths, and environmental mastery have predominantly been investigated in the first months after the event, while self-esteem, spirituality, relationships, and meaning in life have been studied for periods up to 10 years.

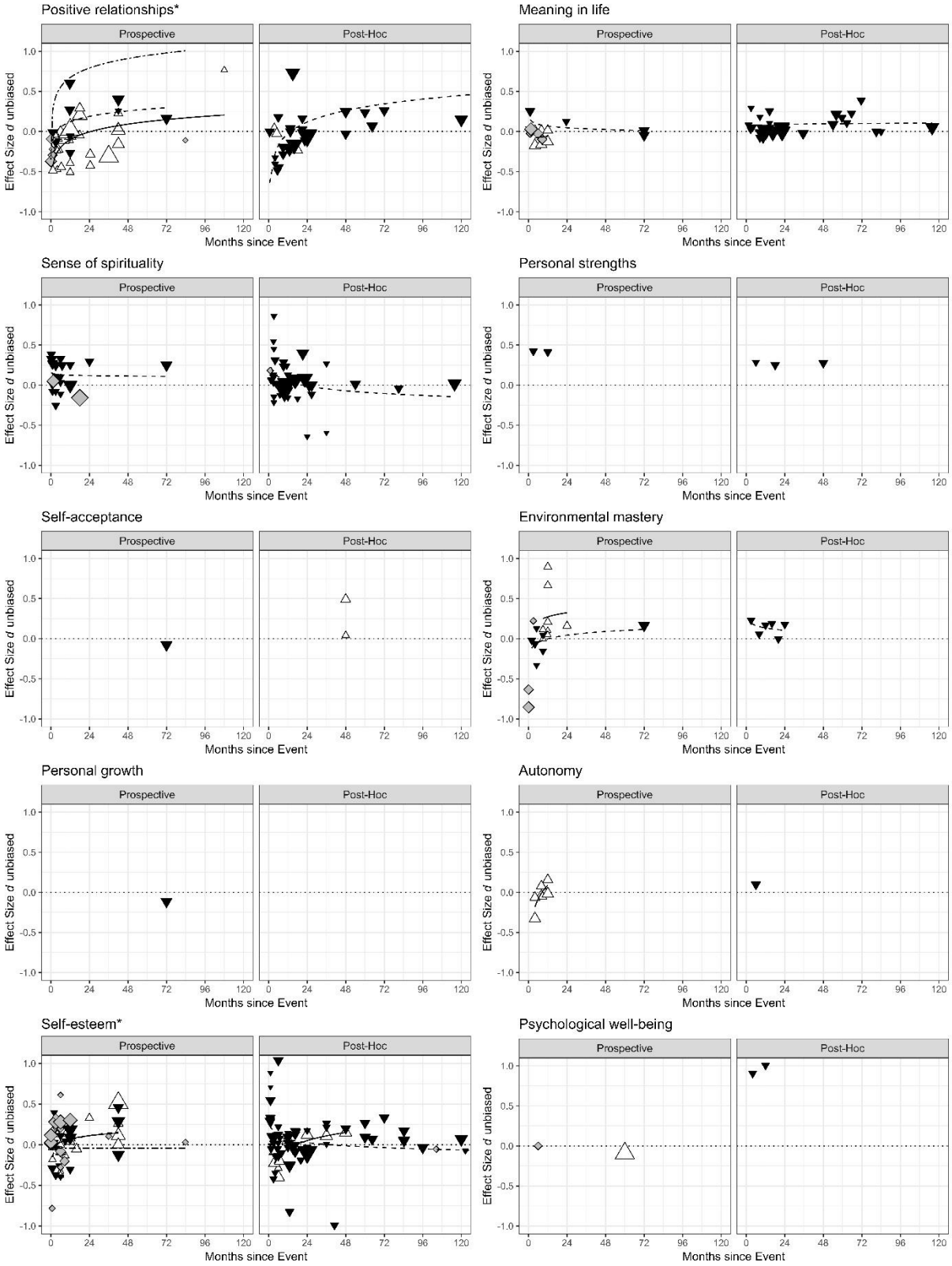


Figure 9. Overview of effect sizes and predicted logarithmic change. *Figures marked with an asterisks are zoomed for reasons of visibility. A full version of these figures is depicted further below. Figures with 5 or less data points are depicted in the supplementary material.

4.3.2 Social relationships

With a total of 38 longitudinal studies and 56 samples, yielding 79 effect sizes and the data of n = 77,982 participants, social relationships was one of the most intensively studied outcome variables. As some of the publications focused on female-specific experiences, such as breast cancer, men were somewhat underrepresented in the results (40.32%). Half (51.3%) of the longitudinal studies on social relationships were based on clinical samples, of people suffering from severe illnesses. Prospective (n = 21, 55.3%; positive: n = 11, negative: n = 6, ambiguous: n = 4) and post-hoc (n = 17, 44.7%; positive: n = 2, negative: n = 15) studies were fairly equally distributed. The first measurement time point was about one year before the event (M = 12.14, SD = 18.41, *median* = 2.43) for prospective studies and more than two years after the event (M = 26.61, SD = 66.01, *median* = 26.61) for post-hoc publications. The average number of time points did not differ between prospective (M = 2.48, SD = .87) and post-hoc studies (M = 2.47, SD = 0.72).

Prospective studies. Figure 10 (left) depicts the effect sizes of all prospective studies investigating social relationships longitudinally. The intercept for negative physical events was negative and significant (b_0 = -.48, 95% CI [-.84, -.11]). The initial reaction to positive (b_2 = -.08, 95% CI [-.39, .24]) and ambiguous life events (b_3 = .42, 95% CI [-.21, 1.04] was a decline of relationship quality, which was not significantly different from the initial effect of negative experiences.

Most effect sizes of positive life events below zero are based on studies which assessed the influence of childbirth on marital relationships. After the initial negative reaction, a significant positive trend emerged, which led to long-term positive effects, significantly increasing over time for all events (b_1 = .21, 95% CI [.07, .35]). As can be seen in Figure 10, this change continues for positive, negative, and ambiguous events beyond the pre-event level of social relationships, indicating growth. The interaction of time and valence of events was not significant and therefore not included in the model.

Negative physical events were the reference category used to investigate if distinguishable kinds of life events differ in their impact on social relations. Natural events, such as hurricanes, had a more positive initial effect on social relationships than physical experiences (b_7 = .38, 95% CI [.11, .65]). There was no significant difference between physical events, such as illnesses, and family (b_6 = -.19, 95% CI [-.53, .14]) or work-related events (b_8 = .01, 95% CI [-.30, .33]).

Posthoc-studies. The post-hoc effect sizes showed a negative intercept (c_0 = -.60, 95% CI [-1.23, .03]), and a positive, but not significant, slope for negative physical experiences (c_1 = .23, 95% CI [-.07, .52]). There was a significant difference in the intercept of effect sizes after positive and negative events. Positive life events led to a significantly stronger increase in relationship quality between the first two measurement time points (c_2 = 3.03, 95% CI [.47, 5.59]). In addition, there was a significant interaction effect between valence and time for positive events, indicating that with time, negative events led to a stronger increase in relationship quality (c_4 = -.08, 95% CI [-.14, -0.02]). However, because of the small number of positive life events, these findings need to be interpreted carefully. There was no significant difference in the effects of physical and family related (c_6 = .11, 95% CI [-.64, .42]), natural (c_7 = -.16, 95% CI [-.38, .06]), or work-related (c_8 = -1.00, 95% CI [-2.18, .16]) events.

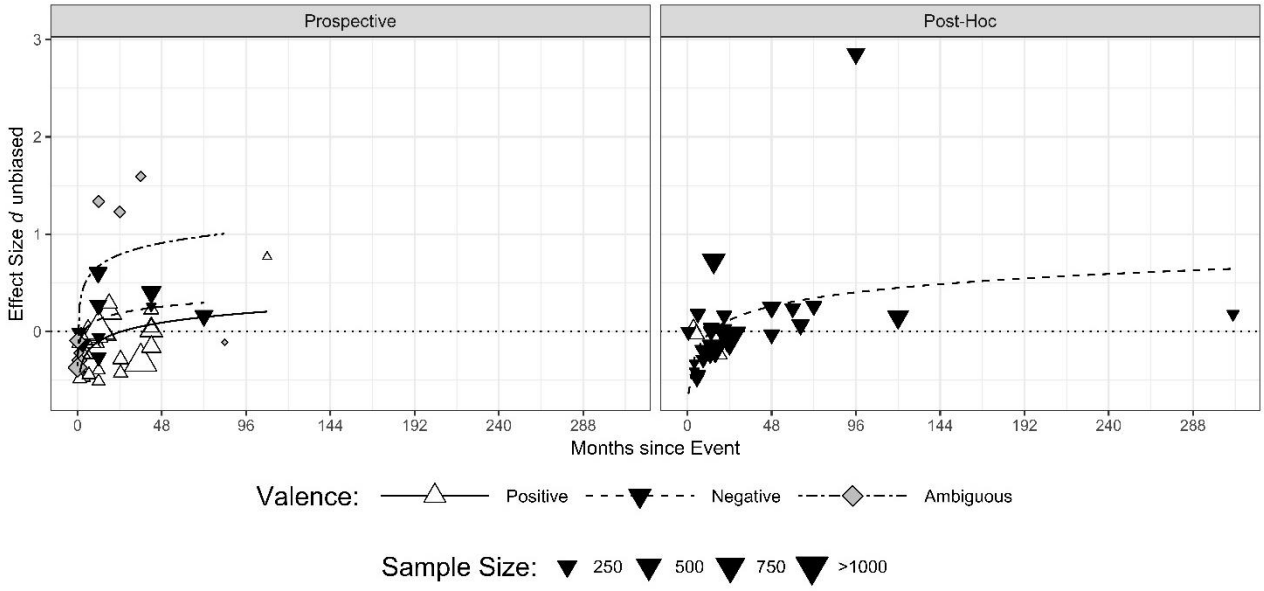


Figure 10. Effect sizes of positive relationships with logarithmic curve.

Summary. Participants who experienced major life events initially reacted with a significant decline in relationship quality, irrespective of the event's valence. This effect seems to be strongest for positive events. After this impairment, a significant positive trend emerged that went beyond the pre-event level of social relationships after traumatic, positive, and ambiguous experiences. The results suggested that major life events lead to deeper relationships after an initial phase of impairment. The post-hoc effects suggest that this positive trend continues over time.

4.3.3 Meaning

In total, 22 studies with 24 samples and 41 effect sizes could be found which addressed changes in meaning or purpose in life after major life events. Notably, only one publication (4.55%), providing 6 effect sizes, was found that assessed meaning longitudinally and focused on a positive event, which was employment. Corresponding to the publications on social relations, male participants were also underrepresented here (33.85%), since some studies only reported data from female participants. The majority of the studies that investigated meaning longitudinally were medical studies (59.1%) and had a post-hoc design (59.1%; prospective studies: positive = 1, negative = 4, ambiguous = 4; post-hoc studies: negative: n = 13). Most of

these publications (77.3%) reported results of clinical studies which investigated changes in meaning in life after severe illnesses, including cancer, heart attack, stroke, and HIV. The average number of time points was slightly higher for post-hoc studies (M = 2.69, SD = 1.03) than for prospective studies (M = 2.22, SD = 0.67). In prospective publications, the first measurement was assessed about one and a half years (M = 12.95 months, SD = 23.60, *median* = 1.00) before the event, while the time lag in post-hoc studies was more than two years (M = 28.13 months, SD = 34.33).

Prospective studies. Figure 11 (left) depicts the effect sizes of prospective longitudinal studies on meaning after life events with positive, ambiguous, and negative valence. Because of the small number of effect sizes (n = 6) that were based on positive events and the small time lag of these effect sizes, the trend line of positive events has to be interpreted carefully. The initial reaction to negative physical events on meaning was positive and not significant (b_0 = .11, Cl 95% [-.11, .3]). Positive (b_2 = -.03, Cl 95% [-.32, .26]), and the reaction to ambiguous events (b_3 = -.01, Cl 95% [-.25, .24]) showed a comparable initial effect on meaning. The interaction effect of valence and time was not significant and therefore not included in the model.

After this primary effect, the slope for positive, negative, and ambiguous events was not significantly different from zero (b_1 = -.11, Cl 95% [-.28, .07]). There was no significant difference between physical and family (b_6 = .33, Cl 95% [-.36, 1.02]) or work-related events (b_8 = .07, Cl 95% [-.06, .20]).

Post-hoc studies. Figure 11 (right), in which the post-hoc studies are plotted, shows the effect sizes of negative life events. Studies which investigated meaning after positive or ambiguous events with a post-hoc design could not be identified. Again, we found a negative intercept (c_0 = -.09, Cl 95% [-.30, .13]) and a positive, but not significant, slope for negative physical events comparable to the results of the prospective studies (c_1 = .04, Cl 95% [-.01, .09]). Nearly all reported post-hoc effect sizes are positive and the trend line suggests a further

increase of these effects over time, indicating that growth might occur. All post-hoc effect sizes relied on negative physical events.

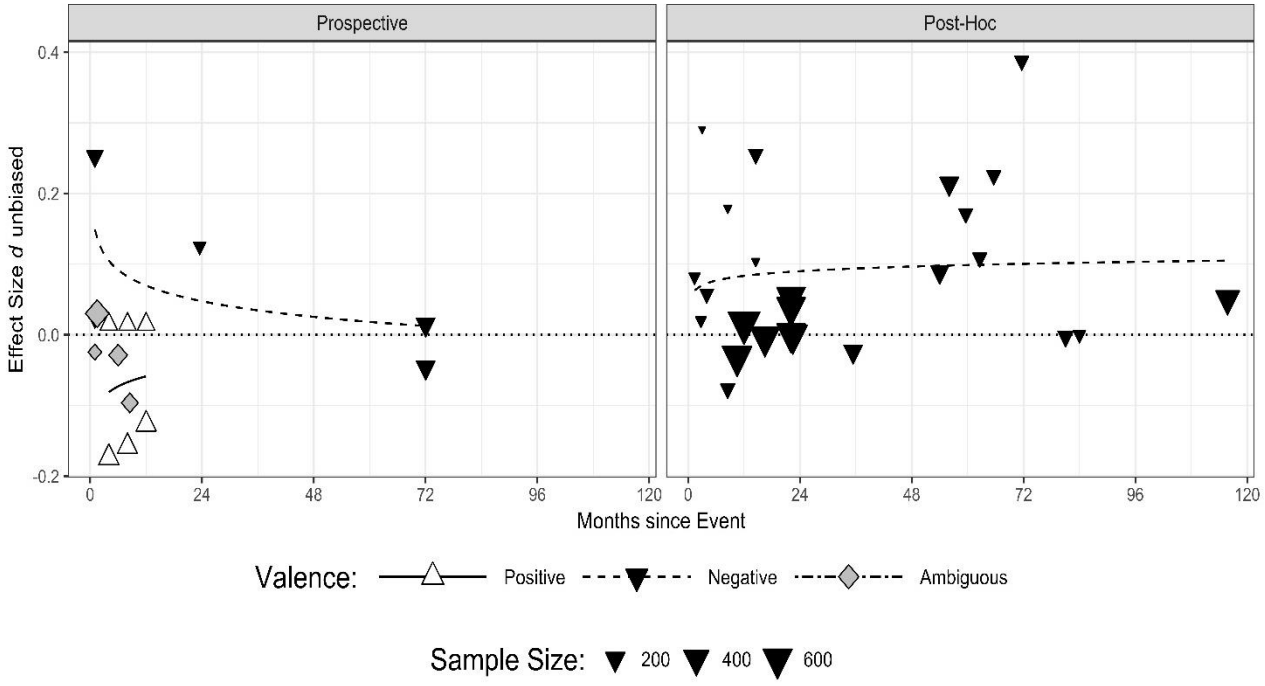


Figure 11. Effect sizes of meaning in life and predicted logarithmic change.

Summary. Taken together, the results of prospective and post-hoc studies indicate that traumatic experiences do not lead to a significant increase in meaning in life for the majority of people. As very few studies have addressed meaning after positive events, this conclusion cannot be generalized across events with different valences.

4.3.4 Spirituality

In total, 24 publications were found which investigated longitudinal changes in spirituality as a consequence of struggling with major life events. None of these studies, which together included 28 samples and reported 64 effect sizes, focused on positive life events. Instead, the vast majority of these publications (87.5%) were based on medical studies, investigating the consequences of severe illnesses and accidents. A quarter of the publications investigated predominantly female-specific life events, such as breast cancer (20%) and widowhood (4.1%). Therefore, the number of male participants was smaller than expected

(28.0%). As most of these studies recruited participants after their initial diagnosis, there were fewer prospective (33.3%; negative: *n* = 6, ambiguous: *n* = 2) than post-hoc studies (66.7%; negative: *n* = 15, ambiguous: 1 = 4). The first measurement occasion of the prospective studies was about one year before the event (*M* = 12.82 months, *SD* = 16.90, *median* = 5.5 month). Meanwhile, post-hoc studies had their first assessment, on average, 17 months after the event occurred *(M* = 16.53, *SD* = 30.90, *median* = 1.00). It is important to note that the timing of post-hoc studies had a large range reaching from immediate assessment after diagnosis to 10 years after the event had happened.

Prospective studies. Figure 12 (left) shows the effect sizes of all included prospective studies investigating spirituality. In contrast to the initial effects on social relationships, there is an immediate but not significant increase (b_0 = .13, Cl 95% [-.10, .35]) in spirituality as a direct reaction to negative physical events. The trend over time that follows this initial effect of spirituality was close to zero and not significant (b_1 = .003, Cl 95% [-.05, .06]). Most of the effect sizes are positive, indicating at least temporary beneficial changes in spirituality through the event. Ambiguous events had a significantly more negative initial effect than negative ones (b_3 = -.22, Cl 95% [-.45, -.01]).

Since there were no studies that investigated changes in spirituality after positive events, we could not include further predictors in the model to investigate differences due to event valence. There was no significant difference between the effects of physical and family-related (b_5 = .07, Cl 95% [-.10, .24] or natural events (b_7 = -.14, Cl 95% [-.29, .02]).

Post-hoc studies. Figure 12 (right) depicts the post-hoc development of spirituality. Comparable to the prospective results, most effect sizes that were assessed in the first two years after the event took place were positive, indicating an initial positive trend. The intercept of post-hoc studies was positive, but not significant (c_0 = .17, Cl 95% [-.01, .35]). However, over time an insignificant decrease of these effects emerges (c_1 = -.04, Cl 95% [-.09, .01]). Physical

and family-related events (b_5 = -.10, Cl 95% [-.41, .22]) did not show significant differences in their effects.

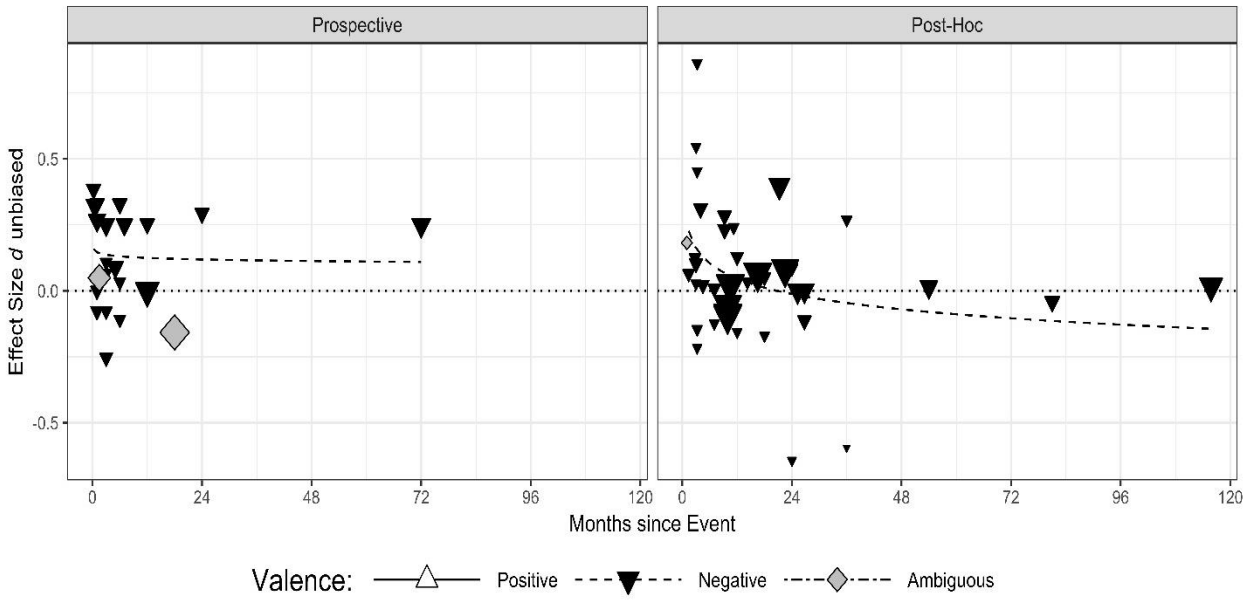


Figure 12. Effect sizes of spirituality and predicted logarithmic change.

Summary. Negative life events lead to a not significant increase of spirituality, especially in the first two years after the event. The findings of the post-hoc studies, which investigated longer periods, suggest that with time, this effect diminishes and is not sustained, as would be expected for posttraumatic growth.

4.3.5 Strengths

One of the outcome variables for which we found little empirical evidence was the perception of personal strengths. Only three longitudinal studies could be identified which investigated change in personal strengths after major life events over time. The publications addressing this topic included 3 samples and reported 5 effect sizes in total. All of them investigated life events with negative emotional valence. One third of the studies reported data from clinical populations. The three studies focused on two kinds of life events: bereavement or widowhood (66.6%) and cancer (33.3%). Since all these events are more likely to occur at an older age, participants of these samples were somewhat older than in the other samples (*M* = 56.45, *SD* = 6.43). Men (50.0%) and women (50.0%) were equally distributed in the samples.

The majority of the publications had a post-hoc design (66.7%), assessing their participants for the first time four months (M = 4.00, SD = 2.82) after the event. Only one study had the first measurement time point one month before the event occurred. Because of the very small number of effects, the results should be interpreted carefully and are not depicted separately. What can be said, is that all found effect sizes of the prospective (d_1 = .41; d_2 = 42) and post-hoc studies (d_3 = .25; d_4 = .28; d_5 = .28) were positive and stable over time, suggesting a lasting beneficial effect of major life events on personal strengths.

4.3.6 Self-acceptance

Another psychological outcome variable which has rarely been studied is self-acceptance. Only two publications could be found that investigated self-acceptance longitudinally after major life events. The prospective study investigated the impact of cancer on self-acceptance, in a clinical setting, with the first measurement time point 2 years after diagnosis. The post-hoc study focused on students transitioning to college and was conducted in the US. The first assessment took place 4 years before the event. Again, men were underrepresented in the sample (18.7%). With a total of three samples and 3 reported effect sizes these data can only provide preliminary insights into changes in self-acceptance after coping with challenging events. While the prospective effect size (d_1 = -.08) indicates an impairment of self-acceptance through transitioning to college, the post-hoc studies show positive effects (d_2 = .49; d_3 = 04). For the interpretation of these results, it is important to note that next to the small sample size no prospective studies investigated further negative events and no post-hoc studies investigated positive experiences. For a meta-analytic interpretation that goes beyond the findings of the original studies, the data are not sufficient.

4.3.7 Mastery

In total, 9 publications were found which investigated the impact of major life events on environmental mastery in a longitudinal design. Taken together, these studies comprised data from 15 samples yielding 24 effects sizes. Again, most publications focused on the

consequences of negative (44.4%) or ambiguous (22.2%) life events. The majority of these studies (88.9%; positive: n = 3, negative: n = 3, ambiguous: n = 2) had a prospective design with the first measurement occasion about 15 months before the event took place (M = 15.15 months, SD = 15.46, *median* = 12.00). Participants were on average about 51 years old (M = 51.64, SD = 57.70) and mostly female (68.43%). It is important to note, that only one study, providing 6 effect sizes, investigated mastery in a post-hoc design. Since this publication focused on widowhood, the exclusively female participants were much older (M = 71.6 years) at the first measurement time point, compared to the participants of the prospective studies. The women were assessed for the first time immediately after losing their partner (M = .85 months).

Prospective studies. Figure 13 (left) shows the results of the prospective studies investigating mastery after challenging experiences. The initial effect of negative physical events on mastery was negative and significant (b_0 = -.25, 95% Cl [-.48, -.02]). The initial effect of ambiguous life events was not significantly different from the effects of negative experiences (b_3 = .03, 95% Cl [-.39, .45]). Meanwhile, positive events led to a significantly larger direct increase of mastery (b_2 = .19, 95% Cl [.02, .37]). Over time the effect of positive, negative and ambiguous events increased significantly with a slope of b_1 = .25 (95% Cl [.09, .41]). The interaction of time and valence was not significant. The reaction to negative physical events did not differ from the initial effects of family-related (b_6 = .22, 95% CI [-.08, .51]) or work-related events (b_8 = -.12, 95% CI [-.27, .03]).

Post-hoc studies. Figure 13 (right) depicts the post-hoc effect sizes of environmental mastery. All effect sizes were positive. The post-hoc model had a positive, but not significant intercept (c_0 = .20, Cl 95% [-.18, 2.23]) and a not significant negative slope (c_1 = -.06), 95% Cl [-1.93, 1.81]), indicating that the beneficial initial effects found in the prospective studies did not change significantly over time.

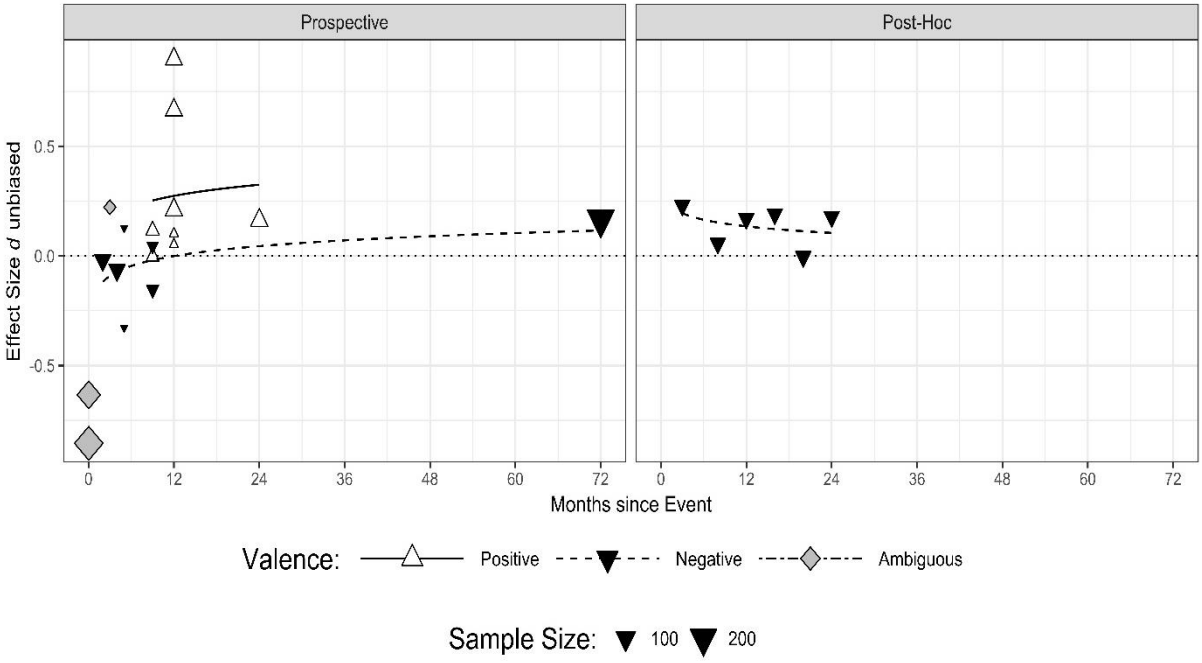


Figure 13. Effect sizes of environmental mastery and predicted linear change.

Summary. Facing major life events increases environmental mastery. This beneficial effect seems to be continuous, leading to lasting higher levels of mastery, especially after positive experiences. The comprised findings of all studies addressing mastery suggest that posttraumatic as well as postecstatic growth in this area does occur and is sustained over time.

4.3.8 Growth

The outcome of personal growth, as defined above, has only been investigated in a single longitudinal study. The panel study that operationalized growth in the sense of an independent psychological asset had a prospective design and investigated psychological adjustment to cancer. Of the 605 participants who suffered from cancer, 207 received their diagnosis between the two waves of the panel, which lay 10 years apart. The average age was 63 years, which

reflects the higher likelihood of being diagnosed with cancer at an older age. As for the other outcome variables, men were underrepresented (37.4%). The study suggests that cancer diagnosis has a negative effect (d_1 = -.11) on growth as a psychological asset.

4.3.9 Autonomy

Like self-acceptance and growth, autonomy has rarely been studied as an outcome in longitudinal studies on major life events. Only two publications with 3 samples and 7 effect sizes could be found, including a total of 443 participants. Men and women were about equally represented with 50.94% (*SD* = 21.30) of male participants. Only one of the two studies provided detailed information about the age of participants. On average, participants were younger than in the other publications (*M* = 27.48). The prospective study investigated the psychological consequences of employment. The post-hoc study had a medical background and investigated health changes after traumatic injury. Both studies had their first measurement time point directly before (*M* = -.03) or immediately after (M = .03) the event. Figure 14 depicts the results of the prospective (left) and the post-hoc study (right). Again, the results must be interpreted carefully due to the limited number of life events, samples, and effect sizes.

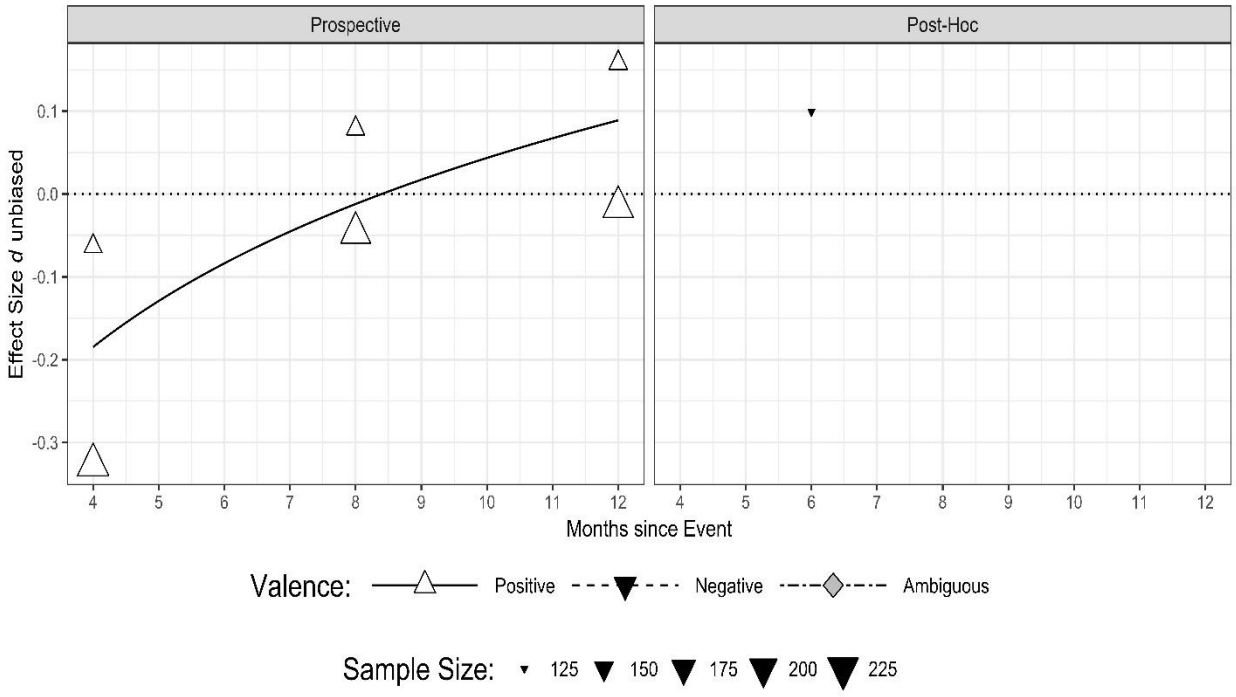


Figure 14. Effect sizes of autonomy and predicted logarithmic change.

Figure 14 suggests that after an immediate negative reaction to the positive event, an upward trend emerges that goes beyond the former level of autonomy. In addition, negative events also show a positive effect after the event. Since these effects are small and close to zero, the positive direction might be an adaptation effect. It is interesting to note that the results of two different groups are depicted in Figure 14 (left). Above the curve are the results for the group of students that transitioned into work life and had favorable employment opportunities, and hereby actually a positive experience. Below the curve are the results for the group with unfavorable employment opportunities, for which the transition from university to work had more negative aspects.

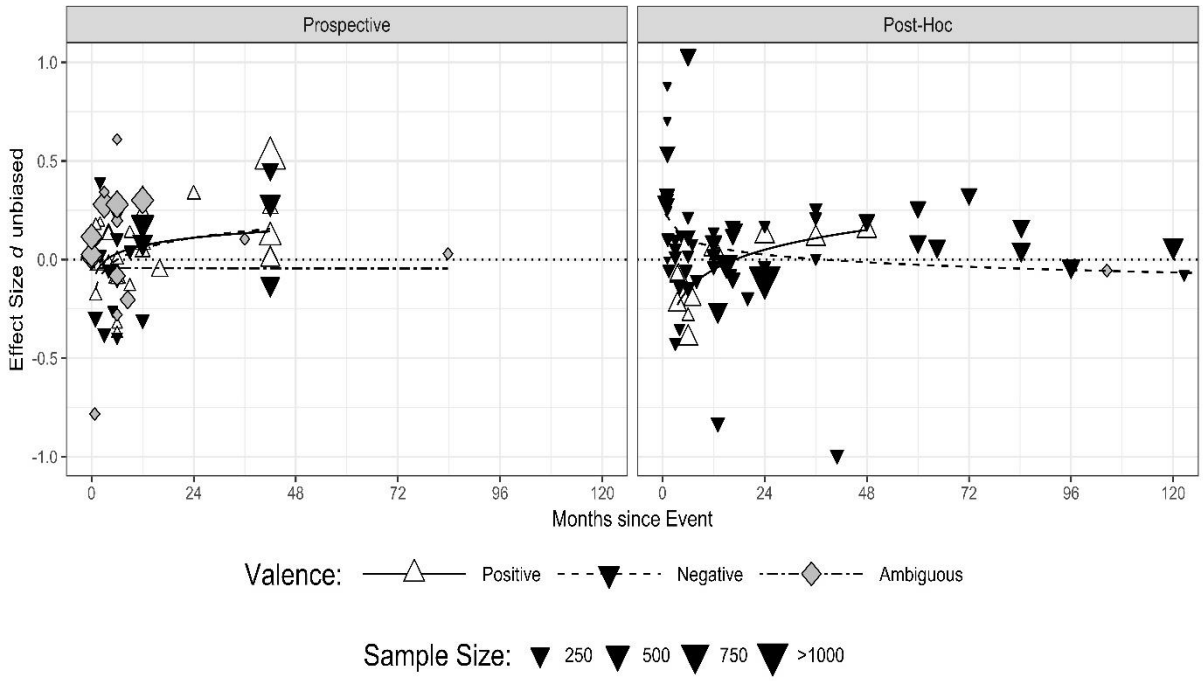
4.3.10 Self-esteem

With 61 longitudinal publications and 136 effect sizes, which together comprised the data of 75 samples, self-esteem was the most intensively studied outcome variable. In total, the studies included the data of n = 15,681 participants. Again, women were somewhat overrepresented with only 39.8% of men in the samples. On average, participants were around 41 years old (M = 40.99, SD = 20.47). A large number of the included publications (41.0%) had a medical background. Most of these studies investigated the psychological consequences of severe illnesses, such as cancer. About half of the studies that focused on self-esteem had a prospective (47.5%; positive = 12, negative = 6, ambiguous = 11) and the other half a post-hoc design (positive: n = 5, negative: n = 26, ambiguous: n = 1). The time lag between the first measurement occasion and the event was about 8 months (M = 6.73, SD = 13.13, *median* = 2.00) for prospective studies. For post-hoc studies, the time lag was on average 23 months (M = 23.02, SD = 54.57). The number of time points was comparable between post-hoc (M = 2.88, SD = 1.74) and prospective studies (M = 2.45, SD = 0.78).

Prospective studies. Figure 15 (left) depicts the effect sizes of all prospective studies that investigated the impact of major life events on self-esteem. The intercept of negative physical events was negative and not significant (b_0 = -.23, 95% CL [-.51, .06]). The initial

effects of positive (b_2 = -.01, 95% CL [-.17, .16]) and ambiguous experiences (b_3 = .17, 95% CL [-.12, .46]) were comparable to those of negative events. This initial reaction is followed by a significant positive upward-trend (b_1 = .08, 95% CL [.01, .14]) after negative physical experiences, that lasts over time. The interaction effect between positive and negative experiences was not significant and therefore not included in the model. The initial reaction to physical life events was not significantly different from the effect of family-related (b_6 = .13, 95% CI [-.21, .16]), or work-related events (b_8 = .10, 95% CI [.47, .35]).

Post-hoc studies. In Figure 15 (right) the post-hoc results for self-esteem are depicted. The post-hoc studies had a positive but not significant intercept (c_0 = .09, Cl 95% [-.07, .24]), a not significant slope of zero (c_1 = .00, 95% CL [-.001, .001]), and a significant interaction effect of zero (c_4 = .00, 95% CL [.00, .001]) between positive and negative experiences.



F*igure 15.* Effect sizes of self-esteem and predicted logarithmic change. For reasons of visibility two data points have been truncated. A version with all data points is provided in the supplementary material.

Summary. Self-esteem is the most extensively studied psychological domain. Most of the found effect sizes were positive. Prospective and post-hoc studies indicate that an encounter with major life events leads to an increase of self-esteem with time. This effect is strongest in

the first 4 years after the event. It is important to notice that the results also indicate an increase in self-esteem after negative and ambiguous events, even though self-esteem is not a subdomain of PTG.

4.3.11 Psychological wellbeing

Very few publications could be found that investigated changes in psychological wellbeing after major life events. Taken together, we found 3 studies with one sample each, and 4 effect sizes that met the eligibility criteria. These studies, though small in number, comprised the data of 1,884 participants, were about equally distributed between men (52.3%) and women, represented data from three continents, and included medical (33.3%) as well as psychological (66.6%) studies. The mean age was M = 56.20 years (SD = 2.21). The two prospective studies had their first measurement occasion about three years before the event (M = 39.00, SD = 46.67), while the post-hoc publication measured their participants within a week after the event.

The effect sizes of two prospective studies show no (d_1 = .00) or only very small changes (d_2 = -.09) in PWB. Meanwhile, the post-hoc results show large positive effects (d_3 = .90; d_4 = 1.01) after the traumatic event. Here, it is important to notice that the prospective studies refer to positive or ambiguous events, while the single post-hoc study investigated an event with negative valence. Hence, the results of prospective and post-hoc studies on PWB are not directly comparable, even though the post-hoc studies suggest positive changes after negative experiences.

4.4 Discusson

The present meta-analysis was the largest and most comprehensive study on personal growth since the beginning of research in this field. With 122 studies, including 364 effect sizes and a total of 98,436 participants, it investigated beneficial changes following major life events with the goal of exploring genuine posttraumatic and postecstatic growth. Through a longitudinal approach that excluded studies which solely relied on the retrospective self-

perception of change, it addressed some of the most salient und controversial topics in research on growth after major life events. It was found that posttraumatic and postecstatic growth do exist and occur partially in psychological areas that are not conceptualized as subcomponents of growth.

Due to the strict eligibility criteria, included studies were of relatively high quality. All publications operationalized growth with independent measures over time. About half of the studies provided pre-event data and the majority had more than two measurement time points.

4.4.1 State of the art of life event research

Of the 206,548 original hits that were found during the initial literature search, 4,807 were coded and checked for eligibility. However, only 122 (2.5%) of the coded studies met the eligibility criteria. Most of the excluded studies either had a cross-sectional design, were exclusively qualitative, or relied solely on the self-perception of change. This circumstance is closely related to some of the most critical methodological problems of life event research: In a rigorous scientific design, prospective longitudinal data are needed to quantify actual change and avoid selection effects and distortions due to retrospective assessments of growth (Jayawickreme & Blackie, 2016). In addition, potentially traumatic life events are relatively rare and often unforeseen. Hence, a large number of participants should be recruited at baseline and followed over years in order to investigate actual change and causal relations. This is an enormously costly and time-consuming research design, which is often only given in representative panels. Consequently, most researchers abstain from this possibility and rely on more convenience samples and cross-sectional designs, which may distort the results.

Moreover, one of the most critical findings was the dearth of literature addressing certain events or target outcome variables, which will be systematically addressed below. First, there is a strong negativity bias in life event research. Second, some subcomponents of PTG, such as priorities in life, have not been investigated in a single included study. Finally, some of

the most impactful negative life events, e.g., sexual molestation (Mangelsdorf & Eid, 2015), have not been addressed in longitudinal growth research at all.

Negativity bias in research. Only 25.5% of all effect sizes stem from studies that focused on positive events. These numbers point out a critical problem in life event research. In the last few decades, scientists have focused much more on the effects of negative, rather than positive, life experiences. Hence, one of the most obvious problems in the large number of studies we reviewed for the present meta-analysis was the negativity bias in research. This bias is especially critical because it reverses the natural occurrence of negative and positive life events. Research on the likelihood of positive and negative events has shown that on average positive events happen much more often than negative ones. Gable (2000) found a ratio of 3.2 positive events for every negative experience we encounter. At the same time, only a small number of studies systematically investigated the long-term consequences of positive life experiences. Future research should put more emphasis on the investigation of positive events in order to develop a comprehensive understanding of personality development across the life span.

Target variables. Even within the pool of longitudinal studies, some target variables have been studied much more extensively than others. Most of the longitudinal research on major life events focused on two outcomes: social relationships and self-esteem. While both constructs are important psychological assets, the study of other outcomes has been severely neglected. Some subcomponents of PTG, such as priorities in life, have not been studied at all with other measures, except for the PTGI. Other subcomponents, for example personal strengths and self-acceptance, have only been addressed in a few longitudinal studies. Thus, there is hardly any reliable scientific evidence for growth in these areas.

Under- and overrepresented life events. Mangelsdorf and Eid (2015) conducted a study in which they asked participants to rate the impact of a large scale of positive and negative life events. In the US sample, four of the top ten most impactful events were related to sexual molestation. At the same time, not a single longitudinal study in the meta-analysis investigated

the consequences of these life events in the target domains. This is especially critical, since sexual abuse is not only one of the most impactful experiences, but also fairly common. A global meta-analysis on the prevalence of sexual child abuse alone has shown that more than 10% of all children experience sexual molestation (Stoltenborgh, van IJzendoorn, Euser, & Bakermans-Kranenburg, 2011). Meanwhile, researchers seem to abstain from studying these events and hereby inform clinical practitioners. It could be argued that asking participants about possible silver linings of abuse could be re-traumatizing. However, following participants over time and measuring growth outcomes independently from the event would not have this effect.

While events that are related to the experience of sexual abuse are underrepresented, the majority of research on PTG is based on clinical samples. Approximately half of all included publications in the meta-analysis were medical studies. Jayawickreme and Blackie (2014) have pointed out before that most researchers in the field who have the possibility to draw from clinical samples do so, since it is a convenient way of studying trauma. However, it is likely that the focus of PTG research on severe illnesses biases the scientific results. Presumably, growth is not only influenced by the valence of the event, but also by other event characteristics. Hefferon, Grealy, and Mutrie (2009) found in their comprehensive systematic review on PTG after life-threatening illness that people reported growth in another psychological domain. Survivors of cancer and other severe illnesses perceived that they had gained a new awareness of the body as a consequence of the struggle with their illness. While this finding is consistent for physical life events, it would be unlikely to expect that bereaved individuals would have the same experience. Thus, future research should take a large variety of life events into account and be sensitive to event-specific outcomes.

4.4.2 Evidence for the existence of actual posttraumatic and postecstatic growth

Sufficient data for meta-analytic computations were available for five target variables, namely self-esteem, mastery, social relationships, meaning, and spirituality. The outcomes of prospective studies which focused on self-esteem, mastery, and social relationships show that

major life events with positive, negative, and ambiguous valence result in psychological growth in these areas. The initial effect of negative life events on self-esteem, mastery, and social relationships was either negative or not significantly different from zero, and led to a significant increase over time. These findings fit very well into the conceptualization of PTG as a change in personality that stems from the struggle with challenging experiences (Jayawickreme & Blackie, 2016). In addition, those studies that investigated autonomy provide evidence for growth. However, since very few longitudinal studies were available, these results could not be tested in meta-analytic computations.

The results for spirituality drew a slightly different picture. Negative life events led to a significant increase of spirituality right after the event. However, this increase did not persist. The general understanding of PTG suggests that through the potentially traumatic experience, assumptions of the world are shattered (Cann et al., 2010). As a result of integrating the experience into existing world views or establishing new ones, PTG might occur. This integration process is time consuming and explains why PTG does not occur directly after the event. Thus, the findings reveal an interesting insight. Spirituality seems to be a coping strategy rather than a subdomain of PTG when PTG is conceptualized as a lasting change of personality.

The number of studies for the remaining subcomponents was too small to draw conclusions about lasting changes in these areas. While the effect sizes of studies investigating personal stengths point in the direction that beneficial changes might occur, the few studies that focused on other outcomes are not conclusive. Filling the scientific gaps in these domains should be a primary endeavor for future research.

One of the unanswered questions in PTG research was the stability of personality changes after trauma. Does a challenging life experience lead to lasting psychological benefits or are the psychological changes limited to the time of struggle? For most psychological outcomes with sufficient data, the meta-analysis included studies which followed participants for at least five years. Some of the target variables were investigated in studies that had their

last measurement time point ten, or even more than twenty, years after the event. Taken together, the findings indicate that the benefits which result for the majority of people from encompassing major life events are long-lasting.

4.4.3 Is bad really stronger than good?

Baumeister et al. (2001) stated in their famous article 'Bad is stronger than good' that bad events have greater power than good ones. They wrote: '…events that are negatively valenced (e.g., losing money, being abandoned by friends, and receiving criticism) will have a greater impact on the individual than positively valenced events of the same type…' (Baumeister et al., 2001, *p*. 323). This general assumption has already been challenged in other studies which investigated the perceived impact of life events and found that the experience of negative experiences as more impactful is a cultural artefact (Mangelsdorf & Eid, 2015). In this meta-analysis, we investigated two questions systematically. First, is the initial effect of negative experiences stronger than the effect of positive experiences? Second, do people grow more from negative than from positive events?

Sufficient data to compare the impact of life events with different valences were available for four outcome variables: social relationships, mastery, self-esteem, and meaning in life. While there are many more psychological variables that might be influenced by major life events, the included target variables bring together social, cognitive, and emotional aspects. Thus, they can provide a good picture of the psychological impact of major life events.

Meta-analytic computation showed that negative events did not differ from positive events in their initial effects on social relationships, mastery, meaning in life, or self-esteem. In addition, the increase in social-relationship quality was not faster for negative events than for positive ones. There was a weak interaction between time and valence for self-esteem, suggesting that people grow in this area slightly faster after negative events. Meanwhile, the increase of mastery was stronger for positive events than for negative ones.

When considering all included longitudinal studies that provide data on life events with different valences, it cannot be concluded that the initial impact, or the following development, is generally stronger for negative life events. Suffering seems to be a possible, but not necessary, pathway to growth.

4.4.4 Limitations of studies in life event research

Missing control groups. The main limitation of this meta-analysis is the lack of matched control groups in most studies that were included. Without such a control group, event-related changes are confounded with normative, age-related changes (Luhmann et al., 2014). It is possible that the general growth trend observed for most outcomes included in this meta-analysis partially reflects normal changes across the life span. For most outcomes investigated here, the normative development over the life span is not yet known, due to a lack of longitudinal studies. This is different for self-esteem, however. Orth, Robin, and Widaman (2012) have shown that self-esteem increases between adolescence and middle adulthood and then decreases until old age. To disentangle event-related changes from age-related changes, more studies using matched control groups are needed.

Limited high-quality research in the field. Different researchers have pointed out that while there is a growing number of studies investigating posttraumatic growth, most of these studies use inappropriate research designs and methods (Coyne & Tennen, 2010; Frazier et al., 2009; Jayawickreme & Blackie, 2014). Due to the strict eligibility criteria of this meta-analysis, many studies on posttraumatic growth had to be excluded. Therefore, there are some subcomponents of postecstatic and posttraumatic growth for which very few or no studies were available for meta-analytic computations.

Missing parallelization of events. One of the research questions was the comparison of life events with different valences. Of course, events can be distinguished in more characteristics than just valence. Hence, in order to minimize the influence of other characteristics it would be necessary to parallelize life events, that is, to match events that are

opposite in valence but otherwise comparable (e.g., divorce with marriage, employment with unemployment). However, since many life events are not reversible and because of the large number of outcomes and limited number of studies available, we withdrew from parallelization. Instead, we controlled for the influence of different kinds of life events by categorizing events and including the event category as an additional predictor.

4.4.5 Guidelines for future research

Time frame. Growth is a long-lasting process. As is evident from the meta-analytic results for self-esteem, social relationships, and mastery, the most common initial reactions to a major life event are an immediate decrease, or no significant change. However, after the initial decline, an increase of psychological functioning emerges. This finding fits very well into the conceptual foundation of PTG, which emphasizes that the positive change is not the result of the event per se, but of the struggle with the highly challenging experience (Tedeschi & Calhoun, 2004). Hence, growth occurs time-lagged to the event. On average, the current standing excels the original level between one and two years after the event. These findings highlight a very critical aspect of the study of growth: the time lag between measurement time points and event. From the meta-analytic results, we would not expect to find genuine growth within the first year after the event. Perceived positive changes in that period might rather mirror the recovery process from the initial decline than genuine posttraumatic growth. However, many cross-sectional and longitudinal studies only assess posttraumatic growth within the first year after the potentially traumatic event (e.g., Carboon et al., 2005; Rimé, Páez, Basabe, & Martínez, 2010; Xu & Liao, 2011; Yu et al.; 2010). Thus, a recommendation for future cross-sectional, as well as longitudinal, research would be to include a minimum of one measurement time point that lies at least one and a half year after the event.

Broadening the conceptualization of growth. The concepts of posttraumatic (Tedeschi & Calhoun, 1996) and postecstatic growth (Roepke, 2013) suggest that the positive changes occur in specific areas. While this approach provides a valuable simplification of a complex

psychological construct, it might also be misleading, and a case of data censoring. The results of the meta-analysis suggest that PTG does not only occur in the five areas specified by Tedeschi and Calhoun (1996), but also in other psychological domains, such as self-esteem and mastery. Since neither concept is included in the PTGI, they received little scientific attention in the context of PTG research. That PTG is not limited to the five components identified by Tedeschi and Calhoun (1996) has already been shown in other studies (e.g., Hefferon et al., 2009). Taken together, the findings of this meta-analysis and previous work that used qualitative approaches, suggest incorporating other possible target outcomes in future growth research.

Perceived and genuine growth. This meta-analysis has demonstrated that actual posttraumatic and postecstatic growth do exist. However, previous studies found that genuine and perceived growth are not, or only slightly, related (e.g., Frazier et al., 2009; Ransom, 2006). In addition, perceived PTG is associated with mental illnesses such as anxiety (Carboon et al. 2005) or PTSD (Lowe et al., 2014). These findings raise many critical questions which should be addressed in future research, for example whether genuine or perceived growth is more important for mental health. The positive associations of perceived growth and critical mental outcomes might suggest that it is genuine, and not perceived, growth that enables people to thrive after bad and good experiences.

Investigating the benefits of positive life events. The negativity bias in life event research distorts the general understanding of personal growth. For many years, the possibility that positive life events could also be a catalyst of beneficial personality changes has not been considered. Meanwhile, highly positive events happen much more often than potentially traumatic experiences (Gable, 2000), and contribute to personal growth as much as negative experiences do. Hence, it is likely that our personality is shaped more by life's best experiences than its worst. In consideration of these findings, future research should put more effort into the systematic investigation of the psychological consequences of positive experiences.

4.5 Conclusions

Does growth require suffering? This meta-analysis has shown that positive changes in personality do not only stem from tragedy, but also from positive experiences. We found that the majority of people benefit as much from life's best moments as from its worst, and that growth seems to be the norm and not the exception. While the available longitudinal research in the field is still limited, it indicates that whatever we have to face in life, good and bad events can provide the opportunity to change us for the better.

4.6 Acknowledgement

The authors gratefully acknowledge the Max Planck Research School on the Life Course and Dr. Martin Schultze for the scientific support of this research. We would also like to thank our student assistants Maximilian Bee, Elise Bücklein, Lukas Entezami, Louisa Hohmann, Jonas Jerusalem, Michael Krämer, Lea Musiolek, and Miriam Sellhaus, for their unmitigated support of this work

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Appendix

Model equations

Following Cheung (2008) we used a structural equation modeling approach for meta-analysis, for which the random-effects model is defined as:

$$y^* = X_0^* \cdot u + e^*. \qquad (3)$$

The vector **y*** contains the effect sizes, and is weighted by the inverse sampling error of the effect sizes. $\mathbf{X}_0^*$ is a transformed identity matrix, while **u** is a vector of study specific random effects. Finally, **e*** is the standard error vector of effect sizes weighted with the inverse of the standard errors. An extended version of the model includes the covariates such as valence of event and is expressed as:

$$y^* = X_0^* \cdot u + b_1 \cdot X_1^* + e^*. \qquad (4)$$

The vector $\mathbf{X}_1^*$ contains the values of the moderator variables, which are also weighted by the inverse standard error of the effect size. The regression coefficient of the moderator variable is denoted with $\boldsymbol{b_1}$. In this model the value b_0 of the random intercept variable *u* is the expected effect size of the reference category (negative physical events) for $\mathbf{X}_1^* = 0$. We extended the model to include multiple covariates.

CHAPTER 5

General discussion

5. General Discussion

The present dissertation opened with the words of the German Philosopher Friedrich Nietzsche, who emphasized the human ability to thrive in the face of trauma. Many people share the conviction that life's greatest challenges might hold unique opportunities to outgrow one's potential. However, the idea that positive life events might contribute to personality development in much the same way has previously received little scientific attention.

Therefore, this dissertation aimed to explore the possibility of positive life events functioning as a catalyst for personal growth. In four different studies, I aimed to contribute to the field of growth research by addressing the role of positive life events and exploring the association of posttraumatic and postecstatic growth. Study 1 aimed to elucidate whether the negativity bias is a universal phenomenon, and to provide a quantification of major life events. In Study 2, we proposed a model to predict growth after positive as well as negative experiences. Consequently, in Study 3 we investigated brain structural associations of personal growth initiative after one of the most positive life events for many: the transition to parenthood. Finally, in Study 4, we conducted a large-scale meta-analysis to investigate the genuine nature of personality growth in the aftermath of major life events, and to explore in more depth whether genuine growth requires suffering. In the following section, the main results of each study will be summarized. Thereafter, the overall findings will be discussed and directions for future research addressed.

5.1 Summary and brief discussion of main findings

Study 1 aimed to provide a systematic overview of the impact of a large array of experiences and address the shortcomings of the original Social Readjustment Rating Scale (Holmes & Rahe, 1967) such as the limited scope of included events (Tausig, 1982), the focus on negative events (Cohen, Barker, & White, 2017), and the missing cross-cultural differentiations (Zimmerman, 1983). Additionally, we investigated whether negative life events

are perceived as more impactful than positive ones. The results demonstrated that the original version of the Social Readjustment Rating Scale (SRRS; Holmes & Rahe; 1967) did not include some of the most impactful life events. Many of the items that were not part of the original set of life events, such as those addressing sexual molestation, ranked among the top ten most impactful events in the present study.

Furthermore, the results reflect a great disparity across countries in the negativity bias of major life events, as suggested by Rozin and Royzmen (2001). While US American participants evaluated negative experiences as more impactful, the reverse effect was found in the Indian sample. The results suggested that the negativity bias in life event research is rather a cultural artifact than a universal characteristic. Studies investigating cultural differences in other psychological biases, such as the positivity bias in attribution (Mezulis, Abramson, Hyde, & Hankin, 2004) and in old age (Fung et al., 2008), support these findings. They found strong cultural differences and concluded that the positivity biases are not generalizable across cultures. Hence, it might be reasonable to infer that the same is true for the negativity bias concerning major life events. Furthermore, previous work on the centrality of life events has shown that with time, participants perceive the positive events of their past as more central to them (Berntsen, Rubin, & Siegler, 2011). Taken together, these findings stand in contrast to the idea of Baumeister et al. (2001) that the negativity bias is an evolutionary adaptation and a universal phenomenon.

In **Study 2**, we introduced a novel model that aimed to predict posttraumatic and postecstatic growth across countries. Structural equation modeling has shown that positive emotions and social relationships had a direct effect, while meaning-making was a mediator of growth. Reports of posttraumatic and postecstatic growth were highly interrelated, indicating that people who perceive that they have grown from negative experiences also reported beneficial changes after positive events. The results are concurrent with earlier work on the critical role of meaning-making (Tavernier & Willoughby, 2012), social relationships (Nez et

al., 2010; Schroevers et al., 2010), and positive emotions (Fredrickson et al., 2003; Tugade & Fredrickson, 2004) as facilitators for personal development after potentially traumatic experiences. Interestingly, despite the fact that most of these factors have primarily been identified as supporting factors struggling with adverse events in previous research, they also predicted personality change following positive experiences. Future research should aim to replicate these findings in longitudinal studies in order to verify the causality of these associations.

In **Study 3**, we investigated whether proactive coping through personal growth initiative before childbirth is associated with postpartal gray matter volume. This research question was especially interesting in view of the fact that gray matter volume reductions are a strong indicator of severe psychological impairment following highly stressful experiences (Karl et al. 2006; Nardo et al., 2010; Woon & Hedges, 2008). It was found that prenatal personal growth initiative predicted postpartal gray matter volume in the ventromedial prefrontal cortex. This association was significant one month after birth and positive, but not significant 3 months later.

The association of proactive coping and gray matter volume in the ventromedial prefrontal cortex is backed by earlier coping research. Proactive coping is known to help people to choose a constructive path of action and help them to successfully overcome future challenges (Schwarzer & Knoll, 2003). At the same time, the ventromedial prefrontal cortex plays an important role in resilience and coping (Maier & Watkins, 2011). The perceived ability to cope with the stressful experience (Yi, Smith, & Vitaliano, 2005) and the actual ability to control the situation (Zimmerman, Ramirez-Valles, & Maton, 1999) are key mechanisms for resilience. Maier et al. (2006) pointed out that actual and perceived control inhibit the impact of the stressor by altering the output of the ventromedial prefrontal cortex. In stressful situations, prefrontal cortical anandamide signaling coordinates coping responses through serotonergic pathways (McLaughlin et al., 2012). Hence, it would stand to reason that the

ventromedial prefrontal cortex, a brain area that shows volume reductions in PTSD patients (Kühn & Gallinat, 2013), might play a critical role in proactive coping.

The given research design does not allow for conclusions about the direction of the association and a possible preventive function of personal growth initiative for PTSD. However, it presents an exciting new endeavor for future research: the investigation of neural correlates of personal growth processes.

The last study of this dissertation was a large-scale meta-analysis. I conducted **Study 4** with the goal of systematically addressing whether suffering is a prerequisite for genuine personality changes. One of the most outstanding findings was the negativity bias in life event research. Despite the fact that positive life events are much more common than negative ones (Gable, 2000), the vast majority of studies investigated the consequences of potentially traumatic experiences. Although the meta-analysis revealed many gaps in research on personal growth, empirical evidence was found for genuine changes following major life events in mastery, self-esteem, and social relationships. The results indicated that positive as well as negative life events are pathways to personal growth. This finding falls in line with earlier studies which investigated self-perceived growth after positive life events (Ben-Shlomo, Finaler, Sivan, & Dolizki, 2005; Roepke, 2013; Taubman-Ben-Ari, Findler, & Sharon, 2011) and previous meta-analyses on self-perceived posttraumatic growth (Prati & Pietrantoni, 2009; Sawyer, Ayers, & Field, 2010; Vishnevsky, Cann, Calhoun, Tedeschi & Demakis, 2010).

Another important result of the meta-analysis was that we found evidence for personality growth in psychological areas that have not previously been identified as subdomains of posttraumatic growth (e.g., self-esteem) or postecstatic growth (e.g., mastery). This might be accounted for by the fact that the conceptualizations of posttraumatic (Tedeschi & Calhoun, 1996) and postecstatic growth (Roepke, 2013) were primarily based on self-disclosure of patients and focus groups, rather than a comprehensive meta-analytic process.

5.2 Overall contribution

Life's best and worst experiences shape not only our life path (Pillemer, 2001), but also our personality (Specht, Egloff, & Schmukle, 2011). However, nearly all research on personal growth after major life events focused exclusively on negative experiences (Damian & Roberts, 2014). In the first year of this dissertation, Roepke (2013) published her work on postecstatic growth. Apart from this, there was hardly any empirical evidence for the existence of beneficial personality changes following positive life events. This dissertation includes multiple studies providing empirical evidence for the existence of personality growth following positive life events.

In addition, due to the unidirectional approach of previous studies, in which only the consequences of negative life events were addressed, there was no systematic investigation of the superiority of negative life events over positive ones. Numerous researchers have argued that bad events are more impactful (e.g., Baumeister et al. 2001; Rozin & Royzman, 2001). However, because of a lack of research investigating this premise, there was not sufficient empirical evidence backing or rejecting this assumption. The present dissertation includes the first comprehensive investigation addressing the negativity bias in life event research.

Moreover, while multiple scientists urged early on to include external indicators of growth and the related processes in research on personality changes after major life events (Park & Helgeson, 2006), very few scientists set out to follow this endeavor (e.g., Rabe, Zöllner, Maercker, & Karl, 2006). Thus, this dissertation includes the first study known to the author that used an MRI approach to investigate brain structural associations of proactive coping in the context of positive life events.

Finally, while there is a large body of research investigating posttraumatic growth, most of the studies in this field were cross-sectional and relied on retrospective self-perceptions of change (Jayawickreme & Blackie, 2014). The few studies which had a longitudinal design and investigated personal growth with independent measures suffered from other methodological

shortcomings, such as a short period of investigation (Frazier et al., 2009), or a small number of outcome variables (Ransom, 2006), that did not mirror the complexity of multidimensional personality growth. The included meta-analysis is the largest meta-analysis on posttraumatic and postecstatic growth in the field, and the only one relying on longitudinal studies. With this approach, many open questions, such as the authenticity of posttraumatic as well as postecstatic growth or the endurance of growth, could be answered. In the next section, the overall contributions of this dissertation will be addressed in more detail.

5.2.1 Positive life events as catalyst for personality development – Does growth require suffering?

The terminology of posttraumatic growth, which stood for decades at the center of research investigating positive development after major life events, emphasized one critical fact: trauma is an inherent part of growth. Leading scientists in the field have repeatedly argued that struggling with a potentially traumatic experience is the main facilitating factor for positive personality changes (Blackie, Roepke, Hitchcott, & Joseph, 2016; Jayawickreme & Blackie, 2014; 2016; Pat-Horenczyk, 2016; Tedeschi & Calhoun, 1996; 2004). In addition, as has been shown in Study 4, the vast majority of studies investigating psychological changes after major life events exclusively focused on negative events. These two factors have led to the impression that growth requires suffering. However, the results of this dissertation suggest the contrary.

I investigated the possibility that positive life events might function as catalysts for personal changes in three studies. Self-reports of postecstatic growth in Study 2 confirm that participants experienced, on average, a moderate degree of change as a consequence of highly positive events. This finding is especially interesting in light of the arguments of different authors who attribute reports of posttraumatic growth to positive illusions to cope with the traumatic experience (Frazier et al., 2009; Maercker & Zöllner, 2004; McMillen & Cook, 2003; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). While this line of reasoning might

explain posttraumatic growth, it does not explain why people perceive to have changed for the better after positive life events.

In addition, the meta-analysis has shown that actual postecstatic growth exists. The results indicate that positive life events lead to lasting beneficial changes in self-esteem, environmental mastery, and social relationships. Thus, for two of the four subcomponents of postecstatic growth we found empirical evidence that confirms its genuine nature. The fourth subcomponent, namely spirituality, was not investigated in longitudinal studies. However, the results indicate that the conceptualization of postecstatic growth (Roepke, 2013) should be extended by a fifth domain, which is environmental mastery.

While it could be argued that studying the psychological trajectories of negative life events is more important to help people overcome traumatic experiences, this might not be the only way. This dissertation has shown that capitalizing on positive experiences is connected to enhanced self-esteem, deeper social relationships, and a greater sense of mastery. All three components are critical assets for resilience and coping (e.g., McAdams & Jones, 2016; Gil & Weinberg, 2015; Yu et al., 2014). Thus, it could be argued that growth - and resilience – do not require suffering, but can also stem from positive experiences.

Future research on therapeutic interventions for PTSD patients should consider the role which positive experiences can play in order to enhance resilience and post-event growth.

5.2.2 The negativity bias in life event research – Is bad really stronger than good?

Across different studies, we tested the superiority of negative life events over positive ones. Baumeister et al. (2001) wrote that in general, negatively valenced events have a greater impact on the individual than positive experiences. I explored the validity of this assumption in several of the included studies.

First, in Study 1 I investigated the perceived impact of positive and negative life events, in order to explore whether negative life events demand more socio-emotional adjustment. The results indicated that only US American participants experienced negative events as more

impactful. Second, in Study 2 participants reported on perceived posttraumatic and postecstatic growth, after their worst and best life events. In both samples, the mean level of self-perceived posttraumatic growth was not higher than the mean level of postecstatic growth. Third, we asked the mothers in Study 3 to answer the posttraumatic growth questionnaire (Tedeschi & Calhoun, 1996) but altered the questions to refer to the childbirth experience instead of a traumatic event[7]. The mean PTGI scores (M = 3.33 - 3.64) reported by this group that previously encountered a positive experience were comparable to the PTGI scores in Study 2 (M = 3.61), in which participants referred to their worst experiences. Moreover, in Study 4, we systematically investigated whether the initial reaction and the long-term changes of various psychological outcomes are stronger for negative than for positive events. The findings showed that for most outcomes there is no significant difference in the impact of major life events. Both positive and negative events functioned to a comparable extent as catalysts for personal development. It has to be considered that for some variables the meta-analysis was based on a small number of studies and had therefore limited power to detect smaller differences. However, in conclusion, the findings of all four studies indicate that the assumption that the negativity bias applies to major life events (Baumeister et al., 2001; Rozin & Royzman, 2001) seems not to be true.

Additionally, Study 2, although it has a cross-sectional design, revealed an interesting insight concerning the association of earlier life events and growth following more recent experiences. In this study, we provided participants with a list of positive and negative life events to indicate which experiences they have encountered in life. Furthermore, they had the possibility to add events that were not included in the list. It was found that the number of highly positive life events predicted posttraumatic and postecstatic growth following later experiences, while the number of potentially traumatic experiences had no influence on post-event growth.

[7] These results are not included in the article anymore, since one reviewer asked to focus the article on the neural correlates of personal growth initiative only.

Research on the evolutionary role of positive emotions and experiences backs these findings, which suggest that positive life events might be as important for personal development as negative experiences (Fredrickson, 2004). In her broaden-and-build theory, Fredrickson (2004) proposes that positive emotions broaden the momentary attention, mindset, and thought-action repertoire, thereby promoting novel thoughts, ideas, and actions that build lasting resources (Fredrickson & Branigan, 2005). In addition, stress research has shown that positive emotions lead to more adaptive coping and consequently to more resilience (Gloria & Steinhardt, 2014). These findings suggest that experiences which increase positive emotions might be an important developmental advantage. Berntsen, Rubin, and Siegler (2011) proposed that life events with positive and negative valence play different, but critical, roles in building identity and that their importance varies depending on the time since the event. They found that the centrality of positive events increases with time, while the importance of negative events diminishes. Thus, while emphasizing the negative might be an evolutionary advantage for survival (Baumeister et al., 2001; Vaish, Grossmann, & Woodward, 2008), capitalizing on the positive seems to be an evolutionary advantage for development (Fredrickson, 2004; Fredrickson & Branigan, 2005).

5.2.3 A new perspective on mechanisms underlying personality growth after major life events

One of the key questions of growth research was to understand which psychological mechanisms lead to the occurrence of posttraumatic growth. As elucidated above, it has been proposed in multiple studies that the disruption of core beliefs and the consequent reestablishment of these fundamental assumptions leads to posttraumatic growth (Ben-Ezra, Hamama-Raz, Mahat-Shamir, Pitcho-Prelorentzos, & Kaniasty, 2017; Cann et al., 2010; Jayawickreme & Blackie, 2014; Tedeschi & Moore, 2016). However, this dissertation has illustrated two facts: First, perceived (Study 2 and Study 3) and genuine growth (Study 4) do not only occur after traumatic experiences, but also after highly positive events that do not

challenge our basic assumptions about the world. Second, we found in Study 2 and Study 3 that posttraumatic and postecstatic growth are highly interrelated. Hence, it is reasonable to assume that the same mechanism underlies posttraumatic and postecstatic growth and that this mechanism is not limited to a disruption of core beliefs.

Positive and negative events share one critical commonality: they broaden the scope of our previous experiences. Damian and Simonton (2016) have referred to these kinds of events as diversifying experiences that have the potential to break mental boundaries. The integration and mental reorganization that is necessary in order to accommodate the new experience might be the universal mechanism underlying posttraumatic and postecstatic growth, rather than a mere shattering of core beliefs. This assumption would also be supported by research on meaning-making after life-altering events, which emphasizes the role of meaning-making as an integrational process to accommodate intense experiences (Park, 2010; Tavernier & Willoughby, 2012; Tedeschi & Calhoun, 2004).

Moreover, Study 2 has shown that positive emotions are positively related to posttraumatic and postecstatic growth. It would be reasonable to assume that this effect is mediated by the broadened mindset caused by positive emotions that foster personal growth (Fredrickson, Tugade, Waugh, & Larkin, 2003) by facilitating the integration of diversifying experiences.

5.2.4 Genuine posttraumatic and postecstatic growth

The occurrence of posttraumatic growth is widely reported. Meanwhile, many researchers questioned if these self-perceived changes represent genuine and lasting psychological transformations (Frazier et al., 2009, Jayawickreme & Blackie, 2016, Maercker & Zoellner, 2004, McFarland & Alvaro; 2000). The over-reliance on self-reported change, as well as a lack of prospective longitudinal studies in the field, posed severe scientific problems (Ford et al., 2008). Hence, many researchers expressed their doubts on the genuine nature of

the construct and argued that posttraumatic growth might be a cognitive distortion (Tennen & Affleck, 2002; McFarland & Alvaro, 2000).

In order to contribute to the discourse on the genuine nature of post-event growth I included two studies with a longitudinal design in this dissertation. In the meta-analysis we were able to identify 122 studies, although there is a severe lack of longitudinal publications which explicitly investigate posttraumatic growth. We found strong empirical evidence for lasting genuine changes in self-esteem, environmental-mastery, and social relationships after positive as well as negative life events. The primary effect of negative events on relationships, mastery, and self-esteem, was either not significantly different from zero or negative. Thereafter, a significant increase that excelled the pre-event level occured. In addition, studies which investigated autonomy changes through major life events revealed the same pattern, but could not be included in meta-analytic computations due to the small number of publications.

The trajectories of these constructs fall in line with the theoretical conceptualization of posttraumatic growth. Many researchers have emphasized that posttraumatic growth is not the result of the event per se, but of the psychological struggle with the experience (Blackie, Roepke, Hitchcott, & Joseph, 2016; Pat-Horenczyk et al., 2016; Tedeschi & Calhoun, 1996; 2004). Hence, we expected to find an increase in psychological functioning with time and not immediately after the event. Interestingly, the trajectory of spirituality was not gradual, but increased immediately after the event. However, changes in spirituality were not lasting. This pattern would suggest that spirituality is not a subdomain of growth, but a coping strategy. The critical role of spirituality as a coping strategy has been investigated in a large number of medical studies, which identified spiritual coping as an important strategy to handle life-threatening illnesses (e.g., Gall, Guirguis-Younger, Charbonneau, & Florack; 2009; Sacco, Park, Suresh, & Bliss, 2014; Yanez et a., 2009). Thus, the meta-analysis showed that while some of the psychological areas in which genuine positive changes occurred were not identified

as growth domains in previous research, others are mistakenly defined as subdomains of post-event growth.

As well as longitudinal research designs, multi-methodological approaches are also a solution for the methodological shortcomings of growth research. However, due to the complex character of multidimensional personality changes, a critical question arises. Which other methods could be considered to mirror personality changes or associated mechanisms? In addition to the meta-analysis, Study 3 aimed to investigate the genuine nature of growth following major life events. In Study 3, which was the first structural MRI study investigating personal growth, we investigated neural correlates of personal growth initiative as a mechanism closely related to beneficial psychological changes after negative (Borowa, Robitschek, Harmon, & Shigemoto, 2016) as well as positive life events (Roepke, 2013). Since personal growth initiative (Robitschek et al., 2012) is a more focused construct than multidimensional personality growth, neural correlates are more likely to be found through this approach. Whole brain voxel-based morphometry revealed the ventromedial prefrontal cortex as the only region associated with personal growth initiative. Thus, the vmPFC might be a critical area to investigate in future studies on neural correlates of personal growth, as has been discussed above. Despite the prospective design of the study, it is important to mention that we were not able to compare pre- and post-event brain data in order to make any assumptions about neuroplasticity in this region. Meanwhile, the mere fact that the vmPFC is closely related to PTSD, which has been shown in multiple studies (for a meta-analysis see Kühn & Gallinat, 2013) highlights that it might play a critical role for future studies on genuine posttraumatic growth and resilience.

5.2.5 The association of posttraumatic and postecstatic growth

Through multiple studies included in this dissertation, I have shown that there is a strong relationship between posttraumatic and postecstatic growth. The results of Study 2 indicated that people who report to have grown from potentially traumatic experiences also perceive to

have grown from highly positive life events. Moreover, in Study 2 we found that the same model predicts posttraumatic and postecstatic growth. In Study 3, participants answered the questions of posttraumatic and postecstatic growth scales referring to the same recent life event. The correlation of both constructs in Study 3 was even higher than in Study 2. While it could be argued that this effect could also be driven by the response style of participants and similar items of questionnaires, it highlights that the distinction between the subdomains of postecstatic and posttraumatic growth seems to be artificial. Finally, in the meta-analysis we found that positive and negative life events seem to have a comparable influence on psychological functioning. Taken together, the results suggest that posttraumatic and postecstatic growth are either highly interrelated, or two terms referring to the same psychological construct.

Nearly all previous research on growth following positive or negative life events has emphasized that the valence of the encountered event and the associated event characteristics are critical for the occurrence of growth (e.g., Brooks, Graham-Kevan, Lowe, & Robinson, 2017; Canevello, Michels, & Hilaire, 2016; Jayawickreme & Blackie, 2016; Park & Helgeson, 2006; Prati & Pietrantoni, 2009; Roepke, 2013; Tedeschi & Calhoun, 2004). The artificial theoretical distinction between personality growth after positive and negative life events has led to a research practice that excludes life events with different valence. For example, Brooks et al. (2017) recently introduced the Cognitive Growth and Stress (CGAS) model for predicting posttraumatic growth and distress. In their model they included event centrality, rumination, and perceived control as cognitive processing factors in order to predict growth after stressful experiences. Even though the CGAS model would be easily applicable to positive events, such as childbirth, the authors asked participants only about their traumatic experiences. Through this unidirectional approach, valuable scientific information as well as possible practical implications are lost.

Some scientists have undertaken the first attempts to include positive life events as catalysts for posttraumatic growth (e.g., Sawyer, Ayers, Young, Bradley, & Smith, 2012;

Taubman-Ben-Ari et al., 2011). However, the assumption that posttraumatic and postecstatic growth are two distinct phenomena is still dominant. Jayawickreme and Blackie (2014) stated that posttraumatic growth is a research area which should be of special interest in personality psychology, since it addresses a shift in personality and behavior. In addition, this dissertation suggests that individual psychological characteristics, rather than event features, might be more important factors determining growth.

5.2.6 A novel conceptualization of post-event growth

As elucidated above, the findings of the present dissertation suggest that scientists should reconsider the general conceptualization of posttraumatic and postecstatic growth. First, it is reasonable to look at growth after positive and negative events not as distinct phenomena, but as a possible outcome of diversifying experiences. Major life events, which challenge existing mental structures, including assumptive worlds and core beliefs (Cann et al., 2010; Janoff-Bulman, 2004) can lead to distress and require accommodation independently of the event's valence. Second, in this dissertation, we have identified different resources as well as coping strategies (meaning making, positive emotions, social relationships, and personal growth initiative) that are likely to promote the integration of the diversifying event and facilitate the accommodation of the experience. Finally, the meta-analysis has indicated that the scope of growth domains should be extended. Figure 16 depicts a comprehensive model and new conceptualization of post-event growth. Despite this model not being exhaustive, concerning possible resources, coping strategies and growth domains, it is the most comprehensive approach to explain growth following positive and negative life events. Please note that some proposed growth domains (e.g. autonomy, Linley & Joseph, 2005) are - because of a lack of evidence - not included, but might be added in future extensions of the model. Future research should aim to investigate which personality or event characteristics, apart from the event's valence, predict growth in specific subdomains.

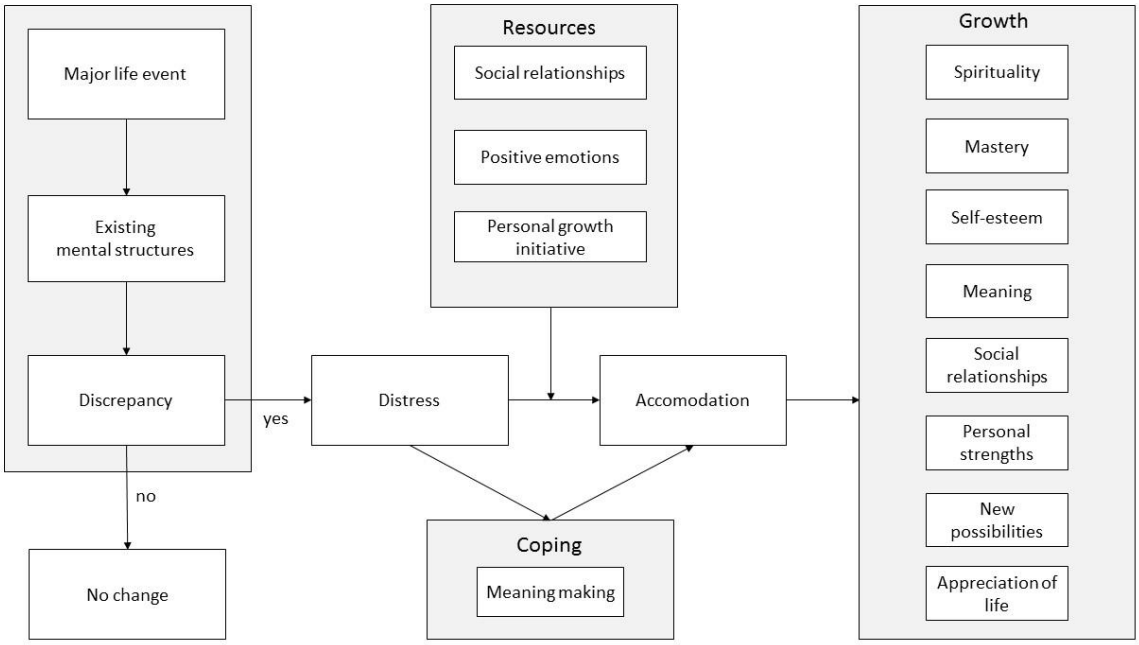

Figure 16. Comprehensive growth model.

5.3 Limitations of the present dissertation

While this dissertation aimed to comprehensively answer the open questions discussed above, there are overall limitations which need to be considered before directions for future research can be given. In the following section, I address only those limitations which apply to the dissertation as a whole and have not been discussed earlier. The specific limitations of the single studies are not repeated here, but can be found in the discussion section of each study.

Perceived and genuine growth. This dissertation used different methods to operationalize personal changes following major life events. We investigated perceived as well as genuine growth. Despite the fact that most research in the field entangles both phenomena (e.g. Tedeschi & Calhoun, 2004), it might well be possible that perceived posttraumatic growth reflects genuine growth, but also cognitive illusions to some extent (Maercker & Zoellner, 2004; McFarland & Alvaro; 2000). Thus, the validity of the scales used in Study 2 might be limited by the fact that retrospective self-perceived growth might also include mental

distortions. An important next step of research in the field will be to systematically investigate the relationships of self-perceived and actual growth (Park & Helgeson, 2006).

The challenge of criterion change. The conceptualization of posttraumatic growth relies on a fundamental shattering of worldviews and assumptions (Cann et al., 2010; Tedeschi & Calhoun, 1996; Jayawickreme & Blackie, 2014). Tedeschi and Calhoun (2004) compare posttraumatic growth to a psychological earthquake. They pose that the seismic event destroys, shakes, or threatens the mental structures that underlie decision-making and understanding. Reconstructing or redesigning these mental structures leads to posttraumatic growth (Tedeschi & Calhoun, 2004). Thus, the psychological consequences that occur through posttraumatic growth change our understanding of the world. This fact is a critical methodological challenge for longitudinal studies, such as those included in the meta-analysis. For example, when participants answer questions addressing the presence of meaning in life before and after a life-threatening diagnosis, their personal understanding of meaning may have changed fundamentally. Thus, while they might have felt they lead a meaningful life before diagnosis, afterwards they would judge their former standing in the same psychological domain differently. The most efficient way to solve this methodological problem in longitudinal studies would be to incorporate qualitative methods in growth research (e.g., Hefferon, Grealy, & Mutrie, 2009), which have not been used in this dissertation.

Between-subjects approach. All studies of this dissertation used a between-persons approach to operationalize post-event growth. This strategy simplifies the complexity of possible trajectories that individuals can make following highly stressful events. For example, Bonanno (2004) found that some individuals react with a psychological impairment immediately after traumatic events, while others' reaction is delayed or they show no impairment at all. While a detailed within-subject investigation of post-traumatic and postecstatic growth was not in the scope of this dissertation, it should be a critical endeavor for future research to focus on individual trajectories of growth.

In addition, we used general ratings of events concerning their impact (Study 1) and their desirability (Study 1, Study 2, and Study 4). With this approach we accepted that for some participants, events which we classified as positive might have had a negative valence and vice versa and that the specific socio-emotional impact of a certain event as described in Figure 1 might differ between individuals. Furthermore, the original SRRS (Holmes & Rahe, 1967) was criticized for the presumption that the average rating of a life event's impact could be generalizable across individuals (Geyer, 1999; Filipp, & Aymanns, 2010). Through the cross-cultural approach of Study 1 and 2 we tried to account for some of the variance in the ratings of events. While it can be argued that life event ratings and classifications simplify a complex experience to a degree that no longer reflects the individual perception, they can give insights into a bigger picture of (shared) life experience. For example, already in the original SRRS results, about 50 years ago, the death of a partner was rated as one of the worst experiences (Holmes & Rahe, 1967). We found the same result in Study 1 across cultures. Additionally, recent studies which investigated the significance of a large array of events came to the same conclusion (Cohen et al., 2017). Thus, while these ratings might not reflect the individual truth, they can provide valuable insights into the general perception of life events. Future research could take into consideration additional subjective ratings concerning the impact, valence, and controllability of events to account for individual differences.

We also used general ratings to classify the valence of different events. As a result, the resemblance of the impact of events classified as positive or negative found in Study 4 could partially be due to the fact that individual perceptions might differ from general ratings and that the same event may be judged as positive by some and negative by others. However, it is reasonable to assume that these cases are the exception, especially because we have classified events, which for the majority of people might not be clearly positive or negative, such as retirement or children leaving home, as ambiguous from the start. Future research could use

these insights as a starting point to investigate the impact and consequences of a specific event - for example retirement - depending on the individual desirability.

5.4 Directions for future research

In the following section, general challenges for research are given, which stem from the current findings but go beyond the scope of this dissertation. Theoretical as well as methodological aspects will be addressed which constitute leverage points for future research.

5.4.1 The relationship of resilience and posttraumatic growth

The overall results of this dissertation show that on average, the majority of people experience posttraumatic growth as a consequence of trauma exposure. In Study 4, we found genuine posttraumatic growth in a longitudinal between-subjects approach, which suggests that the majority of participants most probably experienced posttraumatic growth to some extent. In addition, in Study 2 and Study 3, participants also reported medium levels of growth, on average. These findings fit well into research on the prevalence of perceived posttraumatic growth that emphasized the commonality of the experience (Affleck et al. 1987, 1991; Joseph & Linley, 2004; McMillen, Smith, & Fisher, 1997; Sears, Stanton, & Danoff-Burg, 2003).

Meanwhile, Bonanno (2004) found that most people do not develop PTSD after trauma exposure and that resilience is the most common reaction to trauma. This poses an interesting new question for future research. Studies on the relationship between resilience and posttraumatic growth have shown that resilient individuals have the lowest posttraumatic growth scores and that both salutogenic constructs are inversely related (Levine, Laufer, Stein, Hamama-Raz, & Solomon, 2009). In other words, either people suffer from the negative consequences of traumatic events and possibly experience posttraumatic growth through struggling with the trauma, or they are resilient and therefore not affected by the event at all. The explicit distinction between resilience and posttraumatic growth is also supported by the assumption that the process of core belief disruption (Cann et. al., 2010) underlies both

posttraumatic stress and posttraumatic growth. However, in light of the overall results of this dissertation, there must be people who experience both resiliency and posttraumatic growth.

In most studies, resiliency is operationalized by a lack of PTSD after trauma exposure (e.g., Bonanno, Galea, Bucciarelli, & Vlahov, 2007; Levine et al., 2009). However, not suffering from PTSD is not the same as not being affected by the event (Almedom, & Glandon, 2007). Possibly, some people who are exposed to highly adverse events suffer emotionally from the event, but cope effectively enough to prevent PTSD and simultaneously develop posttraumatic growth. Studying these individuals could be one of the most exciting new perspectives for research on human thriving in the face of trauma.

5.4.2 Measuring personal growth

This dissertation investigated personal growth following major life events. Strictly speaking, the concepts of posttraumatic and postecstatic growth do not suggest that personality growth can only stem from major life events. Rather, they suggest that impactful events are one source of personal change processes among others, such as daily experiences as described in the introduction. Changes in self-esteem for instance, are not only driven by major life events, but can also be influenced by minor experiences (Lehnart, Neyer, & Eccles, 2010; Wrzus, & Roberts, 2017). Jayawickreme and Blackie (2014) pointed out in their critique on cross-sectional retrospective measures of growth that people need to be able to judge to which extent personal changes during a certain period can be attributed to a specific experience. Otherwise, they might confuse normative changes with event-specific personal development. However, the same problem applies to prospective studies.

Studies with a prospective longitudinal design, such as those included in the meta-analysis, can provide data on change processes at the time of the event. However, it is not possible to exclude the possibility that these differences are also driven by normative changes (Luhmann, Orth, Specht, Kandler, & Lucas, 2014). Methodologically, it would be necessary to compare change scores of participants who underwent certain life events with change scores of

a matched control group that did not experience a major life event in the same timeframe (Jayawickreme & Blackie, 2016). Without matched control groups, pre- and post-event differences can be confounded with age-related changes (Luhmann et al., 2014).

Costanzo, Ryff, and Singer (2009) conducted a prototypical study that could define the new standard in the research field of resilience and growth. The authors used data of the MIDUS survey (Midlife in the United States) and identified 398 survivors of cancer. Data of cancer survivors on social-wellbeing, spirituality, and other domains of psychological functioning were compared to the outcomes of 796 matched controls that had no cancer history. This comprehensive design allowed for distinguishing cancer related changes from other developmental processes. However, it is important to point out one methodological flaw in this otherwise ideal study. Costanzo et al. (2009) matched cancer survivors with participants that had not received a cancer diagnosis. Meanwhile, they did not control for any other medical condition or other potentially traumatic life events. Thus, the control group might include participants that in the time of the study experienced other major life events which influenced their psychological functioning. This study exemplifies the demands and pitfalls that future research needs to take into account.

Since the majority of studies in the field did not include matched control groups, it was not possible to compare event-specific growth processes and normal change processes in the included meta-analysis. Hence, also in this dissertation, we could not investigate the role of age-related normative changes in depth. Future research should either aim for a research design comparable to the study of Costanzo et al. (2009) or critically reflect the possibility of confounded outcomes.

5.4.3 Process oriented research

Most research on growth following major life events investigates the influence of a single distinct event, such as breast cancer (Boyle, Stanton, Ganz, & Bower, 2017), deployment (Tsai, Sippel, Mota, Southwick, & Pietrzak, 2016) or a terror attack (Dekel, Hankin, Pratt,

Hackler, & Lanman, 2016). While the given approach aims to estimate the direct effect of single events, it discounts a critical aspect of major life events: they seldom come alone.

Every person's path through life is marked by multiple major events. In addition, most people experience at least one potentially traumatic event (Ozer et al., 2003) and a large number of people (38%; Green et al., 2000) appear to experience even more. Despite this fact, most studies ignore prior trauma exposure (Green et al., 2000) or other major life events when investigating the outcomes of single events. In addition, it is known from PTSD research that there is a cumulative effect of multiple trauma on PTSD symptoms and depression (Suliman et al., 2009). Thus, through focusing on the most recent event, interaction und cumulative effects of prior experiences are ignored and mistakenly understood as effects, which can solely be attributed to the investigated event.

Future research should therefore take a process-oriented approach that considers the critical role of prior events for more recent ones. There are many insufficiently answered questions connected to the interaction of multiple positive and negative events. For example, Fredrickson's (2004) broaden-and-build theory suggests that positive emotions and experiences build long lasting resources and resilience (Fredrickson, Tugade, Waugh, & Larkin, 2003). Thus, it would be reasonable to assume that prior positive events counteract the disruptive consequences of negative ones and that multiple positive events would be even more beneficial. Future research should address these questions systematically and investigate the interplay of multiple positive and negative events and their consequences for post-event growth.

5.4.4 Clinical applications and growth based interventions

Researchers who have studied posttraumatic growth have found that personal growth moderates the risk of suicide among trauma-exposed individuals (Sheline & Rosén, 2017). It was not the number or severity of traumatic events which decided suicidal ideations, but the perception of growth that stemmed from this experience. These findings suggest that interventions that aim to foster posttraumatic growth might be of high value for traumatized

individuals. Meanwhile, different researchers have emphasized that, given the open empirical and conceptual questions and the vulnerability of the target group, clinical interventions can only be applied very cautiously (Park & Helgeson, 2006).

Most intervention studies that aimed to foster posttraumatic growth used written approaches to enhance meaning-making through self-disclosure (e.g., Cafaro, Iani, Costantini, & Di Leo 2016). For example, McCullough, Root, and Cohen (2006) asked participants to write about the personal benefits of a situation of interpersonal transgression. They found that participants of the intervention group felt more forgiveness after the exercise than controls. In another study, participants were asked to write about the adverse event from a perspective of gratitude (Watkins, Cruz, Holben, & Kolts, 2008). The results showed that participants of the grateful condition felt more at peace with the event and themselves than participants in the other conditions. While these interventions showed beneficial effects for the recipients, they might also involve risks, since writing about traumatic events always holds the possibility of re-traumatization (Berman, 2005).

The results of this dissertation suggest additional starting points for interventions that aim to foster posttraumatic growth and possibly be of help for traumatized individuals. It is important to note that the cross-sectional design of the studies, which investigated mediating and moderating factors of post-event growth, does not allow for causal conclusions. Thus, the following suggestions for possible practical applications and interventions require additional longitudinal studies that ensure the causality of the found effects.

In this dissertation, we identified four psychological factors which are associated with post-event growth, namely: the presence of positive emotions, having supportive relationships, personal growth initiative, and meaning-making. All four of these factors could be addressed through different interventions, without the necessity of reliving the event. The design of the included studies does not allow us to draw causal conclusions, but suggests associations

between the constructs mentioned above and post-event growth. Thus, intervention studies are needed in order to verify the causality of the relationship.

While the beneficial role of supportive relationships has been extensively studied in trauma research (e.g., Brewin, Andrews, & Valentine, 2000), little is known about the effects of interventions that foster positive emotions. Potentially traumatic experiences are often accompanied by intrusive images, which are associated with strong feelings of disgust, fear, or anger (Holmes, Gray & Young, 2005) and depressive symptoms (Brewin, Gregory, Lipton, & Burgess, 2010). Meanwhile, research on the undoing effect of positive emotions has shown that positive emotions, such as joy, can function as a buffer against negative ones (Fredrickson, Mancuso, Branigan, & Tugade, 2000). The assumption that positive emotions could counteract the negative emotions connected to the traumatizing experience is also supported by work on positive imagery in psychotherapy. Arntz, Kindt, and Tiesema (2007) have found that psychotherapies which used positive imagery reduced guilt, shame, and anger in patients. In addition, positive emotions broaden thought-action repertoires (Fredrickson, 2004) and might therefore allow a perspective change on the traumatic experience. Thus, one possibility for less intrusive interventions which might help people to cope with trauma and develop posttraumatic growth could be to enhance positive emotions (Fredrickson, Tugade, Waugh, & Larkin, 2003).

Another possibility to foster growth after highly stressful events, without needing to directly address the experience, is to support personal growth initiative (Robitschek et al., 2012). The found association of personal growth initiative and vmPFC volume suggests that it might play a critical role in coping with highly stressful events. Even though the design of the included study does not allow for inferring causality, other studies support the assumption that personal growth initiative fosters posttraumatic growth (Shigemoto, Ashton, & Robitschek, 2016) and might support recovery after traumatic experiences (Borja & Callahan, 2009). Thoen and Robitschek (2013) introduced the intentional growth training as a comprehensive set of interventions that increases personal growth initiative. Applying this training to patients that

have undergone highly stressful experiences, or as a preventive strategy for endangered populations, might be another path to foster post-event growth.

Finally, this dissertation revealed one highly interesting and novel approach to supporting traumatized individuals: meaning-making interventions based on positive life events. In Study 2, we found that meaning-making predicts growth after negative as well as positive experiences. Furthermore, the mediating role of meaning-making after traumatic life events has been suggested in multiple previous studies (e.g., Janoff-Bulman, 2004, Park, Chmielewski, & Blank, 2010). However, since interventions which aim to foster meaning-making approaches based on traumatic experiences (e.g., Cafaro et al., 2016; McCullough et al., 2006; Watkins et al., 2008) hold the risk of re-traumatization, an approach focusing on positive experiences might be a valuable alternative. While deriving meaning from positive events might not necessarily counteract core belief disruption (Cann et al., 2010), it can foster the presence of meaning in life, which is highly adaptive (Linley & Joseph, 2011). Thus, it might be an interesting endeavor for future intervention research to capitalize on life's best experiences, in order to help patients overcome their worst.

5.5 Conclusions

Every person's life is shaped by the major events we encounter. Experiences, such as having a child, falling in love, or being diagnosed with a life-threatening illness do not only change our daily routines, but who we are as a person. This dissertation aimed to answer whether personal growth following major life events requires suffering or can also stem from life's best experiences. Through intercultural, longitudinal, meta-analytical and MRI approaches I explored the facilitating role of positive life events for personal development.

This dissertation has shown that life's best and worst moments can lead to perceived and genuine growth. Taking good and bad events into consideration when studying beneficial

consequences of major life events can fundamentally broaden our understanding of positive human development.

Thus, while we might not be able to change people's life paths, we might be able to help them grow, whatever their life paths may be.

5.6 References

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6. List of tables

7. List of figures

8. Authors contribution

Study 1 & 2

Mangelsdorf, J., & Eid, M. (2015). What makes a thriver? Unifying the concepts of posttraumatic and postecstatic growth. *Frontiers in Psychology, 6*, 1–17. doi: 10.3389/fpsyg.2015.00813

Concept:	Judith Mangelsdorf
Identification of the scientific problem:	Judith Mangelsdorf
Development of the research design:	Judith Mangelsdorf & Michael Eid
Formulation of materials for the investigation:	Judith Mangelsdorf
Aquisiton of participants:	Judith Mangelsdorf
Processing:	Judith Mangelsdorf
Statistical computations:	Judith Mangelsdorf
Discussion of the data:	Judith Mangelsdorf & Michael Eid
Writing of manuscript:	Judith Mangelsdorf
Supervision:	Michael Eid

Study 3

Mangelsdorf, J. (2017). Coping with childbirth: Brain structural associations of personal growth initiative. *Frontiers in Psychology, 8, 1-9.* doi: 10.3389/fpsyg.2017.01829

Concept:	Judith Mangelsdorf
Identification of the scientific problem:	Judith Mangelsdorf
Development of the research design:	Judith Mangelsdorf, Michael Eid, Nina Lisofsky, & Simone Kühn
Formulation of materials for the investigation:	Judith Mangelsdorf
Aquisiton of participants:	Judith Mangelsdorf, Nina Lisofsky
Processing:	Judith Mangelsdorf, Nina Lisofsky
Statistical computations:	Judith Mangelsdorf, Nina Lisofsky
Discussion of the data:	Judith Mangelsdorf, Nina Lisofsky, Simone Kühn & Michael Eid
Writing of manuscript:	Judith Mangelsdorf Nina Lisofsky (MRI methods)
Supervision:	Michael Eid & Simone Kühn

Study 4

Mangelsdorf, J., Eid, M., & Luhmann, M. (2017). Does growth require suffering? A meta-analysis and systematic review on genuine posttraumatic and postecstatic growth. *Mansucript submitted for publication.*
.

Concept:	Judith Mangelsdorf
Identification of the scientific problem:	Judith Mangelsdorf
Development of the research design:	Judith Mangelsdorf, Michael Eid
Formulation of materials for the investigation:	Judith Mangelsdorf
Literature search & coding:	Judith Mangelsdorf & research assistants
Processing:	Judith Mangelsdorf
Statistical computations:	Judith Mangelsdorf
Discussion of the data:	Judith Mangelsdorf & Michael Eid
Writing of manuscript:	Judith Mangelsdorf
Supervision:	Michael Eid & Maike Luhmann

Appendix

9.1 Supplementary material of the meta-analysis

The following section comprises the supplementary material of the meta-analaysis. First, literature search terms, studies with missing standard deviations and descriptive statistics for all effect sizes and studies are presented in more detail in Table 16 – 37. Subequently, the figures of outcomes with less than 6 effect sizes are depicted.

Overview of supplementary material

9.1.1 Tables with background information of the meta-analysis

Table 16
Keywords of the literature search process

"psychological well-being" or self-acceptance or personal growth or purpose or meaning or environmental mastery or autonomy or positive relation* or "Posttraumatic growth" or "benefit finding" or "adversarial growth" or "meaning-making" or spirituality or strength or priorities or "changed priorities" or "altered priorities" or "new priorities" or "life priorities" or "priorities in life" or "different priorities" or "appreciation of life" or self-esteem)
AND
("major life event" or "positive event" or "positive life event" or "negative event" or "negative life event" or marriage or wedding or childbirth or birth or parenthood or confinement or labor or delivery or rape or sexual molestation or "sexual assault" or abuse or death or "end of life" or "dying or bereavement" or accident or "natural disaster" or earthquake or flood or volcanic eruption or tsunami or tornado or hurricane or illness or HIV or cancer or "breast cancer" or stroke or heart attack or war or combat or battle or deployment or "physical attack" or robbery or "physical assault" or attack or "spiritual experience" or "spiritual awakening" or "achieving a long-term goal" or "goal achievement" or graduation or graduating or achievement or "living a dream" or "life dream" or "child leaving home" or "empty nest" or divorce or "martial separation" or unemployment or "being fired" or "being laid off" or reemployment or employment or "being hired" or retirement or "falling in love" or love or "falling into love" or love or "meeting an inspiring person" or "soul mate" or idol)

Table 17

Overview of included studies with missing standard deviations and the corresponding articles from which SDs have been substituted

Articles	**Event**	**Sample**	***N***	**Outcome variable**	**Measure**	***Mean***	***SD***
Fournier & Payne (1994)	Graduation to job transition	Graduates	56	Self-esteem	PCP RG	0.89	-
Sub.: Arnold & Nicholson (1991)	Job entry after graduation	Graduate entrants	94	Self-esteem	PCP RG	0.84*	.24*
Hynes et al. (1992)	Failed IVF attempt	Infertile women	173	Self-esteem	RSES	8.43	-
Sub.: Freeman et al. (1987)	IVF attempt	Infertile women	156	Self-esteem	RSES	9.00	1.60
Lin et al. (2002)	Earthquake	Taiwanese elder	368	Relationships	WHOQOL-BREF	-	-
Sub. : Skevington et al. (2004).	Unspecified	Malaysian sample	320	Relationships	WHOQOL-BREF	12.7	3.3
Logsdon et al. (1998)	Bypass surgery	Clinical	58	Self-esteem	RSES	18.3	-
Sub.: Lee et al. (2006)	Cancer	Clinical	74	Self-esteem	RSES	17.08*	5.47*
Patterson (1997)	Employment Unemployment	Unemployed teenager	80	Self-esteem	RSES	13.39*	-
Sub.: Waters & Moore (2002)	Unemployment	Unemployed	201	Self-esteem	RSES	15.98*	3.18*
Pernice & Long (1996)	Re-employment Unemployment	Unemployed	99	Self-esteem	RSES	38.75	-
Sub.: Dooley & Prause (1995)	Unemployment	Unemployed teenager	5241	Self-esteem	RSES	30.85*	3.85*
Schroevers et al. (2006)	Cancer diagnosis	Clinical	475	Relationships	MMQ	9.66	-
				Self-esteem	RSES	15.65*	-
Sub.: Hagedoorn et al. (2000)	Cancer	Clinical	68	Relationships	MMQ	7.17	0.89
Sub.: Lee et al. (2006)	Cancer	Clinical	74	Self-esteem	RSES	17.08*	5.47*
Samuelson et al. (2012).	Cancer	Clinical	406	Spirituality	FACIT-Sp 12	-	-
Sub.: Manning-Walsh (2005)	Cancer	Clinical	100	Spirituality	FACIT-Sp 12	33.87	8.95

Articles	Event	Sample	N	Outcome variable	Measure	*Mean*	*SD*
Sherman et al. (2005)	Cancer/ AIDS	Clinical	182	Spirituality	SWBS (RWB) SWBS (EWB)	-	-
Sub.: Bello-Haas et al. (2000)	ALS	Clinical	60	Spirituality	SWBS (RWB) SWBS (EWB)	49.1 45.1	9.1 8.1
Sirilla & Overcash (2013)	Stem cell transplantation (cancer)	Clinical	83	Spirituality	FACIT-Sp 12	37.35*	-
Sub.: Manning-Walsh (2005)	Cancer	Clinical	100	Spirituality	FACIT-Sp 12	33.87	8.95
Sirilla & Overcash (2013)	Stem cell transplantation (cancer)	Clinical	83	Spirituality	FACIT-Sp 12	37.35*	-
Sub.: Manning-Walsh (2005)	Cancer	Clinical	100	Spirituality	FACIT-Sp 12	33.87	8.95
Thornton et al. (2011)	Prostatectomy (cancer)	Clinical (male)	71	Self-esteem	PC QoL (SE)	93.00	-
				Relationships	PC QoL (PA) PC QoL (O)	93.97 41.49	-
Sub.: Clark et al. (2003)	Prostate cancer	Clinical (male)	349	Self-esteem	PC QoL (SE)	75.1	21.7
				Relationships	PC QoL (PA)	83.7	23.7
				Strengths	PC QoL (O)	47.4	33.4

Note: Sub. = substitute article with standard deviations; * = means and SDs that are based on more than one sample; MMQ = Maudsley Marital Questionnaire; PC QoL (SE) = Prostate cancer quality of life subscale masculine self-esteem; PC QoL (PA) = Prostate cancer quality of life subscale partner affection; PC QoL (O) = Prostate cancer quality of life subscale outlook (strengths); RSES = Rosenberg Self-esteem Scale; PCP RG = Personal construct psychology repertory grid scale; WHOQOL-BREF = brief version pf the Health Organization's quality of life questionnaire.

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Table 18

Prospective effect sizes for social relationships

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Abbey et al. (1994)	Childbirth	1	Family	Women infertile	SS	12.00	73	-0.52	-0.51
Abbey et al. (1994)	Childbirth	1	Family	Women fertile	SS	12.00	27	0.07	0.07
Abbey et al. (1994)	Childbirth	1	Family	Men infertile	SS	12.00	73	-0.40	-0.40
Abbey et al. (1994)	Childbirth	1	Family	Men fertile	SS	12.00	27	-0.12	-0.12
Andersen et al. (2005)	Cancer recurrence	2	Physical	Recurrent	PSSS	42.00	30	0.19	0.19
Bosse et al. (1993)	Employment	1	Work	Full time employed	SSS	18.00	514	0.20	0.20
Bosse et al. (1993)	Retirement	1	Work	Retired	SSS	18.00	158	0.29	0.29
Bosse et al. (1993)	Employment	1	Work	Part-time employed	SSS	18.00	96	-0.05	-0.05
Caffo et al. (2006)	Interstitial Brachytherapy	3	Physical		Own items	1.00	147	-0.30	-0.30
Caffo et al. (2006)	Interstitial Brachytherapy	3	Physical		Own items	12.00	69	1.35	1.34
Caffo et al. (2006)	Interstitial Brachytherapy	3	Physical		Own items	24.00	65	1.24	1.23
Caffo et al. (2006)	Interstitial Brachytherapy	3	Physical		Own items	36.00	45	1.62	1.59
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	PWBS (SC)	72.00	207	0.16	0.16
Dyrdal et al. (2011)	Childbirth	1	Family		RSS	-2.50	62117	0.07	0.07
Dyrdal et al. (2011)	Childbirth	1	Family		RSS	6.00	50174	-0.07	-0.07
Dyrdal et al. (2011)	Childbirth	1	Family		RSS	36.00	13821	-0.31	-0.31
Frazier et al. (2009)	Negative event	2	Other		PWBS (SC)	1.00	119	-0.01	-0.01
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment	PWBS (SC)	4.00	233	-0.22	-0.22
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment opportunity	PWBS (SC)	8.00	220	-0.11	-0.11
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment opportunity	PWBS (SC)	12.00	223	-0.06	-0.06
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment	PWBS (SC)	4.00	147	-0.09	-0.09

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment opportunity	PWBS (SC)	8.00	148	-0.04	-0.04
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment opportunity	PWBS (SC)	12.00	150	0.09	0.09
Hackel & Ruble (1992)	Childbirth	1	Family	Women	SMAT	4.00	50	-0.24	-0.24
Hackel & Ruble (1992)	Childbirth	1	Family	Men	SMAT	4.00	50	-0.48	-0.48
Keizer et al. (2010)	Childbirth	1	Family	Women with child	Own items	24.50	130	-0.29	-0.28
Keizer et al. (2010)	Childbirth	1	Family	Men with child	Own items	24.50	98	-0.43	-0.43
Kim & Moen (2002)	Retirement	3	Work	Men	Own items	0.03	282	-0.37	-0.37
Kim & Moen (2002)	Retirement	3	Work	Women	Own items	0.03	176	-0.09	-0.09
Kim (1999)	Marriage	1	Family	Cohabitating -> marriage	Own items	42.00	116	0.23	0.22
Kim (1999)	Marriage	1	Family	Never married -> marriage	Own items	42.00	402	0.02	0.02
Kim (1999)	Cohabitation with partner	1	Family	Never cohabitated -> cohabitating	Own items	42.00	134	0.04	0.04
Kim (1999)	Remarriage	1	Family	Seperation -> marriage	Own items	42.00	262	-0.16	-0.16
Kim (1999)	Divorce Separation	2	Family	Marriage -> divorce	Own items	42.00	257	0.40	0.40
Lin et al. (2002)	Earthquake	2	Other	Women	WHOQOL-BREF	11.75	164	0.27	0.27
Lin et al. (2002)	Earthquake	2	Other	Men	WHOQOL-BREF	11.75	204	0.61	0.60
Logsdon et al. (1997)	Preterm baby	3	Family	-	PSQ	0.75	37	-0.23	-0.22
Moraal et al. (2009)	Ilizarov limb lengthening	3	Physical	-	RSES	83.75	17	-0.12	-0.11
Nahum-Shani & Bamberger (2011)	Retirement	1	Work	-	SF	12.00	1000	0.02	0.02
Sawyer et al. (2012)	Childbirth	1	Family	-	MSPSS	2.18	96	-0.04	-0.04

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Schwarzer et al. (2006)	Cancer surgery	2	Physical	-	BSSS	3.00	117	-0.13	-0.13
Schwarzer et al. (2006)	Cancer surgery	2	Physical	-	BSSS	12.00	117	-0.27	-0.26
Tallman et al. (2010)	Cancer treatment	1	Physical	-	MOS	108.00	25	0.79	0.77
Tanyi et al. (2013)	Radiotherapy for cancer	1	Physical	-	FACT-G	1.25	91	-0.49	-0.49
Tanyi et al. (2013)	Radiotherapy for cancer	1	Physical	Radiotherapy for cancer	FACT-G	6.46	91	-0.45	-0.44
Tanyi et al. (2013)	Cancer diagnosis	2	Physical	Cancer diagnosis	FACT-G	5.46	91	-0.49	-0.49
Tanyi et al. (2013)	Cancer diagnosis	2	Physical	-	FACT-G	6.46	91	-0.45	-0.44
Thornton et al. (2011)	Robotic prostatectomy (cancer)	2	Physical	-	PCQoL	3.00	71	-0.12	-0.12
Thornton et al. (2011)	Robotic prostatectomy (cancer)	2	Physical	-	PCQoL	12.00	71	-0.06	-0.06

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 19

Post-hoc effect sizes for social relationships

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Adams & Boscarino (2006)	Terror attack (9/11)	2	Other	-	Own items	24.00	1681	-0.05	-0.05
Aitken et al. (2012)	Traumatic injury	2	Physical	-	IAS	6.00	125	0.18	0.18
Bloom et al. (2004)	Breast cancer	2	Physical	-	SNI	64.50	185	-0.20	-0.20
Bloom et al. (2012)	Breast cancer	2	Physical	-	Own items	120.00	312	0.15	0.15
Chang & MacKenzie (1998)	Stroke	2	Physical	-	SSQ	0.60	115	0.00	0.00
Danhauer et al. (2013)	Breast cancer	2	Physical	-	RAND	15.90	572	-0.17	-0.17
Danhauer et al. (2013)	Breast cancer	2	Physical	-	RAND	15.90	572	-0.17	-0.17

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Danhauer et al. (2013)	Breast cancer	2	Physical	-	RAND	15.90	572	-0.17	-0.17
Friedlander et al. (2007)	Transition to college	1	Work	-	SPPCS	3.50	115	0.04	0.04
Jaffee et al. (2007)	Child maltreatment	2	Family	-	TRF – child behavior	48.00	214	0.25	0.25
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SBS-Agency	48.00	142	-0.03	-0.03
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SBS-Agency	60.00	142	0.24	0.24
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SBS-Agency	72.00	142	0.26	0.26
Mann et al. (1999)	Arthritis	2	Physical	-	OARS	310.80	61	0.18	0.18
Manne et al. (2004)	Breast cancer diagnosis	2	Physical	-	DAS	13.50	141	0.00	0.00
Manne et al. (2004)	Breast cancer diagnosis	2	Physical	-	DAS	22.50	120	-0.11	-0.11
Manne et al. (2004)	Partner of breast cancer victim	2	Family	-	DAS	13.50	135	0.04	0.04
Manne et al. (2004)	Partner of breast cancer victim	2	Family	-	DAS	22.50	115	-0.05	-0.05
Riegel & Gocka (1995)	Heart attack	2	Physical	Women	FACT-G	4.00	32	-0.33	-0.33
Riegel & Gocka (1995)	Heart attack	2	Physical	Men	UCLA-SSI	4.00	32	-0.42	-0.41
Schroevers et al. (2006)	Cancer diagnosis	2	Physical	Patients	MMQ	15.00	403	0.73	0.73
Schroevers et al. (2006)	Cancer diagnosis	2	Physical	Patients	MMQ	96.00	206	2.87	2.85
Teoh et al. (2009)	First-ever stroke	2	Physical		AQoL	16.50	115	0.13	0.13
Teoh et al. (2009)	First-ever stroke	2	Physical		AQoL	21.00	119	0.16	0.16
Tremblay & Pierce (2011)	Childbirth	1	Family	Fathers	DAS-4	5.00	160	-0.03	-0.03

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Tremblay & Pierce (2011)	Childbirth	1	Family	Fathers	DAS-4	18.00	160	-0.23	-0.23
Wang et al. (2000)	Earthquake	2	Other	10 km from epicenter	WHOQOL-BREF	9.00	101	-0.29	-0.29
Wang et al. (2000)	Earthquake	2	Other	10 km from epicenter	WHOQOL-BREF	9.00	162	-0.19	-0.19
Westin et al. (1999)	Ischemic heart disease	2	Physical	Women	Own items	13.00	82	-0.25	-0.25
Westin et al. (1999)	Ischemic heart disease	2	Physical	Men	Own items	13.00	267	-0.21	-0.21

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 20
Prospective effect sizes for meaning in life

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Floyd et al. (2013)	Death of adult child	2	Family	Bereaved	PWBS/purpose	72.00	175	-0.05	-0.05
Floyd et .al. (2013)	Death of adult child	2	Family	Controls	PWBS/ purpose	72.00	175	0.01	0.01
Frazier et al. (2009)	Negative event	2	Other	-	MLQ (presence)	1.00	119	0.03	0.03
Frazier et al. (2009)	Negative event	2	Other	-	MLQ (presence)	1.00	119	0.25	0.25
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment opport.	PWBS (purpose)	4.00	233	-0.17	-0.17
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment opport.	PWBS (purpose)	8.00	220	-0.16	-0.16
Haase et al. (2012)	Transition from university to Work	1	Work	Favourable employment opport.	PWBS (purpose)	12.00	223	-0.13	-0.13
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment opport.	PWBS (purpose)	4.00	147	0.01	0.01

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment opport.	PWBS (purpose)	8.00	148	0.01	0.01
Haase et al. (2012)	Transition from university to Work	1	Work	Unfavourable employment opport.	PWBS (purpose)	12.00	150	0.01	0.01
Lowe et al. (2013)	Hurricane Katrina	2	Other	-	SSM	0.00	334	-0.64	-0.64
Oh et al. (2004)	Cancer recurrence	2	Physical	-	new items	23.50	54	0.13	0.13
Oh et al. (2004)	Breast cancer	2	Physical	-	new items	84.00	53	0.00	0.00
Pinquart & Fröhlich (2009)	Chemotherapy	3	Physical	-	PIL	8.50	163	-0.10	-0.10
Ransom (2006)	Radiotherapy	3	Physical	-	PMP	1.00	88	-0.02	-0.02
Samuelson et al. (2012)	Cancer treatment	3	Physical	-	FACIT-SP (meaning)	1.50	406	0.03	0.03

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 21
Post-hoc effect sizes for meaning in life

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Adams et al. (2014)	Caregiving for cancer patient	2	Family	-	FACIT-SP (meaning)	4.00	70	0.06	0.06
Avis et al. (2013)	Breast cancer diagnosis	2	Physical	-	FACIT-SP (meaning)	16.50	592	0.00	0.00
Avis et al. (2013)	Breast cancer diagnosis	2	Physical	-	FACIT-SP (meaning)	22.50	563	0.00	0.00
Avis et al. (2013)	Breast cancer diagnosis	2	Physical	-	FACIT-SP (meaning)	10.50	612	-0.03	-0.03
Avis et al. (2013)	Transition to college	3	Work	-	WHOQOL-100	6.00	213	-0.03	-0.03
Cotton et al. (2006)	HIV	2	Physical	-	FACIT-SP	115.80	347	0.05	0.05
Danhauer et al. (2013)	Cancer	2	Physical	-	FACIT-SP	1.38	40	0.08	0.08
Danhauer et al. (2013)	Cancer	2	Physical	-	FACIT-SP	2.75	37	0.02	0.02
Danhaueret al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	22.09	562	0.00	0.00
Danhaueret al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	22.09	562	0.05	0.05

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Danhaueret al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	22.09	562	0.04	0.04
Hsiao et al. (2013)	Breast cancer treatment	2	Physical	-	MLQ (presence)	59.60	76	0.17	0.17
Hsiao et al. (2013)	Breast cancer treatment	2	Physical	-	MLQ (presence)	62.60	76	0.11	0.11
Hsiao et al. (2013)	Breast cancer treatment	2	Physical	-	MLQ (presence)	65.60	76	0.23	0.23
Hsiao et al. (2013)	Breast cancer treatment	2	Physical	-	MLQ (presence)	71.60	76	0.39	0.39
Larson et al. (2008)	Spouse of a stroke Victim	2	Family	Male	SOC	8.50	20	0.19	0.18
Larson et al. (2008)	Spouse of a stroke victim	2	Family	Male	SOC	14.50	20	0.11	0.10
Larson et al. (2008)	Spouse of a stroke victim	2	Family	Female	SOC	8.50	80	-0.08	-0.08
Larson et al. (2008)	Spouse of a stroke victim	2	Family	Female	SOC	14.50	80	0.26	0.26
Lyon et al. (2011)	HIV diagnosis	2	Physical	-	FACIT- SP (meaning)	3.00	18	0.30	0.29
Park et al. (2008)	Cancer	2	Physical	-	PPMS	35.40	172	-0.02	-0.02
Sacco et al. (2014)	Heart Failure	2	Physical	-	PPMS	81.00	103	0.00	0.00
Scheffold et al. (2013)	Cancer diagnosis	2	Physical	-	PMI	56.03	183	0.21	0.21
Updegraff et al. (2008)	Terror attack (9/11)	2	Physical	-	new items	12.00	741	0.02	0.02
Yanez et al. (2009)	Cancer	2	Physical	Survivors	FACIT-SP (meaning)	54.00	165	0.09	0.09

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 22
Prospective effect sizes for spirituality

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Chan & Rhodes (2013)	Hurricane	2	Other	-	Own items	12.00	386	0.00	0.00
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	RIS	72.00	207	0.25	0.25
Folkman (1997)	Death of partner	2	Family	-	RSB	-3.00	119	0.15	0.15
Folkman (1997)	Death of partner	2	Family	-	RSB	-1.00	147	0.12	0.12
Folkman (1997)	Death of partner	2	Family	-	RSB	0.50	160	0.32	0.32
Folkman (1997)	Death of partner	2	Family	-	RSB	1.00	157	0.27	0.27
Folkman (1997)	Death of partner	2	Family	-	RSB	3.00	146	0.25	0.25
Folkman (1997)	Death of partner	2	Family	-	RSB	5.00	138	0.09	0.09
Folkman (1997)	Death of partner	2	Family	-	RSB	7.00	130	0.25	0.25
Gall et al. (2009)	Cancer diagnosis	2	Physical	Breast cancer diagnosis	RCOPE	0.25	87	0.39	0.38
Gall et al. (2009)	Cancer diagnosis	2	Physical	Breast cancer diagnosis	RCOPE	1.00	87	0.33	0.33
Gall et al. (2009)	Cancer diagnosis	2	Physical	Breast cancer diagnosis	RCOPE	6.00	87	0.33	0.33
Gall et al. (2009)	Cancer diagnosis	2	Physical	Breast cancer diagnosis	RCOPE	12.00	87	0.26	0.25
Gall et al. (2009)	Cancer diagnosis	2	Physical	Breast cancer diagnosis	RCOPE	24.00	87	0.30	0.29
Kim et al. (2012)	Cancer remission	3	Family	Partner	FACIT-SP	18.00	820	-0.16	-0.16
Kisch et al. (2012)	Stem cell transplantation	2	Physical	-	FACIT-SP	3.00	57	-0.26	-0.25
Kisch et al. (2012)	Stem cell transplantation	2	Physical	-	FACIT-SP	3.00	40	0.11	0.11
Samuelson et al. (2012)	Cancer treatment	3	Physical	-	FACIT-SP (faith)	1.50	406	0.05	0.05
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Autologous	FACIT-SP	1.00	57	0.00	0.00
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Autologous	FACIT-SP	3.00	41	0.07	0.07

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Autologous	FACIT-SP	6.00	37	0.03	0.03
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Allogenic	FACIT-SP	1.00	54	-0.08	-0.08
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Allogenic	FACIT-SP	3.00	46	-0.08	-0.08
Sirilla & Overcash (2013)	Stem cell transplantation	2	Physical	Allogenic	FACIT-SP	6.00	37	-0.11	-0.11

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 23
Post-hoc effect sizes for spirituality

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Adams et al. (2014)	Caregiving for cancer patient	2	Family	-	FACIT-SP (peace)	4.00	70	0.31	0.31
Avis et al. (2013)	Breast cancer diagnosis	2	Physical	-	FACIT-SP (peace)	16.50	592	0.07	0.07
Avis et al. (2013)	Breast cancer diagnosis	2	Physical	-	FACIT-SP (peace)	22.50	563	0.08	0.08
Avis et al. (2013)	Breast camcer diagnosis	2	Physical	-	FACIT-SP (peace)	10.50	612	0.02	0.02
Bowman et al. (2009)	Cancer	2	Physical	-	CDQ	4.50	52	0.02	0.02
Cotton et al. (2006)	HIV	2	Physical	-	FACIT-SP	115.80	347	0.02	0.02
Danhauer et al. (2013)	Cancer	2	Physical	-	FACIT-SP	1.38	40	0.07	0.06
Danhauer et al. (2013)	Cancer	2	Physical	-	FACIT-SP	2.75	37	0.13	0.12
Danhauer et al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	9.91	581	-0.06	-0.06
Danhauer et al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	9.91	581	-0.09	-0.09
Danhauer et al. (2014)	Breast cancer	2	Physical	-	FACIT-SP	9.91	581	-0.09	-0.09
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	3.00	62	0.10	0.10
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	7.00	54	0.01	0.01

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	12.00	51	0.13	0.13
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	18.00	44	0.05	0.05
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	24.00	38	0.09	0.09
Frost et al. (2012)	Cancer surgery	2	Physical	-	FACIT-Sp-Ex	36.00	25	0.28	0.27
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	3.00	19	0.03	0.03
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	7.00	20	-0.13	-0.12
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	12.00	17	-0.16	-0.16
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	18.00	18	-0.18	-0.17
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	24.00	12	-0.69	-0.64
Frost et al. (2012)	Partner of cancer victims	2	Family	-	FACIT-Sp-Ex	36.00	7	-0.68	-0.59
King, Speck, & Thomas (1995)	Hospitalization / severe illness	2	Physical	Gynecological patients	RFI	9.25	71	0.23	0.23
King, Speck, & Thomas (1995)	Hospitalization/ severe illness	2	Physical	Cardilogical patients	RFI	9.25	71	0.29	0.28
Loerzel et al. (2008)	Breast cancer diagnosis	2	Physical	-	QOL-BC	11.24	26	0.25	0.24
Loerzel et al. (2008)	Breast cancer diagnosis	2	Physical	-	QOL-BC	14.24	26	0.03	0.03
Lyon et al. (2011)	HIV diagnosis	2	Physical	-	FACIT-SP	3.00	18	0.57	0.55
Pargament et al. (2004)	Hospitalization/ severe illness	2	Physical	-	RCOPE	21.25	268	0.40	0.40
Rademacher (2005)	Chemotherapy breast cancer	3	Physical	-	FACIT-SP	1.00	43	0.18	0.18
Sacco et al. (2014)	Heart Failure	2	Physical	-	BMMR/S	81.00	103	-0.04	-0.04
Sherman et al. (2005)	Cancer diagnosis	2	Physical	Patient	SWBS	3.25	21	0.90	0.86
Sherman et al. (2005)	Cancer diagnosis partner	2	Physical	Caregiver	SWBS	3.25	16	-0.23	-0.22
Sherman et al. (2005)	HIV diagnosis	2	Physical	Patient	SWBS	3.25	23	-0.15	-0.15
Sherman et al. (2005)	Cancer diagnosis partner	2	Physical	Caregiver	SWBS	3.25	19	0.47	0.45
Wyatt et al. (2013)	Metastasis diagnosis	2	Physical	No distant metastasis	LTQL (spirituality)	25.25	74	0.00	0.00
Wyatt et al. (2013)	Metastasis diagnosis	2	Physical	No distant metastasis	LTQL (spirituality)	26.75	66	-0.11	-0.11

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Wyatt et al. (2013)	Metastasis diagnosis	2	Physical	Distant metastasis	LTQL (spirituality)	25.25	231	0.00	0.00
Wyatt et al. (2013)	Metastasis diagnosis	2	Physical	Distant metastasis	LTQL (spirituality)	26.75	204	0.00	0.00
Yanez et al. (2009)	Having survived cancer	2	Physical	-	FACIT-SP	54.00	165	0.01	0.01

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 24
Prospective effect sizes for personal strengths

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Thornton et al. (2011)	Robotic prostatectomy	2	Physical	-	PC-QoL	3.00	71	0.43	0.42
Thornton et al. (2011)	Robotic prostatectomy	2	Physical	-	PC-QoL	12.00	71	0.42	0.41
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	PWBS	72.00	207	-0.08	-0.08

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 25
Post-hoc effect sizes for personal strengths

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Kim et al. (2011)	Bereavement	2	Family	-	Own items	18.00	101	0.26	0.25
Kim et al. (2011)	Bereavement	2	Family	-	Own items	48.00	101	0.28	0.28
Pratt et al. (1992)	Bereavement	2	Family	-	MBE	6.00	38	0.29	0.28

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 26
Prospective effect sizes for self-acceptance

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	PWBS	72.00	207	-0.08	-0.08

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 27
Post-hoc studies for self-acceptance

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Ceyhan & Ceyhan (2011)	University transition	1	Work	Female	SAI	48.00	139	0.49	0.49
Ceyhan & Ceyhan (2011)	University transition	1	Work	Male	SAI	48.00	59	0.04	0.04

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 28
Prospective effect sizes for environmental mastery

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Abbey et al. (1994)	Childbirth	1	Family	Women infertile	P&S MS	12.00	73	0.67	0.67
Abbey et al. (1994)	Childbirth	1	Family	Women fertile	P&S MS	12.00	27	0.10	0.10
Abbey et al. (1994)	Childbirth	1	Family	Men infertile	P&S MS	12.00	73	0.91	0.90
Abbey et al. (1994)	Childbirth	1	Family	Men fertile	P&S MS	12.00	27	0.05	0.05
Ali & Avison (1997)	Employment transition	1	Work	Married mOthers	P&S MS	9.00	46	0.12	0.12
Ali & Avison (1997)	Employment transition	1	Work	Single mOthers	P&S MS	9.00	43	0.00	0.00
Ali & Avison (1997)	Unemployment transition	2	Work	Married mOthers	P&S MS	9.00	32	0.05	0.04
Ali & Avison (1997)	Unemployment transition	2	Work	Single mOthers	P&S MS	9.00	38	-0.16	-0.15
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	PWBS	72.00	207	0.17	0.17
Doherty & Needle (1991)	Divorce of parents	2	Family	Boys	P&S MS	5.00	24	-0.34	-0.33
Doherty & Needle (1991)	Divorce of parents	2	Family	Girls	P&S MS	5.00	24	0.13	0.13
Kim & Moen (2002)	Retirement	3	Work	Women	P&S MS	0.03	176	-0.64	-0.63
Kim & Moen (2002)	Retirement	3	Work	Men	P&S MS	0.03	282	-0.86	-0.85
Mausbach et al. (2014)	Caregiver places spouse into longterm care	3	Family	-	P&S MS	3.00	44	0.23	0.22
Stiegelis et al. (2003)	Radiotherapy	2	Physical	Patients	P&S MS	2.00	67	-0.02	-0.02

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Stiegelis et al. (2003)	Radiotherapy	2	Physical	Patients	P&S MS	4.00	67	-0.06	-0.06
Wright et al. (2000)	Becoming deinstitutionalized from a closed mental ward	1	Other	-	P&S MS	12.00	77	0.21	0.21
Wright et al. (2000)	Becoming deinstitutionalized from a closed mental ward	1	Other	-	P&S MS	24.00	77	0.16	0.16

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 29.
Post-hoc effect sizes for mastery

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	3.00	58	0.23	0.23
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	8.00	58	0.06	0.06
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	12.00	58	0.17	0.17
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	16.00	58	0.19	0.19
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	20.00	58	0.00	0.00
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	PWBS (mastery)	24.00	58	0.18	0.18

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 30
Prospective effect sizes for growth

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Costanzo et al. (2009)	Cancer	2	Physical	Cancer	PWBS	72.00	207	-0.11	-0.11

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 31
Prospective effect sizes for autonomy

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Haase et al. (2012)	Transition from university to work	1	Work	Favourable Employment	PWBS (autonomy)	4.00	233	-0.33	-0.33
Haase et al. (2012)	Transition from university to work	1	Work	Favourable Employment	PWBS (autonomy)	8.00	220	-0.05	-0.05
Haase et al. (2012)	Transition from university to work	1	Work	Favourable Employment	PWBS (autonomy)	12.00	223	-0.02	-0.02
Haase et al. (2012)	Transition from university to work	1	Work	Unfavourable Employment	PWBS	4.00	147	-0.06	-0.06
Haase et al. (2012)	Transition from university to work	1	Work	Unfavourable Employment	PWBS	8.00	148	0.08	0.08
Haase et al. (2012)	Transition from university to work	1	Work	Unfavourable Employment	PWBS	12.00	150	0.16	0.16

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 32
Post-hoc effect sizes for autonomy

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Aitken et al. (2012)	Accident/traumatic injury	2	Physical	-	IAS (subscale)	6.00	125	0.10	0.10

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 33
Prospective effect sizes for self-esteem

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Ali & Avison (1997)	Employment	1	Work	Married mothers	RSES	9.00	46	-0.14	-0.14
Ali & Avison (1997)	Employment	1	Work	Single mothers	RSES	9.00	43	0.13	0.13
Ali & Avison (1997)	Unemployment	2	Work	Married mothers	RSES	9.00	32	0.05	0.05
Ali & Avison (1997)	Unemployment	2	Work	Single mothers	RSES	9.00	38	0.04	0.04

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Borgen & Amundsen (1996)	Graduation	1	Work	-	RSES	6.00	172	-0.10	-0.10
Borgen & Amundsen (1996)	Graduation	1	Work	-	RSES	16.00	172	-0.06	-0.06
Broers et al. (2000)	Bone marrow transplantation	3	Physical	-	RSES	1.00	89	0.11	0.11
Broers et al. (2000)	Bone marrow transplantation	3	Physical	-	RSES	6.00	59	0.20	0.20
Broers et al. (2000)	Bone marrow transplantation	3	Physical	-	RSES	12.00	55	0.28	0.27
Broers et al. (2000)	Bone marrow transplantation	3	Physical	-	RSES	36.00	32	0.11	0.10
Carr (2004)	Spousal bereavement	2	Family	Male bereaved	RSES	6.00	59	0.11	0.11
Carr (2004)	Spousal bereavement	2	Family	Female bereaved	RSES	6.00	151	0.24	0.24
Creed (1999)	Reemployment	1	Work	Reemployment	RSES	2.00	15	0.20	0.18
Creed (1999)	Unemployment	2	Work	Unemployment	RSES	17.14	88	0.16	0.16
Creed (1999)	Unemployment	2	Work	2nd unempl.	RSES	2.00	35	0.40	0.39
Creed et al. (2003)	Transition to university	1	Work	Ffull-time students	RSES	6.00	29	-0.34	-0.33
Creed et al. (2003)	Transition to university	1	Work	Full-time students + Working part time	RSES	6.00	51	-0.06	-0.06
Creed et al. (2003)	High scool to job transition	1	Work	-	RSES	6.00	36	-0.38	-0.37
Creed et al. (2003)	High scool to unemployment transition	2	Work	-	RSES	6.00	30	-0.40	-0.39
Doherty & Needle (1991)	Divorce of parents	2	Family	Boys	RSES	5.00	24	-0.27	-0.26
Doherty & Needle (1991)	Divorce of parents	2	Family	Girls	RSES	5.00	24	0.27	0.26
Dooley & Prause (1995)	High school to job transition	1	Work	Employed satisfied	RSES	42.00	2033	0.51	0.51
Dooley & Prause (1995)	High school to job transition	2	Work	Employed unsatisfied	RSES	42.00	157	0.46	0.46

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Dooley & Prause (1995)	High school to job transition	2	Work	Unemployed	RSES	42.00	253	0.29	0.29
Durik et al. (2000)	Childbirth	1	Family	Unplanned cesarean	RSES	1.00	56	-0.19	-0.18
Durik et al. (2000)	Childbirth	1	Family	Unplanned cesarean	RSES	4.00	56	-0.02	-0.02
Durik et al. (2000)	Childbirth	1	Family	Planned cesarean	RSES	1.00	37	0.18	0.17
Durik et al. (2000)	Childbirth	1	Family	Planned cesarean	RSES	4.00	37	0.15	0.14
Durik et al. (2000)	Childbirth	1	Family	Vaginal	RSES	1.00	75	0.02	0.02
Durik et al. (2000)	Childbirth	1	Family	Vaginal	RSES	4.00	75	0.13	0.12
Gomes & Speizer (2010)	Childbirth	3	Family	-	RSES	8.00	202	1.97	1.97
Graham et al. (2002)	Childbirth	1	Family	-	RSES	1.55	163	-0.02	-0.02
Hynes et al. (1992)	Failed IVF attempt	2	Physical	-	RSES	0.90	100	-0.29	-0.29
Kim (1999)	Marriage	1	Family	Previously cohabitating	RSES	42.00	116	0.02	0.02
Kim (1999)	Marriage	1	Family	Never married -> marriage	RSES	42.00	402	0.11	0.11
Kim (1999)	Cohabitation with partner	1	Family	Cohabitation with partner	RSES	42.00	134	0.26	0.26
Kim (1999)	Remarriage	1	Family	Remarriage	RSES	42.00	262	0.00	0.00
Kim (1999)	Divorce/Separation	2	Family	Divorce/Separation	RSES	42.00	257	-0.13	-0.12
Klein et al. (1998)	Childbirth	1	Family	Homemakers	RSES	12.00	120	0.04	0.04
Klein et al. (1998)	Childbirth	1	Family	Employed parttime	RSES	12.00	155	0.23	0.23
Klein et al. (1998)	Childbirth	1	Family	Employed fulltime	RSES	12.00	146	0.08	0.08
Kobayashi et al. (2008)	Cancer surgery	3	Physical	Low self-esteem group	RSES	6.00	20	-4.26	-4.09
Kobayashi et al. (2008)	Cancer surgery	3	Physical	High self esteem group	RSES	6.00	38	-0.29	-0.28
Logsdon et al. (1997)	Preterm baby clinic discharge	3	Family	-	RSES	0.75	37	-0.80	-0.78
Major et al. (2000)	First-trimester abortion	3	Family	-	RSES	0.00	423	0.01	0.01
Major et al. (2000)	First-trimester abortion	3	Family	-	RSES	0.00	436	0.03	0.03

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Major et al. (2000)	First-trimester abortion	3	Family	-	RSES	0.00	441	0.12	0.12
Margraf et al. (2013)	Aesthetic surgery	3	Physical	-	RSES	3.00	542	0.28	0.28
Margraf et al. (2013)	Aesthetic surgery	3	Physical	-	RSES	6.00	536	0.28	0.28
Margraf et al. (2013)	Aesthetic surgery	3	Physical	-	RSES	12.00	519	0.30	0.30
Martinez et al. (2012)	Transition to college	3	Work	-	SDQ-II	6.00	213	-0.08	-0.08
Moraal et al. (2009)	Ilizarov limb lengthening	3	Physical	-	RSES	83.75	30	0.03	0.03
Pancer et al. (2000)	Transistion to parenthood	1	Family	Mothers	RSES	6.00	69	0.00	0.00
Pancer et al. (2000)	Transistion to parenthood	1	Family	Fathers	RSES	6.00	69	-0.10	-0.10
Patterson (1997)	Unemployment	1	Work	-	RSES	6.00	32	-0.08	-0.07
Patterson (1997)	Employment	2	Work	-	RSES	6.00	48	-0.10	-0.10
Pernice & Long (1996)	Unemployment	2	Work	-	RSES	41.00	77	-1.00	-0.99
Pernice & Long (1996)	Re-employment	3	Work	-	RSES	6.00	22	10.26	9.89
Pinquart & Fröhlich (2009)	Chemotherapy	3	Physical	-	RSES	8.50	163	-0.20	-0.20
Reitzes et al. (1996)	Retirement	2	Work	Retired	RSES	12.00	295	0.09	0.09
Reitzes et al. (1996)	Employment	2	Work	Employed	RSES	12.00	432	0.18	0.18
Stiegelis et al. (2003)	Radiotherapy	2	Physical	Patients	RSES	2.00	67	0.02	0.02
Stiegelis et al. (2003)	Radiotherapy	2	Physical	Patients	RSES	4.00	67	-0.05	-0.05
Thornton et al. (2011)	Robotic prostatectomy	2	Physical	-	PCQoL	3.00	71	-0.38	-0.37
Thornton et al. (2011)	Undergoing robotic prostatectomy	2	Physical	-	PCQoL	12.00	71	-0.31	-0.30
Waters & Moore (2002)	Re-employment	3	Work	-	ASPP	3.00	30	0.35	0.34
Wright et al. (2000)	Becoming deinstitutionalized from a closed mental ward	1	Other	-	RSES	12.00	77	0.33	0.33

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Wright et al. (2000)	Becoming deinstitutionalized from a closed mental ward	1	Other	-	RSES	24.00	77	0.33	0.33

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 34
Post-hoc effect sizes for self-esteem

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Adams & Boscarino (2006)	World Trade Center disaster	2	Other	-	RSES	24.00	1681	-0.09	-0.09
Bakheit et al. (2004)	Stroke	2	Physical	-	VASES	3.00	40	0.11	0.10
Bakheit et al. (2004)	Stroke	2	Physical	-	VASES	6.00	40	0.22	0.22
Besser & Zeigler-Hill (2014)	Transition to college	1	Work	-	RSES	3.75	217	-0.08	-0.08
Bloom et al. (2004)	Breast cancer	2	Physical	-	RSES	64.50	185	0.07	0.07
Bloom et al. (2004)	Breast cancer	2	Physical	-	RSES	120.00	312	-0.09	-0.09
Carboon et al. (2005)	Cancer	2	Physical	-	WAS	5.51	62	-0.05	-0.05
Chan et al. (2007)	Acute coronary syndrome	2	Physical	State self-esteem	SSES	6.00	145	1.04	1.04
Chang & MacKenzie (1998)	Stroke	2	Physical	-	SSES	0.60	115	0.30	0.30
Chung et al. (2014)	Transition to college	1	Work	-	RSES	6.00	295	-0.40	-0.40
Chung et al. (2014)	Transition to college	1	Work	-	RSES	12.00	295	0.05	0.05
Chung et al. (2014)	Transition to college	1	Work	-	RSES	24.00	295	0.12	0.12
Chung et al. (2014)	Transition to college	1	Work	-	RSES	36.00	295	0.11	0.11
Chung et al. (2014)	Transition to college	1	Work	-	RSES	48.00	295	0.15	0.15
Cooper-Evans (2008)	Acquired brain Injury	2	Physical	-	RSES	122.55	22	-0.08	-0.07
Craig et al. (1994)	Spinal cord injury	2	Physical	Patients	RSES	7.00	31	0.08	0.08
Craig et al. (1994)	Spinal cord injury	2	Physical	Patients	RSES	12.00	31	0.14	0.14

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Craig et al. (1994)	Spinal cord injury	2	Physical	Patients	RSES	24.00	31	0.18	0.17
Feiring et al. (2001)	Sexual child abuse	2	Physical	White	PCS	36.00	48	0.22	0.22
Feiring et al. (2001)	Sexual child abuse	2	Physical	Black	PCS	36.00	57	0.26	0.26
Feiring et al. (2001)	Sexual child abuse	2	Physical	Hispanic	PCS	36.00	25	0.01	0.01
Fournier & Payne (1994)	College to job transition	1	Work	-	Repertory grid	6.00	56	-0.29	-0.29
Friedlander et al. (2007)	Transition to college	1	Work	-	SPPCS	3.50	115	-0.08	-0.08
Healy et al. (1990)	Divorce	2	Family	-	PCS	16.50	121	0.17	0.17
Houssemand & Meyers (2011)	Unemployment	2	Work	Unemployment	RSES	6.00	37	0.02	0.02
Houssemand & Meyers (2011)	Unemployment	2	Work	Unemployment	RSES	12.00	37	-0.03	-0.03
Houssemand & Meyers (2011)	Unemployment	2	Work	First-time unemployment	RSES	6.00	95	-0.14	-0.14
Houssemand & Meyers (2011)	Unemployment	2	Work	First-time unemployment	RSES	12.00	95	0.02	0.02
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SEI	48.00	142	0.20	0.20
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SEI	60.00	142	0.27	0.27
Kim & Cicchetti (2006)	Child maltreatment	2	Family	-	SEI	72.00	142	0.33	0.33
King & Patterson (2000)	Birth of child with Down syndrome	3	Family	-	RSES	104.40	42	-0.06	-0.06
Lee et al. (2006)	Cancer diagnosis	2	Physical	-	RSES	4.41	39	0.13	0.12
Logsdon et al. (1998)	Coronary artery bypass	2	Physical	-	RSES	1.25	58	0.11	0.11
Logsdon et al. (1998)	Coronary artery bypass	2	Physical	-	RSES	3.00	58	0.02	0.02
Mann et al. (1999)	Arthritis	2	Physical	-	RSES	310.80	61	0.02	0.02
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	3.00	58	0.06	0.06

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	8.00	58	-0.10	-0.10
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	12.00	58	-0.03	-0.03
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	16.00	58	-0.07	-0.07
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	20.00	58	-0.19	-0.19
Montpetit et al. (2010)	Conjugal bereavement	2	Family	-	RSES	24.00	58	-0.03	-0.03
Murphy et al. (2002)	Parental bereavement	2	Family	-	RSES	12.00	173	0.09	0.09
Murphy et al. (2002)	Parental bereavement	2	Family	-	RSES	60.00	173	0.09	0.09
Nir & Neumann (1990)	Heart attack	2	Physical	-	RSES	1.50	50	-0.05	-0.05
Nir & Neumann (1990)	Heart attack	2	Physical	-	RSES	3.00	43	-0.43	-0.42
Riegel & Gocka (1995)	Heart attack	2	Physical	Women	SPI	4.00	32	-0.15	-0.14
Riegel & Gocka (1995)	Heart attack	2	Physical	Men	SPI	4.00	32	-0.36	-0.35
Schroevers et al. (2006)	Cancer diagnosis	2	Physical	Patients	RSES	15.00	403	-0.02	-0.02
Schroevers et al. (2006)	Cancer diagnosis	2	Physical	Patients	RSES	96.00	206	-0.03	-0.03
Shim et al. (2012)	Transition to college	1	Work	-	RSES	3.50	242	-0.23	-0.23
Shim et al. (2012)	Transition to college/university	1	Work	-	RSES	7.00	200	-0.20	-0.20
Storksen et al. (2005)	Divorce of parents	2	Family	Girls	RSES	84.29	233	0.05	0.05
Storksen et al. (2005)	Divorce of parents	2	Family	Boys	RSES	84.29	180	0.17	0.17
Teoh et al. (2009)	First-ever stroke	2	Physical	-	RSES	16.50	115	-0.09	-0.09
Teoh et al. (2009)	First-ever stroke	2	Physical	-	RSES	21.00	119	0.13	0.13
Thomas & Lincoln (2008)	Stroke	2	Physical	-	VASES	6.00	92	0.12	0.12

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.06	120	0.33	0.33
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.07	100	0.28	0.28
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.08	63	0.31	0.31
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.09	29	0.32	0.31
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.10	15	0.27	0.25
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.11	6	1.05	0.88
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.12	4	0.97	0.71
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.13	2	0.83	0.00
Vickery et al. (2009)	Stroke	2	Physical	-	SSES	1.14	120	0.55	0.54
Westin et al. (1999)	Ischemic Heart Disease	2	Physical	Women	Own items	13.00	82	-0.84	-0.83
Westin et al. (1999)	Ischemic Heart Disease	2	Physical	Men	Own items	13.00	267	-0.26	-0.26

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 35
Prospective effect sizes for psychological well-being

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Kubicek et al. (2011)	Retirement	1	Work	-	PWBS	60.00	1728	-0.09	-0.09
Yeung (2013)	Retirement	3	Work	-	PWBS	6.00	90	0.00	0.00

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 36
Post-hoc effect sizes for psychological well-being

Publication	Event	Valence	Category	Group	Scale	Months	*N*	*g*	*d*
Forsberg-Wärleby et al. (2004)	Spouses of stroke victims	2	Family	-	PGWB	4.00	66	0.92	0.90
Forsberg-Wärleby et al. (2004)	Spouses of stroke victims	2	Family	-	PGWB	12.00	66	1.02	1.01

Note. *N* = number of participants; *g* = standardized mean change; *d* = bias-corrected standardized mean change. Abbreviations for the scales are listed below.

Table 37
Abbreviations for the most common scales used in the meta-analysis.

Abbreviation	Name of Scale	Reference
AQoL	Assessment of Quality of Life	Hawthorne, Richardson, & Osborne (1999)
ASPP	Adult Self-Perception Profile	Messer & Harter (1986)
BMMR/S	Brief Multidimensional Measure of Religiosity and Spirituality	Fetzer Institute and National Institute on Aging (1999)
BSSS	Berlin Social Support Scales	Schulz & Schwarzer (2003)
CDQ	Cancer and Deity Questionnaire	Bowman, Beitman, Palesh, Perez, & Koopman (2009)
DAS	Dyadic Adjustment Scale	Spanier (1976)
DAS – 4	Dyadic Adjustment Scale – 4 item version	Sabourin et al. (2005)
FACIT-SP	The Functional Assessment of Chronic Illness Therapy- Spiritual Well-being Scale	Peterman, Fitchett, Brady, Hernandez, & Cella (2002)
FACT-G	Functional Assessment of Cancer Therapy-General Questionnaire	Cella et al. (1993)
FACIT-SP-EX	Functional Assessment of Chronic Illness Therapy–Spiritual Well-Being Scale	Brady et al. (1999)
IAS	Information, Autonomy and Support Scale	Somerset, Peters, Sharp, & Campbell (2003)
LTQL – SP	Long-Term Quality of Life - Spirituality Subscale	Wyatt & Friedman-Donze (2003)
MLQ	Meaning in Life Questionnaire	Steger, Frazier, Oishi, & Kaler (2006)
MMQ	Maudsley Marital Questionnaire	Arrindell, Boelens, & Lambert (1983)
MOS	The Medical Outcomes Study Social Support Survey	Sherbourne & Stewart (1991)
MSPSS	Multidimensional Scale of Perceived Social Support	Zimet, Dahlem, Zimet, & Farley (1988)
OARS	Older Americans Resources and Services	Fillenbaum & Smyer (1981)
P&S MS	Perlin & Schooler Mastery Scale	Perlin & Schooler (1978)
PCQoL	The Prostate Cancer-Related Quality of Life Scales	Clark, Bokhour, Inui, Silliman, & Talcott (2003)
PCS	Perceived Competence Scale	Harter (1982)
PGWB	Psychological General Well-Being Index	Dupuy (1984)
PIL	Purpose in Life Test	Crumbaugh & Maholick (1964)
PMI	Personal Meaning Index (PMI)	Vehling et al. (2012)
PMP	Personal Meaning Profile	Wong (1998)

Abbreviation	Name of Scale	Reference
PPMS	Perceived Personal Meaning Scale	Wong (1998)
PSQ	Postpartum Support Questionnaire	Logsdon et al. (1996)
PS-QOL	State-specific quality of life	Clark, Bokhour, Inui, Silliman, & Talcott (2003)
PSSS	Perceived Social Support Scale	Procidano & Heller (1983)
PWBS	Psychological Well-being Scale	Ryff (1989)
QOL-BC	Quality of Life-Breast Cancer	Ferrell et al. (1997)
RAND	RAND Social Support Scale	Sherbourne & Stewart (1991)
RCOPE	Religiouse Coping Measure	Pargament, Koenig, & Perez (2000)
RFI	Royal free interview for Religiouse and Spiritial Beliefs	King et al. (1995)
RIS	Religious Identification Scale	Garfield, Ryff, & Singer (2001)
RSB	Religious/ Spiritual Beliefs	Folkman et al. (1992)
RSES	Rosenberg Self-Esteem Scale	Rosenberg (1965)
RSS	Relationships Satisfaction Scale	Røysamb et al. (2010)
SAI	Self-Acceptance Inventory	Ceyhan & Ceyhan (2011)
SBS-Agency	Social Behavior Scale - Agency	Sroufe (1983)
SCL-90	Symptom Checklist-90	Derogatis (1977)
SDQ-II	Self-Description Questionnaire II	Marsh (1990)
SEI	The Self Esteem Inventory	Coopersmith (1981)
SF	Streeter & Franklin Scale (1992)	Streeter & Franklin (1992)
SF-36	Short Form Health Survey (SF-36)	Ware & Sherbourne (1992)
SMAT	Locke & Wallis Short Marital Adjustment Test	Locke & Wallis (1959)
SMD	Semantic Differential	Osgood, Suci, & Tannenbaum (1957)
SNI	Social Network Index	Berkman (1977)
SOC	Sense of Coherence Scale	Antonovsky (1993)
SPI	Self-Perception Inventory	Soares & Soares (1985)
SPPCS	Self-Perception Profile for College Students	Neemann & Harter (1986)
SS	Spousal Support	Abbey & Andrews (1985)
SSES	State Self-Esteem Scale	Heatherton & Polivy (1991)
SSM	Sense of Self Measure	Brock & Richburg-Hayes (2006)
SSQ	Social Support Questionnaire Short Form	Sarason, Sarason, Shearin, & Pierce (1987)
SSS	Social Support Scale	Zuckerman et al. (1984)

Abbreviation	Name of Scale	Reference
SWBS	Spiritual Well-being Scale	Paloutzian & Ellison (1982)
TRF	Teacher Report Form	Achenbach (1991)
UCLA-SSI	UCLA Social Support Inventory	Dunkel-Schetter, Feinstein, & Call (1986)
VASES	Visual Analogue Self-Esteem Scale	Brumfitt & Sheeran (1999)
WAS	World Assumptions Scale	Janoff-Bulman (1989)
WHOQOL-100	World Health Organization's Quality Of Life Questionnaire	WHOQOL Group (1998)
WHOQOL-BREF	World Health Organization's Quality Of Life Questionnaire	WHOQOL Group (1998)

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9.1.2 Figures not included in the meta-analysis

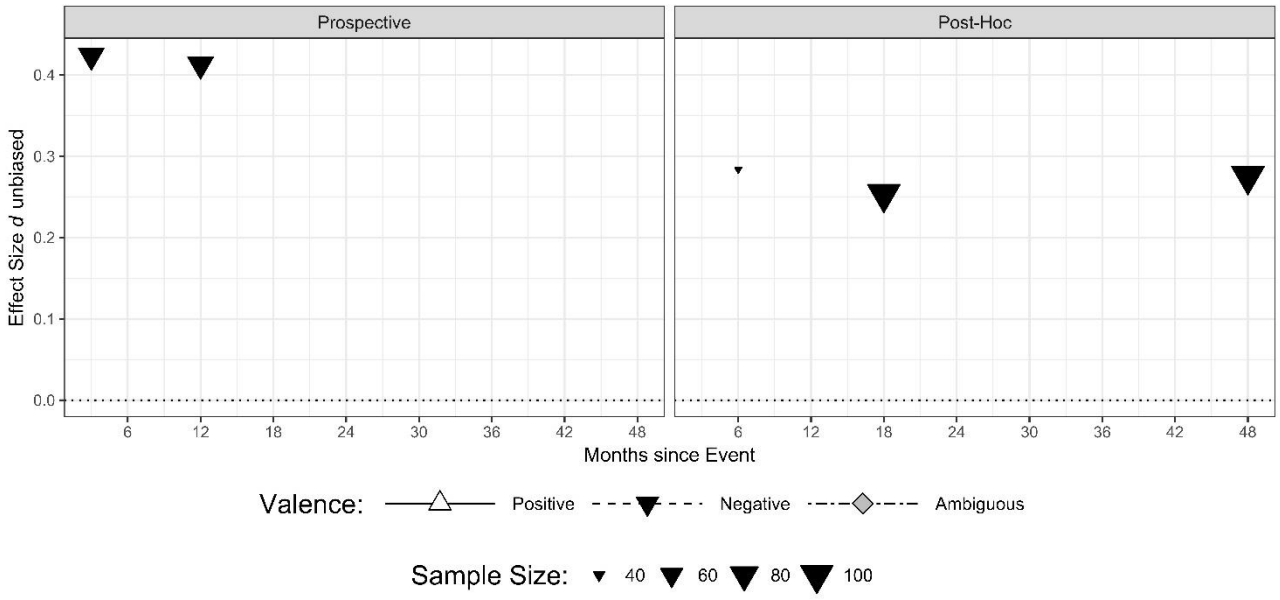

Figure 17. Effect sizes of personal strengths.

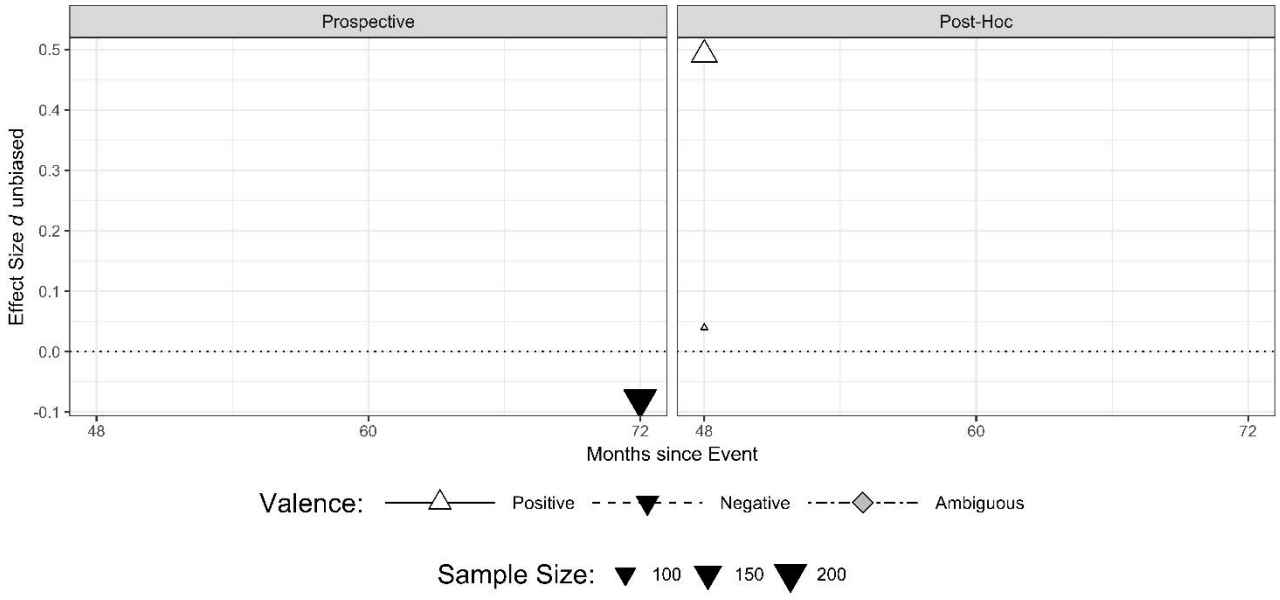

Figure 18. Effect sizes of self-acceptance.

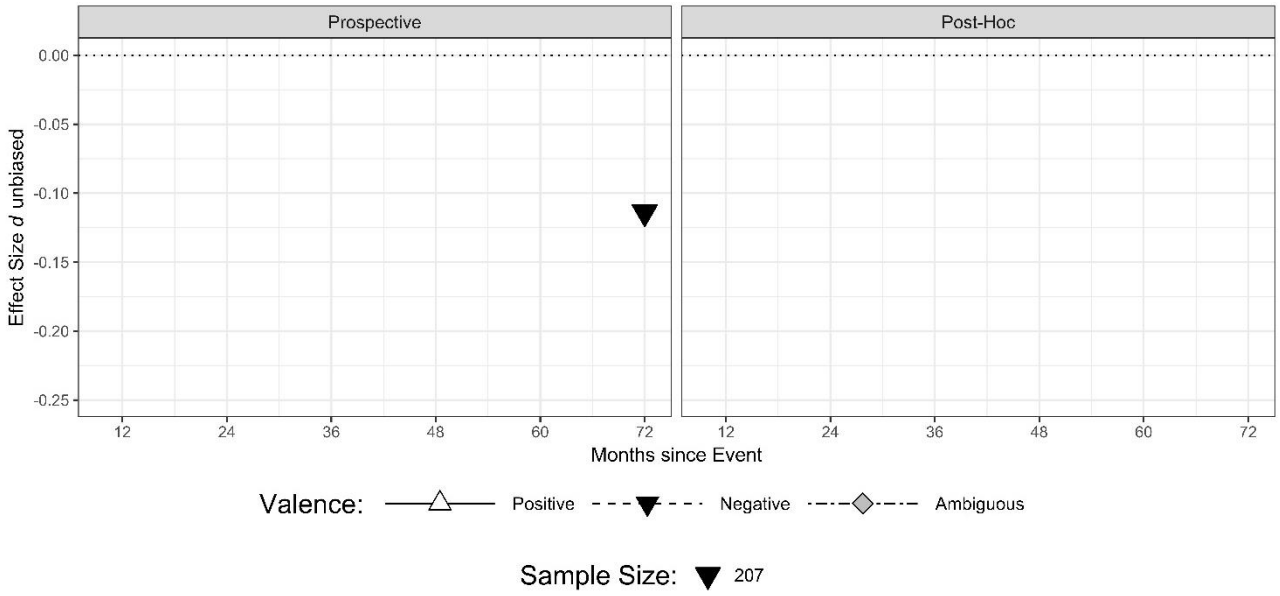

Figure 19. Effect sizes of personal growth.

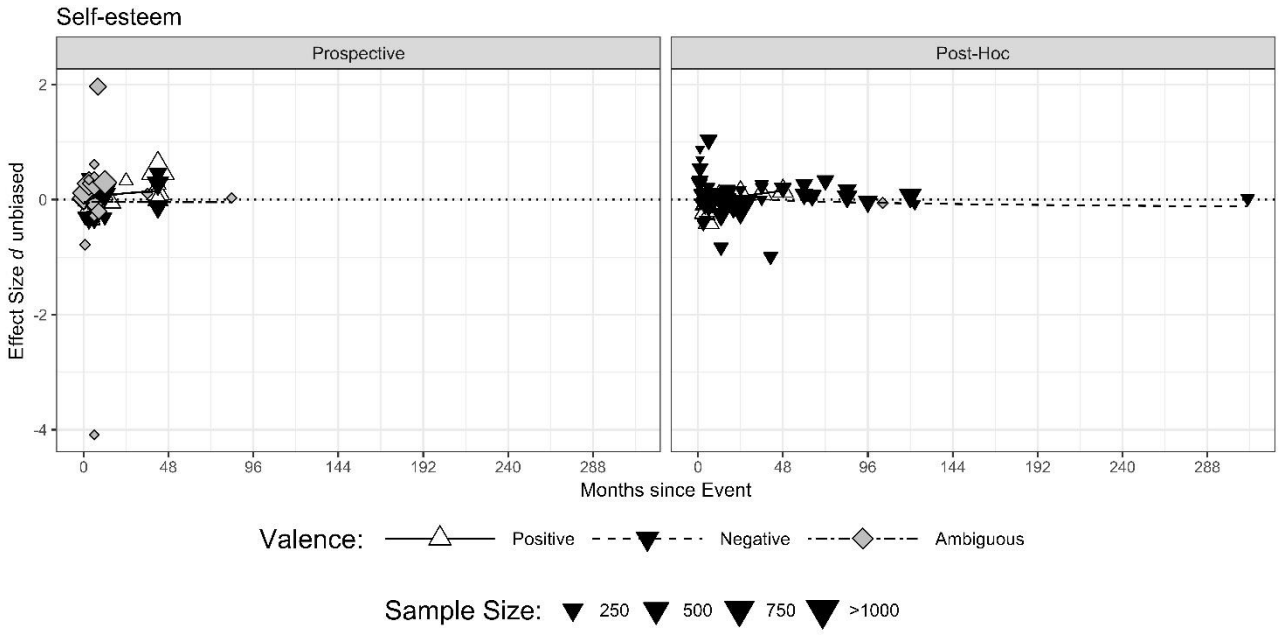

Figure 20. Effect sizes of self-esteem.

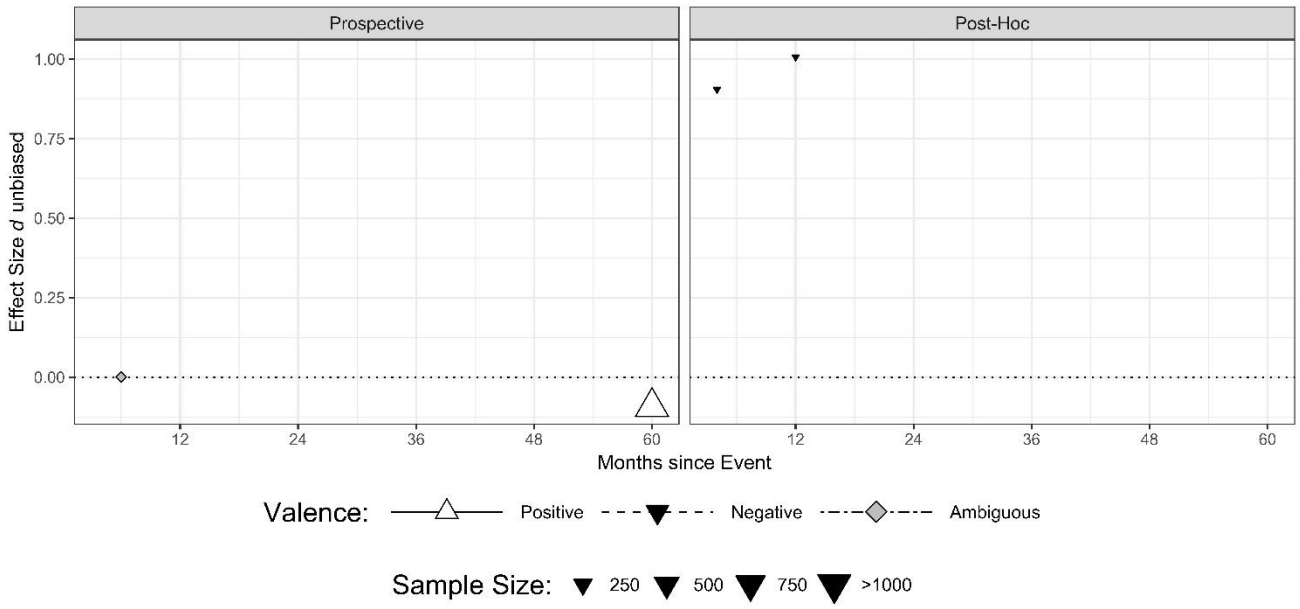

Figure 21. Effect sizes of psychological well-being.

Curriculum Vitae

For reasons of data protection, the curriculum vitae is not included in the online version.

9.3 Eigenständigkeitserklärung

Hiermit versichere ich, dass ich die vorliegende Dissertation selbstständig verfasst habe. Ich habe keine anderen als die aufgeführten Hilfsmittel verwendet. Die Arbeit wurde zu keinem anderen Zeitpunkt zu einem Promotionsverfahren angenommen oder abgelehnt.

Berlin, den 01.10.2017

Judith Mangelsdorf