The Perception of Major Life Events:
Understanding Changes in Personality Traits, Depression, and Subjective Well-Being

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Acknowledgements (in German Language)

General Abstract

Major life events such as the death of a loved one or a relationship breakup can lead to changes in people's subjective well-being, mental health, and personality traits. However, the effects of major life events differ among individuals (i.e., not everyone changes in the same way after experiencing a major life event). Currently, the understanding of these individual differences is limited by the fact that most studies employed rather simple assessments of major life events such as life event checklists. These measures capture whether a major life event occurred or not, but they do not provide a detailed understanding of people's subjective experience of an event. To overcome this limitation, different authors suggested to examine how people perceive major life events on different dimensions (called perceived event characteristics).

The present dissertation employed a recently by Luhmann et al. (2021) proposed taxonomy of nine perceived event characteristics to address two overall research questions: (1) Can perceived event characteristics explain individual differences in personality trait changes and depression following major life events? (2) Does the perception of major life events change over time? If so, are such changes in the event perception related to changes in subjective well-being?

Study 1 examined the associations between the perception of major life events and personality trait changes in a longitudinal online study assessing young adults' personality traits at five measurement occasions spread over 1 year ($N = 433$). In this study, some small associations between perceived event characteristics and personality trait changes were found. Building on these findings, Study 2 examined personality trait changes in participants who had recently experienced a negative life event such as the death of a loved one or a relationship breakup ($N = 1,069$). Beyond perceived event characteristics, other event-related, personal, and environmental moderators were examined to explain individual differences in personality trait changes. However, in the main analyses of this study no significant effects were found suggesting that these moderators are either not relevant to explain personality trait changes or that their effects are (very) small. Study 3 was a scoping review on the association between the perception of major life events and depression (276 studies, $N_{total} = 89,600$). This review illustrated several important gaps in the existing literature on this topic. For example, the association between the perception of

major life events and depression has often been examined using student samples and non-validated ad-hoc questionnaires. Nonetheless, the review found convincing evidence for cross-sectional correlations between perceived event characteristics and depression. However, more longitudinal research is needed to examine whether a certain way of perceiving major life events longitudinally predicts the onset of depression. Study 4 shifted the focus from a one-time assessment of perceived event characteristics to the question whether perceived event characteristics are changing over time. This study was based on a sample of young adults who rated their personality traits, their affective well-being, and the perceived characteristics of a recently experienced major life event at five measurement occasions spread over 1 year ($N = 619$). Results suggested a moderate rank-order stability of perceived event characteristics. Furthermore, significant mean-level changes for two perceived event characteristics were found (i.e., events were perceived as more world view changing and as less extraordinary over time). Finally, building on these findings, Study 5 examined the question whether changes in the perception of major life events are associated with changes in subjective well-being. Across two datasets ($N_{Study1} = 619$; $N_{Study2} = 691$), several correlated changes between these constructs were consistently found. For example, perceiving life events as more externally controlled and as more social status threatening was consistently associated with a decrease in people's life satisfaction.

Taken together, the five studies of this dissertation illustrate the relevance of examining how people perceive major life events. Perceived event characteristics may be seen as one piece of a puzzle to better understand the associations between environmental experiences such as major life events and changes in important life outcomes. Furthermore, this dissertation demonstrates the relevance of considering the role of time to examine event-related changes as the perception of a major life event can change over time. Building on these findings, future research should aim for a more comprehensive assessment of environmental experiences, examine individual differences in the reaction to major life events in large-scale studies, and further advance the understanding of the time course of event-related changes (e.g., by using longitudinal studies with short time lags between assessments).

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Introduction

1. Introduction

"You are fired!" ——————— *"I am breaking up with you."* ——————— *"We are married."*

These sentences refer to three common major life events (i.e., clearly timed, personally relevant experiences; Luhmann et al., 2021). Our life is packed with such events – some positive and some negative – and they can be important turning points in our life course (e.g., Hutteman et al., 2014; Lüdtke et al., 2011; Sutin et al., 2010). An extensive amount of research has examined the effects of major life events on various important life outcomes. The occurrence of major life events is, for example, associated with increased mortality, the onset of various diseases such as cardiovascular diseases and mental disorders, changes in personality traits, and changes in people's subjective well-being (e.g., Aldwin et al., 2014; Bleidorn et al., 2018; Cohen et al., 2019; Hammen, 2005; Luhmann et al., 2012).

However, not everybody changes in the same way after experiencing a major life event (Blackie & Jayawickreme, 2022; Bleidorn et al., 2020; Doré & Bolger, 2018; Jayawickreme et al., 2021; Yap et al., 2014). For example, some people quickly recover after experiencing a job loss whereas others suffer for many years (e.g., Mancini et al., 2011). Although existing research consistently pointed to the fact that there are individual differences in the reaction to major life events (e.g., Denissen et al., 2019; Lucas, 2007; Yap et al., 2014), the understanding of these individual differences is limited (Bleidorn et al., 2020; Jayawickreme et al., 2021). This limitation may be explained by the fact that most studies used rather simple assessments of major life events such as life event checklists which allowed only limited insight into people's subjective experience of an event (i.e., their event perception).

As people differ in how they perceive major life events, considering people's event perception may be important to better understand individual differences in the reaction to major life events (Bleidorn et al., 2020; Jayawickreme et al., 2021; Kritzler et al., 2022). Luhmann et al. (2021) therefore proposed a dimensional taxonomy of nine perceived event characteristics (e.g., valence, predictability, and challenge) that can be used to investigate whether the perception of major life events is able to explain individual differences in the direction, strength, and duration of the effects of these events.

Building on this dimensional taxonomy of perceived event characteristics, the present dissertation aimed to advance the understanding of major life events and perceived event characteristics by examining two broad research questions:

1) Can perceived event characteristics explain individual differences in personality trait changes and depression following major life events?

2) Does the perception of major life events change over time? If so, are such changes in the event perception related to changes in subjective well-being?

1.1   Definition of Major Life Events

In this dissertation, major life events are defined as "events that are clearly timed, disrupt one's everyday routine, and are perceived as personally significant and memorable by those who experienced them" (Luhmann et al., 2021, p. 634). This definition favors a rather broad conceptualization of major life events as it is not restricted to negative events (also called stressful life events; Cohen et al., 2019) but includes events of any valence. Furthermore, this definition does not only include discrete status transitions (e.g., marriage, divorce, or job loss) but also other clearly timed, personally relevant events[1] (e.g., failing an important exam or winning a sports competition).

Major life events must be distinguished from other environmental experiences such as chronic stressors, daily events, or situations. Chronic stressors (e.g., discrimination or poverty) have to be distinguished from major life events as they are not clearly timed but persist over longer periods (Cohen et al., 2019; Luhmann et al., 2014). Furthermore, daily events (e.g., meeting a friend, having a nice dinner, or being in a traffic jam) do not necessarily disrupt one's everyday routine, and they are only of minor personal relevance (Kanner et al., 1981). Finally, situations (momentary, fleeting circumstances in everyday life) are often not personally meaningful and major life events typically comprise several situations (Luhmann et al., 2021; Rauthmann et al., 2015).

1.2   Methodological Considerations in Research on Major Life Events

Major life events have been examined in various areas of psychology including but not limited to personality psychology (e.g., Denissen et al., 2019; Specht et al., 2011), developmental psychology (e.g., Fox et al., 2010; Morales & Guerra, 2006), and clinical

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[1] In this dissertation, the terms "major life events" and "events" are used interchangeably.

psychology (e.g., Asselmann et al., 2015; Hammen, 2005). Studies addressing the effects of major life events should ideally fulfill several design requirements and they need to decide on the appropriate method to assess major life events.

1.2.1   *Study Design Requirements to Understand the Effects of Major Life Events*

To adequately address the effects of major life events (e.g., whether major life events lead to changes in subjective well-being), several characteristics of the study design are important. First, the effects of major life events should be studied using longitudinal data (e.g., Bleidorn et al., 2018; Luhmann et al., 2014). Ideally, prospective longitudinal studies are conducted that comprise several measurement occasions before and after the occurrence of a major life event. Only in such studies, it is possible to examine both anticipation effects (i.e., changes before the occurrence of an event) and socialization effects (i.e., changes after the occurrence of an event; Denissen et al., 2019; Luhmann et al., 2014). Furthermore, with multiple measurement occasions before and after the occurrence of a major life event, it is possible to model non-linear and discontinuous change trajectories (Luhmann et al., 2014). Second, careful consideration needs to be given to the time lag between measurement occasions as it is decisive for the effects that can be observed (Bleidorn et al., 2018; Luhmann et al., 2014). Measurement occasions should be close to each other during periods in which fast changes are expected. Third, as some major life events are relatively rare, large samples are needed in prospective longitudinal studies to ensure that a sufficient number of participants experiences the events of interest (Bleidorn et al., 2020). Fourth, to disentangle event-related changes and normative, age-related changes in the respective outcomes, statistical procedures such as propensity score matching may be used to create a control group that did not experience the major life event but that is similar to those who did (Luhmann et al., 2014). Such methods to create a control group are useful in research on major life events as people cannot be randomly exposed to major life events such as a divorce or a job loss (e.g., Anusic et al., 2014).

Taken together, research on the effects of major life events is challenging and an ideal study to understand their effects is likely hard to conduct. Thus, cumulative research is needed to understand whether, when, and why major life events lead to changes in other variables (Luhmann et al., 2014; Luhmann & Intelisano, 2018).

1.2.2   *Commonly Used Methods to Assess Major Life Events*

Another important methodological consideration in research on major life events is the assessment method to measure these events. Existing research commonly used life event checklists, indicators of demographic status changes, or (semi)structured interviews to assess major life events (Dohrenwend, 2006; Luhmann et al., 2021). In general, major life events are mostly captured using a typological approach, that is, different types of major life events (e.g., death of a loved one, relationship breakup, or new employment) are distinguished (Dohrenwend, 2006; Luhmann et al., 2021).

With life event checklists such as the *List of Threatening Experiences* (Brugha et al., 1985), participants receive a list of event types and indicate which events they have experienced in a certain time frame (e.g., the last year). Usually, a sum score of experienced events is created to assess the overall amount of participants' life stress (Cohen et al., 2019). Sometimes the experienced events are additionally weighted by using a rating of the subjective event experience (e.g., perceived impact; Sarason et al., 1978). In general, life event checklists are economical measures of people's life stress. However, with life event checklists, researchers have typically focused on the cumulative effects of multiple major life events. These checklists are limited in their utility to better understand the effects of certain experienced events as they provide only little information on single experienced events. Furthermore, participants differ in the way they interpret certain event types of a life event checklist (a problem also referred to as intracategory variability; Dohrenwend, 2006). For example, *breaking a leg* and *having cancer* are quite different events belonging to the event type *serious illness or injury*.

Another method typically used to assess major life events in large-scale panel studies is the examination of demographic status changes (e.g., Asselmann & Specht, 2020; Denissen et al., 2019). If participants' marital status changes from *single* to *married* in a longitudinal study, then it is inferred that participants experienced the major life event *marriage*. This examination of demographic status changes assesses major life events economically and allows researchers to focus on the effects of single major life events. However, this method is limited to major life events comprising discrete status transitions. Other personally relevant experiences such as a miscarriage or friendship dissolutions cannot be assessed. Furthermore, this method focuses exclusively on the question whether a major life event

occurred or not but it does not provide an detailed understanding of how these events were experienced (Luhmann et al., 2021).

Finally, (semi)structured interviews such as the *Life Events and Difficulties Schedule* (Brown & Harris, 1989) have been used to study major life events. With such interviews, participants are asked to provide detailed information about the experienced events (e.g., what happened, how it happened, and why it happened). The collected information is then presented to independent raters who rate the threat or severity of the experienced events. These interview methods allow to gain a detailed understanding of the experienced events (Dohrenwend, 2006; Monroe, 2008). Furthermore, by using independent raters, the threat or severity ratings are supposed to be independent of the participants' conditions such as mood or mental health (Hammen, 2005; Monroe, 2008). However, these interview methods are labor intensive and time consuming (Dohrenwend, 2006). This limitation is at odds with the study design requirement of large samples. Moreover, aggregating all assessed information in one overall severity or threat rating is likely associated with the loss of important information. For example, major life events may not only differ in their severity but also in other important dimensions such as predictability, extraordinariness, or controllability (Luhmann et al., 2021).

In summary, each described method to assess major life events provides a certain perspective on these events and has some advantages and disadvantages. However, it should be noted that most of the existing research on the effects of major life events employed the economical but rather simple occurrence-focused approaches (i.e., life event checklists and indicators of demographic status changes; Dohrenwend, 2006; Luhmann et al., 2021). Building on these methodological considerations, the next section summarizes and integrates the existing state of empirical research on the effects of major life events.

1.3   The Effects of Major Life Events

Major life events are assumed to be relevant for various psychological variables (e.g., Hammen, 2005; Monroe, 2008). This dissertation focuses more specifically on the relevance of major life events for personality traits, depression, and subjective well-being.

1.3.1   *Major Life Events and Personality Traits*

Personality traits are enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another (Allport, 1961). The Big Five personality traits

(agreeableness, conscientiousness, extraversion, neuroticism, and openness) are a commonly used trait taxonomy to describe such stable interindividual differences (Goldberg, 1990; McCrae & Costa, 2008). Agreeableness is defined as the tendency to be compassionate, warm, and forgiving. Conscientiousness is defined as the tendency to be organized, thorough, and efficient. Extraversion is the tendency to be sociable, energetic, and outgoing. Neuroticism is defined as the tendency to be moody, shy, and irritable. Finally, openness is the tendency to be curious, imaginative, and unconventional (Costa & McCrae, 1992; Soto & John, 2017).

Although personality traits are supposed to be enduring, there is now compelling evidence that personality traits can change throughout the entire lifespan (Bleidorn et al., 2021; Bleidorn et al., 2022; Roberts et al., 2006; Roberts & DelVecchio, 2000). For example, as summarized in the recent meta-analysis of Bleidorn et al. (2022), conscientiousness increases during young adulthood, peaks around age 40 to 50, and then decreases throughout the remainder of the lifespan. As personality traits and changes in these traits are relevant for various important life outcomes (e.g., job satisfaction or mental health problems; Bleidorn et al., 2020; Hoff et al., 2021; Hopwood et al., 2012; Soto, 2019), theories and empirical research addressed possible sources of personality trait changes.

Theoretical accounts differ in their claims whether major life events can cause personality trait changes (Specht et al., 2014). For example, the Five Factor Theory (McCrae et al., 2000; McCrae & Costa, 1999) assumes that personality traits are basic tendencies that are solely influenced by biological factors. Consequently, personality traits should be essentially independent of environmental influences and only biological factors should cause personality trait changes (i.e., a biologically determined personality maturation). In contrast, the Neo-Socioanalytic Theory (Roberts & Nickel, 2017; Roberts & Wood, 2006) predicts that major life events can cause changes in personality traits if they lead to changes in social roles and investments in these new roles (e.g., being a good parent). Similarly, the Experience-Dependent Set-Point Model (Ormel et al., 2012; Ormel et al., 2017) suggests that personality traits generally fluctuate around a stable, genetically determined baseline (i.e., the set point), but that strong environmental influences such as major life events can lead to lasting personality changes by causing permanent shifts in people's set points.

Empirically, there is initial evidence that major life events can lead to personality trait changes, especially in young adulthood (Bleidorn et al., 2018; Bleidorn & Denissen, 2021). However, effect sizes seem to be small and results are at least partly inconsistent across studies (Bleidorn et al., 2018; Bleidorn et al., 2021). For example, Asselmann and Specht (2020) found that people become less extraverted and less neurotic after experiencing spousal bereavement, whereas Denissen et al. (2019) did not find any personality trait changes in reaction to this major life event. Generally, more longitudinal research on event-related personality trait changes is needed (Bleidorn et al., 2018; Bleidorn et al., 2020). In particular, future research should address the question why people differ in their personality trait changes in context of major life events as existing studies consistently indicated that there are significant individual differences in these changes (Bleidorn et al., 2020; Denissen et al., 2019; Jayawickreme et al., 2021).

1.3.2 *Major Life Events and Depression*

Depression is one of the leading causes for disability since more than 300 million people worldwide suffer from a depressive disorder (James et al., 2018; Moreno-Agostino et al., 2021; World Health Organization, 2017). According to the *International Classification of Diseases* (ICD, current version: ICD-11) and the *Diagnostic and Statistical Manual of Mental Disorders* (DSM, current version: DSM-5), a depressive disorder – a categorical, clinical diagnosis – is characterized by symptoms such as depressed mood, reduced interest or pleasure in activities one previously enjoyed, reduced self-esteem, and feelings of hopelessness (American Psychiatric Association, 2013; World Health Organization, 2019). However, depression has also been conceptualized as a dimensional variable that describes individual differences in the mentioned symptoms (Hankin et al., 2005). For example, questionnaires such as the *Center for Epidemiologic Studies Depression* (Radloff, 1977) can be used to assess depressive symptoms dimensionally in the general population.

Different depression theories converge on the idea that major life events can lead to the onset of depression (e.g., Abramson et al., 1989; Beck & Bredemeier, 2016; Ingram, 1984; Oatley & Bolton, 1985; Slavich & Irwin, 2014). For example, the Hopelessness Theory of Depression (Abramson et al., 1989) predicts that hopelessness is the decisive proximal cause of depression. Hopelessness, in turn, may emerge if major life events are perceived as having negative consequences, having negative self-implications, and as being caused by stable and global factors. Although other theories such as the Social Signal Transduction

Theory (Slavich & Irwin, 2014) or the Social Cognitive Theory of Depression (Oatley & Bolton, 1985) suggest other proximal causes of depression (e.g., disruption of important social roles), they all include major life events as important triggering factors. In particular, negative, stressful life events such as losing a close person are assumed to be relevant for the onset of depression (Abramson et al., 1989; Beck & Bredemeier, 2016).

Empirically, there is robust evidence for an association between depression and major life events (Hammen, 2005). Meta-analytic evidence shows that specific major life events (e.g., job loss or bereavement) and a higher number of experienced stressful events are associated with higher scores of depressive symptoms and the onset of depression (Kraaij et al., 2002; Kristiansen et al., 2019; Liu et al., 2019; Paul & Moser, 2009; Qiu et al., 2020). Furthermore, longitudinal studies and natural experiments support the causal relevance of major life events for predicting increases in depressive symptoms and the onset of a depressive disorder (e.g., Hammen, 2005; Keller et al., 2007; Kendler & Gardner, 2010; Maciejewski et al., 2021). Taken together, major life events seem to be one of the strongest predictors of depression (Cohen et al., 2019). However, at the same time, it is also true that most people do not become depressed after experiencing a major life event (Cohen et al., 2019). Consequently, Hammen (2005) proposed that understanding why some people get depressed after major life events and others do not is one of the most important challenges in depression research.

1.3.3 *Major Life Events and Subjective Well-Being*

Subjective well-being describes the way people experience and evaluate their lives. It comprises three related components: life satisfaction, positive affect, and negative affect (Busseri, 2018; Diener, 1984). Life satisfaction captures people's cognitive evaluation of their lives in general. Positive and negative affect (also referred to as affective well-being) describe the frequency of positive and negative mood and emotions (Busseri, 2018; Diener, 1984; Diener et al., 1999). As most people strive for high subjective well-being (Adler et al., 2017; King & Napa, 1998), the question arises why and when subjective well-being changes (e.g., which factors are associated with a decrease in subjective well-being).

Classical well-being theories such as Adaptation-Level Theory (Helson, 1948, 1964) or Dynamic Equilibrium Theory (Headey & Wearing, 1989) assume that lasting changes in subjective well-being are not possible as people inevitable return to their well-being set

point (a process called *hedonic adaptation*). Consequently, major life events should only cause short-term changes in subjective well-being. However, the view of an immutable subjective well-being set point has changed in the last years (Armenta et al., 2014; Headey, 2010; Luhmann & Intelisano, 2018). More recent theories try to explain both stability and change in people's subjective well-being (Headey, 2010). For example, the Subjective Well-Being Homeostasis Theory (Cummins, 2010, 2014) predicts that subjective well-being (in particular, mood) fluctuates within a narrow range around a set point and that automatic processes keep people's well-being within this set-point range. However, strong environmental stimuli such as major life events can lead to failures in these automatic processes and cause significant and lasting changes in people's subjective well-being.

This theoretical paradigm shift was driven by evidence from longitudinal studies showing that major life events were associated with lasting changes in subjective well-being – at least for some people (Lucas, 2007; Luhmann & Intelisano, 2018; Yap et al., 2014). For example, using data from a large, nationally-representative panel study, Lucas et al. (2004) found that people experienced a drop in their life satisfaction after a job loss and that life satisfaction continuously remained below their pre-event level even when they became re-employed. Similarly, Anusic et al. (2014) showed for different major life events (e.g., marriage or disability) that they were associated with lasting well-being changes even when accounting for normative, age-related changes in subjective well-being. In summary, it is empirically and theoretically acknowledged that major life events can lead to changes in people's subjective well-being. However, similar to research on personality trait changes and depression, there is consistent evidence for significant individual differences in event-related changes in subjective well-being (Lucas, 2007; Yap et al., 2012). Thus, addressing the question why people differ in their event-related changes is seen as one of the most important tasks for future research (Luhmann et al., 2012; Luhmann & Intelisano, 2018; Yap et al., 2012).

1.3.4   The Next Step: Individual Differences in the Reaction to Major Life Events

Taken together, modern theories and empirical evidence converge on the idea that major life events can lead to changes in personality traits, depression, and subjective well-being (e.g., Bleidorn et al., 2020; Hammen, 2005; Luhmann & Intelisano, 2018). Nonetheless, (at least) one important question regarding the effects of major life events remains: Why do people differ in their event-related changes?

Understanding such individual differences in the reaction to major life events is of theoretical and practical relevance. First, existing theoretical accounts differ in their explanation of why people change after experiencing major life events (e.g., Luhmann & Intelisano, 2018; Specht et al., 2014). Empirical research on sources of individual differences in change can be used to test conflicting theoretical predictions (e.g., whether social support after a major life event is relevant for the onset of a depression or not; Abramson et al., 1989). Second, empirical evidence can also foster new theoretical approaches and integration of theoretical accounts. For example, empirical research on changes in subjective well-being caused a paradigm shift in the field so that theories now account for both stability and change in subjective well-being (Headey, 2010; Luhmann & Intelisano, 2018). Similarly, understanding individual differences in change may advance theoretical accounts in terms of making concrete predictions regarding factors explaining the causes, context, and duration of change. Third, understanding why people differ in their reaction to major life events may help to allocate treatment resources and identify people at risk for unwanted changes (e.g., identify who is at risk for a lasting decrease in their subjective well-being).

Some studies already addressed possible factors explaining individual differences in event-related changes in depression (e.g., Spinhoven et al., 2011), subjective well-being (e.g., Yap et al., 2012), and personality traits (e.g., Asselmann & Specht, 2020). These studies found that some environmental variables such as social support and personal variables such as personality traits or demographic characteristics can at least partly explain the observed individual differences in change. However, another possible source of individual differences in the reaction to major life events has often been overlooked: individual differences in the way people perceive major life events (Luhmann et al., 2021). Considering how people perceive major life events may be important to gain a better understanding of people's subjective event experience. For example, for some individuals, a separation may be a very sudden and negative experience, whereas for other individuals, it may be a relief that was long incoming (cf. Kritzler et al., 2022). Thus, examining how people perceive major life events may be important to understand why people differ in their event-related changes in subjective well-being, personality traits, and depression.

1.4   The Perception of Major Life Events

The perception of major life events can be assessed on different dimensions, also called *perceived event characteristics* (i.e., dimensional ratings of the subjective experience of major life events). Beyond providing a better understanding of individual differences in event-related changes, dimensionally assessing how people perceive major life events may also help to overcome some limitations of the above-described approaches to measure major life events (e.g., the problem of intracategory variability of life events checklists; Dohrenwend, 2006; Luhmann et al., 2021). Furthermore, assessing perceived event characteristics across different types of major life events may advance the understanding of similarities and differences across events (Luhmann et al., 2021). For instance, it may help to understand which characteristics of major life events explain why some events are associated with more pronounced changes in subjective well-being than others (Luhmann & Intelisano, 2018).

The proposed advantages of a dimensional perspective on event characteristics are also supported by recent research on situation assessment (Rauthmann et al., 2014). The assessment and understanding of situations were improved by moving from a categorical assessment of situation types to a dimensional assessment of situation perception (Rauthmann et al., 2014; Rauthmann & Sherman, 2020). For example, the *DIAMONDS Taxonomy* (Rauthmann et al., 2014) captures psychologically meaningful characteristics of situations on different continuous dimensions (e.g., duty, sociability, and mating). Similarly, regarding major life events, several approaches exist that assess how people perceive major life events on different dimensions.

1.4.1   Existing Research on the Perception of Major Life Events

The perception of major life events has mostly been examined by administering life event checklists as some of these checklists include ratings of one or few perceived event characteristics. For example, with the *Life Experiences Survey* (Sarason et al., 1978), participants rate the perceived impact of experienced major life events on a bipolar scale ranging from *extremely negative* (−3) to *extremely positive* (+3). However, in most studies using such a checklist approach, these ratings are then combined into one weighted overall score so that the effects of the event occurrence and the perception of major life events are mixed (e.g., Bartelstone & Trull, 1995).

Other measures focus more exclusively on the perception of major life events. For example, the *Appraisal of Life Events Scale* (Ferguson et al., 2000) captures people's perception of an experienced major life event on the dimensions proposed in the Appraisal Theory by Lazarus and Folkman (1984) (i.e., challenge, threat, and loss). Similarly, the *Stress Appraisal Measure* (Peacock & Wong, 1990) can be used to assess how people perceive an event on the dimensions controllability, stressfulness, centrality, challenge, and threat. In addition, several ad-hoc created questionnaires assessing people's event perception have been used (e.g., single items such as "What meaning did this loss have for you?"; Reitz et al., 2022).

The extent of research using these approaches to assess how people perceive major life events varies between different outcomes. Only few studies examined associations between perceived event characteristics and personality trait changes. However, this initial research is promising: Perceived event characteristics seemed to predict personality trait changes above and beyond the occurrence of major life events (Kandler & Ostendorf, 2016; Vries et al., 2021; see Chapter 2 for details).

Similarly, there is initial evidence supporting the relevance of perceived event characteristics for understanding event-related changes in subjective well-being. For example, Prizmić-Larsen et al. (2020) showed that the perceived importance of negative events longitudinally predicts higher levels of negative affect. In addition, Gourounti et al. (2010) found cross-sectional correlations between affective well-being and the perceived event characteristics assessed with the Appraisal of Life Events Scale (but no longitudinal research using this measure was published). In contrast to these findings, Reitz et al. (2022) did not find significant associations between perceived valence of a bereavement (assessed with the ad-hoc created item mentioned above) and changes in life satisfaction.

Finally, regarding the relevance of perceived event characteristics for explaining the onset of depression, more empirical research is available (possibly due to the fact that the perception of major life events is explicitly considered in depression theories; Abramson et al., 1989). This existing evidence is described in detail in Chapter 4 (a scoping review on the association between the perception of major life events and depression). However, to preempt one important conclusion of this review, the association between the perception of major life events and depression has often been examined in cross-sectional studies using non-validated ad-hoc questionnaires.

In summary, there is initial evidence supporting the relevance of the perception of major life events for understanding individual differences in the reaction to these events. However, existing research on the perception of major life events has several limitations. First, many studies relied on non-validated ad-hoc questionnaires (e.g., Reitz et al., 2022; Vries et al., 2021). Thus, cumulative research effort on the perception of major life events is impaired as diverging findings may be attributed to differences in the employed measures and as the psychometric quality of these measures is unknown. Second, validated and non-validated measures typically focus only on one or few perceived event characteristics, and the selection of the considered event characteristics was mostly not backed up with theoretical or empirical reasons (see Luhmann et al., 2021). Thus, these measures do not provide a comprehensive understanding of people's subjective experience of a major life event. For example, studies on the association between the perception of major life events and personality trait changes so far only examined the relevance of perceived valence (Kandler & Ostendorf, 2016; Vries et al., 2021). Third, some measures are limited to certain event types. For example, the Stress Appraisal Measure was developed and validated to capture the perception of stressful life events (Peacock & Wong, 1990). Thus, potentially relevant dimensions for understanding the effects of positive life events may be missing in this measure. Taken together, although assessing the perception of major life event might help to answer pressing questions in research on major life events, a validated measure capturing people's event perception on a range of different dimensions that are relevant across different types of events was missing until recently.

1.4.2 *Development of a Dimensional Taxonomy of Perceived Event Characteristics*

Luhmann et al. (2021) aimed to address this gap in the literature by developing an empirically derived taxonomy of perceived event characteristics. This taxonomy of perceived event characteristics should be useable across different event types, allow a broad understanding of people's event perception, and be measured with a validated and economical questionnaire applicable in large samples. To develop such a dimensional taxonomy, Luhmann et al. (2021) first conducted a systematic literature review to identify perceived event characteristics that have been assessed or discussed in the scientific literature on major life events. Second, to identify additional potentially relevant event characteristics, a qualitative study was performed. Third, informed by these two approaches, a broad item pool assessing a range of different perceived event characteristics

was developed. Fourth, based on this item pool, Luhmann et al. (2021) developed and validated a questionnaire, called *Event Characteristics Questionnaire* (ECQ), to reliably assess nine perceived event characteristics:

- *Challenge*: extent to which an event is perceived as scaring, exhausting, and stressful (e.g., "The event exhausted me")
- *Change in world views*: extent to which an event is perceived as changing one's attitudes and world views (e.g., "I see things differently because of the event")
- *Emotional significance*: extent to which an event is perceived as moving, emotional, and memorable (e.g., "The event elicited strong feelings")
- *External control*: extent to which an event is perceived as caused by other people (e.g., "Others had a strong influence on the event")
- *Extraordinariness*: extent to which an event is perceived as extraordinary and uncommon (e.g., "It is uncommon for people like me to experience such an event in their lives")
- *Impact*: extent to which an event is perceived as influential, impactful, and life changing (e.g., "I had to change my life because of the event")
- *Predictability*: extent to which an event is perceived as expected and predictable (e.g., "I knew in advance that the event would be happening")
- *Social status change*: extent to which an event is perceived as threatening one's reputation or social status (e.g., "My reputation suffered from the event")
- *Valence*: extent to which an event is perceived as positive, joyful, and beneficial (e.g., "The event was joyful")

The ECQ in total comprises 38 items which are rated on a scale from 1 (*not true at all*) to 5 (*absolutely true*). Compared to situation taxonomies, the ECQ does not include content-related characteristics (i.e., characteristics such as duty or intellect describing the content of an event). Instead, it includes several consequence-related characteristics (e.g., social status change or change in world views) that describe the perceived consequences of a major life event and that might provide insights into the mechanisms through which major life events lead to changes in other variables (Luhmann et al., 2021; Rauthmann et al., 2014). Compared to existing inventories to assess the perception of major life events (e.g., Ferguson et al., 2000; Peacock & Wong, 1990), the ECQ comprises a broader set of perceived event characteristics and is applicable to any type of major life events. Thus, this new dimensional taxonomy of perceived event characteristics may provide a more complete

understanding of experienced events, and it may help to gain new insights into the effects of major life events (e.g., understanding why the effects of major life events differ among people; Luhmann et al., 2021).

1.4.3   *Using the Event Characteristics Questionnaire: Initial Evidence and Open Questions*

Some initial studies already employed the ECQ. For example, Kritzler et al. (2022) examined how different common major life events are perceived (e.g., unemployment or divorce). They found meaningful differences in the event perception across different event types but also within an event type. Consequently, their findings support the idea that considering how people perceive major life events may provide important information on the event (beyond the event type) that could be used to understand individual differences in event-related changes.

Whether perceived event characteristics can indeed help to understand individual differences in event-related changes was tested by Luhmann et al. (2021). In this study, several perceived event characteristics were associated with individual differences in event-related changes in subjective well-being. For example, a higher perceived impact of negative events was associated with a stronger increase in subjective well-being after the event occurrence. In contrast to these findings, perceived event characteristics were not associated with individual differences in event-related changes in empathy and prosociality (Fassbender et al., 2022). Finally, Rakhshani et al. (2022) found that perceived event characteristics were cross-sectionally related to personality traits and that participants assumed that several perceived event characteristics are associated with personality trait changes. However, they did not examine the relationship between perceived event characteristics and actual personality trait changes in their study.

Together, these initial studies illustrate the utility of the ECQ to better understand the effects of major life events. However, they also outline the necessity for future research. First, as the effects of perceived event characteristics seem to differ across outcomes (e.g., Fassbender et al., 2022; Luhmann et al., 2021) and as research on perceived event characteristics using other measures often relied on cross-sectional studies (e.g., Gourounti et al., 2010), more longitudinal research on the relevance of perceived event characteristics is needed. Generally, the ECQ could be a starting point for a comprehensive research program investigating which perceived event characteristics can explain individual

differences in which outcomes after which major life events as it is applicable across different events and outcomes (Luhmann et al., 2021). Furthermore, a better understanding of the nature of perceived event characteristics (i.e., the properties and correlates of the construct) is needed. For example, it is necessary to understand whether and how the perception of a major life event changes over time as perceived event characteristics can be assessed at different time points after the occurrence of a major life event (Luhmann et al., 2021). Furthermore, information on correlates and the temporal stability of perceived event characteristics may provide initial insights into the question which factors determine how people perceive major life events. Addressing this question could be relevant for treatment purposes as it would allow conclusions on how to modify dysfunctional event perceptions.

1.5   The Present Dissertation

The present dissertation aimed to address several open questions regarding the nature and relevance of perceived event characteristics. It consists of one review and four empirical studies. The studies presented in the Chapters 2 and 3 addressed the question whether perceived event characteristics can explain individual differences in personality trait changes. The scoping review presented in Chapter 4 summarized and integrated existing evidence on the association between the perception of major life events and depression. In Chapter 5, stability and change of the perception of major life events over time were examined. Finally, in Chapter 6, it was tested whether such changes in the perception of a major life event are associated with changes in subjective well-being.

The studies included in this dissertation used a variety of data sources. As the effects of major life events cannot be estimated with cross-sectional data (e.g., Luhmann et al., 2014), all empirical studies were based on longitudinal data sets. Chapter 2, Chapter 5, and Chapter 6 relied on data from the *What's NEXT? Study* – a longitudinal online study addressed to young adults in which the perception of major life events, participants' personality traits, and their subjective well-being were assessed at five measurement occasions over 1 year. Chapter 6 additionally included data from the *One Year of Corona Pandemic Study*. In this study, participants provided information on their subjective well-being, mental health, and perception of a recently experienced major life event at two measurement occasions 3 months apart. Chapter 3 was based on data from the *Post-Event Changes Study*. This study was addressed to participants who has recently experienced a

negative major life event and assessed their mental health, personality traits, and subjective well-being at five measurement occasions spread over 6 months. Finally, in Chapter 4, existing cross-sectional and longitudinal findings on the association between the perception of a major life event and depression were identified through a systematic literature search and integrated in a narrative synthesis.

The research questions, data sources, and analytical approaches of the five studies included in this dissertation are described in more detail below and summarized in Table 1.1.

1.5.1 Can Perceived Event Characteristics Explain Individual Differences in Personality Trait Changes (Chapter 2 and Chapter 3)?

Evidence on the question whether major life events can lead to personality trait changes is mixed and effect sizes for event-related mean-level changes in personality traits seem to be small (Bleidorn et al., 2020; Denissen et al., 2019). However, given the policy relevance of personality traits, it is of critical importance to better understand why and when personality traits change (Bleidorn et al., 2019; Soto, 2019). Changing the assessment of major life events and considering how people perceive these events may be a promising approach to improve the understanding of why people differ in their personality trait changes in the context of major life events (Bleidorn et al., 2020; Luhmann et al., 2021). Two studies included in this dissertation empirically examined this topic.

In the study presented in Chapter 2, my co-authors (Andrew Rakhshani, Ina Fassbender, Richard E. Lucas, M. Brent Donnellan, Maike Luhmann) and I examined whether the perception of major life events can explain individual differences in personality trait changes across different event types. In this study, participants reported their personality traits at five measurement occasions every 3 months. At the second measurement occasion, participants additionally named a major life event they had experienced since the first assessment and provided information on their perception of this event. Using a combination of latent change score models and multilevel models, we examined whether perceived event characteristics are associated with personality trait changes between our pre-event assessment and the four post-event measurement occasions. Furthermore, we explored whether these associations differed among event types (e.g., health-related events or educational events).

Table 1.1: *Overview of the Studies Included in This Dissertation*

Chapter	Title	Research questions	Data source	Participants	Analyses
2	Perception of major life events and personality trait change	(1) Are perceived event characteristics associated with (the amount of) personality trait changes? (2) Do these associations differ among event types?	*What's NEXT? Study* (five measurement occasions over 1 year)	$N = 433$ (young adults)	Latent change score models and multilevel models
3	Examining individual differences in personality trait changes after negative life events	(1) Which personal, environmental, and event-related variables can explain individual differences in personality trait changes after negative life events? (2) Do results differ among differently specified statistical models?	*Post-Event Changes Study* (five measurement occasions over 6 months)	$N = 1,069$ (people who recently experienced a negative life event)	Multilevel lasso regression (and classical multilevel models)
4	The relationship between the perception of major life events and depression in adulthood: A scoping review	(1) How has the perception of major life events been examined in depression research? (2) What is known about the association between the perception of major life events and depression?	Systematic literature search (*PsycINFO* and *Medline*)	$N = 89,600$ (276 studies)	Descriptive statistics and narrative synthesis
5	Stability and change of perceived characteristics of major life events	(1) How stable are individual differences in perceived event characteristics? (2) Does the mean level of perceived event characteristics change over time? (3) What percentage of the total variance of perceived event characteristics can be explained by between-person differences?	*What's NEXT? Study* (five measurement occasions over 1 year)	$N = 619$ (young adults)	Continuous time models
6	Are changes in the perception of major life events associated with changes in subjective well-being?	(1) Are changes in the perception of major life events associated with changes in subjective well-being? (2) Can differences in the designs of the two studies explain differences in the results?	*What's NEXT? Study* and *One Year of Corona Pandemic Study* (two measurement occasions 3 months apart)	Study 1: $N = 619$ (young adults) Study 2: $N = 691$ (general population)	Latent change score models

The study presented in Chapter 3 shed light on the association between perceived event characteristics and individual differences in personality trait changes from a different perspective as it differed in several methodological aspects from the study in Chapter 2. First, the study in Chapter 3 included participants who had recently experienced a negative life event and assessed their personality traits at five measurement occasions over 6 months. Although this approach had the limitation that there was no pre-event assessment, it allowed us to examine the relevance of perceived event characteristics after specific negative events with adequate power (e.g., relationship breakup). Looking at the associations between perceived event characteristics and personality trait changes after specific events is interesting as these associations may differ across different events (Luhmann et al., 2021). Second, in this study, my co-authors (Wiebke Bleidorn, Christopher J. Hopwood) and I additionally included other personal, environmental, and event-related factors possibly explaining individual differences in personality trait changes. Considering a range of different moderators allowed us to more comprehensively address individual differences in personality trait changes and to examine the relevance of perceived event characteristics while controlling for other factors. To identify which moderators improve the prediction of individual differences in personality trait changes, we used the recently developed multilevel lasso estimation (Finch, 2018; Schelldorfer et al., 2011). Furthermore, we tested the robustness of our findings by using a variety of additional statistical methods that have commonly been employed in research on major life events (e.g., structural equation models, classical multilevel models).

Together, the two studies provide important information on the question whether perceived event characteristics can help to understand individual differences in personality trait changes. These studies may thus advance our knowledge about the circumstances and time course of event-related personality trait changes.

1.5.2 *Are Perceived Event Characteristics Associated With Depression (Chapter 4)?*

Compared to research on personality trait changes (Chapters 2 and 3), more empirical studies on the association between perceived event characteristics and depression were available. This may be explained by the fact that different depression theories (e.g., Abramson et al., 1989; Ingram, 1984) predict that the way people perceive major life events determines whether people become depressed or not (see Chapter 4 for a more detailed discussion). To summarize and integrate the existing research on the association between

the perception of major life events and depression, my co-authors (Felix Würtz, Sarah Kritzler, Marius Kunna, Maike Luhmann, Marcella L. Woud) and I conducted a scoping review. In this review, we addressed the question of how the perception of major life events has been examined in depression research. Furthermore, we provided an initial narrative integration of the existing evidence on the associations between different perceived event characteristics and depression.

By providing an overview of the methods that have been used to address the association between the perception of major life events and depression, our review allows to identify important avenues for future research on this topic (e.g., which research designs or samples may be underrepresented). Furthermore, this review provides first indications on which perceived event characteristics have consistently been associated with depression. Thus, it can help to evaluate which theoretical predictions on the relevance of certain perceived event characteristics have been supported by empirical evidence.

1.5.3   *How Stable is the Perception of Major Life Events (Chapter 5)?*

Chapter 5 switched the focus to the inherent properties of the construct of perceived event characteristics. By examining the stability and change of perceived event characteristics over time, initial conclusions regarding factors influencing people's event perception may be drawn. Furthermore, examining the stability and change of perceived event characteristics is important because the perception of major life events has been examined at different time points after the occurrence of a major life event – ranging from weeks to years (Mitchell et al., 1997; Servaty-Seib, 2014). Currently, it is unclear how such temporal differences in the assessment of perceived event characteristics may have influenced the obtained results. Finally, theories such as Affective Adaptation Theory (Wilson & Gilbert, 2008) suggest that the perception of major life events changes over time and that such changes are relevant for changes in subjective well-being and personality traits. However, these predictions have yet to be tested empirically.

Thus, as a first step, my co-authors (Sarah Kritzler, Ina Fassbender, Maike Luhmann) and I examined the stability and change of perceived event characteristics over time. We used data from a longitudinal study in which participants rated their perception of a major life event at five measurement occasions spread over 1 year. By applying continuous time models, we examined rank-order stability, mean-level stability, and intraclass correlations

of perceived event characteristics. Furthermore, we compared the findings on the stability of the perceived event characteristics to the ones of affective well-being and the Big Five personality traits.

1.5.4 *Are Changes in the Perception of Major Life Events Associated With Changes in Subjective Well-Being (Chapter 6)?*

Building on the description of the stability and change of perceived event characteristics in Chapter 5, the study presented in Chapter 6 addressed the question whether changes in perceived event characteristics might be relevant for changes in other variables. Specifically, drawing on theoretical perspectives such as Affective Adaptation Theory (Wilson & Gilbert, 2008), my co-authors (Lena S. Pfeifer, Ina Fassbender, Maike Luhmann) and I examined whether changes in the perception of major life events are associated with changes in subjective well-being. We addressed this research questions in two longitudinal datasets – each comprising two measurement occasions 3 months apart. In the first dataset, we explored correlated changes between perceived event characteristics and subjective well-being using latent change score models. Then, we preregistered our hypotheses and analysis methods for the second dataset and examined correlated changes between these constructs in this second dataset. Furthermore, we conducted several robustness checks to test whether differences in the study design between the two datasets could explain differences in the results.

Examining correlated changes between perceived event characteristics and subjective well-being is important to test theoretical predictions regarding the intertwined development of these constructs (e.g., Wilson & Gilbert, 2008). Furthermore, this study could inform future research whether it is beneficial to assess the perception of major life events repeatedly within longitudinal studies.

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2

Perception of Major Life Events and Personality Trait Change

2. Perception of Major Life Events and Personality Trait Change

Abstract: Major life events can trigger personality trait change. However, a clear, replicable pattern of event-related personality trait change has yet to be identified. We examined whether the perception of major life events is associated with personality trait change. Therefore, we assessed young adults' personality traits at five measurement occasions within 1 year. At the second measurement occasion, we also assessed their perception of a recently experienced major life event using the Event Characteristics Questionnaire. Contrary to our expectations, perceived impact of the event was not associated with the amount of personality trait change, but perceived valence was associated with changes in agreeableness and neuroticism. Exploratory analyses revealed some weak associations between other perceived event characteristics and the amount of personality trait change as well as interactions between perceived event characteristics and event categories in predicting changes in neuroticism. In general, effect sizes were small, and associations depended on the time interval between pre-event and post-event personality assessment. Results indicate that perceived event characteristics should be considered when examining event-related personality trait change.

2.1   Introduction

Personality traits are "enduring patterns of thoughts, feelings, and behaviors, that distinguish individuals from one another" (Bleidorn et al., 2018, p. 83). Although personality traits are relatively enduring, they can also change over the lifetime (e.g., Damian et al., 2019; Roberts et al., 2006), and these changes are relevant for various important life outcomes such as job satisfaction or relationship satisfaction (e.g., Hoff et al., 2021; Schwaba et al., 2019; Scollon & Diener, 2006). Therefore, it is important to understand the causes of personality trait change. One possible environmental cause of personality trait change is the experience of major life events such as graduation, childbirth, or a new employment (Bleidorn et al., 2018). Although several studies have found evidence for personality trait change in reaction to major life events, more research is needed to better understand when and under which circumstances event-related personality trait changes occur (Bleidorn et al., 2020; Denissen et al., 2019). For example, it has been proposed that the way major life events are perceived may be relevant for their effects on psychological outcomes (Bleidorn et al., 2020; Luhmann et al., 2021). Until recently, however, most studies on event-related personality trait change did not assess how people perceive the experienced events or focused only on a single perceived event characteristic (e.g., often the valence of major life events; Kandler & Ostendorf, 2016; Lüdtke et al., 2011; Vries et al., 2021). The present study aimed for a more comprehensive perspective regarding the associations between the perception of major life events and event-related change in the Big Five personality traits.

2.1.1   *Personality Trait Change in the Context of Major Life Events*

Major life events can be defined as "events that are clearly timed, disrupt one's everyday routine, and are perceived as personally significant and memorable by those who experienced them" (Luhmann et al., 2021, p. 634). Personality theories differ in their claims regarding event-related personality trait change. While Five-Factor Theory assumes that personality traits are "essentially independent of environmental influences" (McCrae et al., 2000, p. 173), other theories suggest that major life events may cause lasting personality trait change. For example, Social Investment Principle of Neo-Socioanalytic Theory suggests that major life events can lead to personality trait change if they change people's social roles and everyday life (Roberts et al., 2005; Roberts & Nickel, 2017).

Inspired by the literature on subjective well-being, these different perspectives on event-related personality trait change have also been described using different set-point models (Ormel et al., 2012; Ormel et al., 2017). The Immutable Set-Point Model assumes that people have a biologically determined point of origin for their personality traits (i.e., their set point) and that this set point cannot be changed by environmental influences (similar to the proposal of the Five-Factor Theory). In contrast, the Experience-Dependent Set-Point Model assumes that the set point is responsive to strong environmental experiences such as major life events. Finally, the Mixed Set-Point Model combines both perspectives and assumes that the set point of personality traits has immutable and changeable parts (Ormel et al., 2012; Ormel et al., 2017).

Empirically, several studies found evidence for event-related personality trait changes in line with the Experience-Dependent or Mixed Set-Point Model (for an overview see Bleidorn et al., 2018; Bleidorn et al., 2020). For example, two studies found that neuroticism decreased after experiencing the event "first romantic relationship" (Lehnart et al., 2010; Wagner et al., 2015). However, the effects found for event-related personality trait changes were only small and the results only partly replicated across studies (Bleidorn et al., 2020; Denissen et al., 2019; Löckenhoff et al., 2009). Furthermore, it is unclear why some people show lasting changes in their personality traits after experiencing the same major life event while others do not. Thus, more research is needed to better understand event-related personality trait changes (Bleidorn et al., 2020).

2.1.2 *Perception of Major Life Events in the Context of Personality Trait Change*

Different methods to assess major life events have been used in research on event-related personality trait change. Each method provides a specific perspective on these changes. Some studies focused on the simple occurrence of single major life events (e.g., whether someone experienced the first romantic relationship or not; Asselmann & Specht, 2020; Denissen et al., 2019). Other studies relied on researcher-based classifications of major life events to certain event categories and then, for example, used sum scores of experienced events of a certain category to predict personality trait change (e.g., uncontrollable vs. controllable events, Kandler et al., 2012; positive vs. negative events, Neeleman, 2003). Both methods provide a more objective assessment of major life events, but they ignore how people subjectively perceive major life events.

Assessing the perception of major life events may be important to better understand event-related personality trait changes for several reasons. First, the same major life event can be perceived quite differently by different individuals; and thus, it can have differential effects on personality trait change (Bleidorn et al., 2020; Luhmann et al., 2021). For example, in a study by Kandler and Ostendorf (2016), participants used the complete range of the valence scale (from *very negative* to *very positive*) to describe their subjective experience of the event "separation from spouse". Second, different major life events may have similar effects on personality trait change when they are perceived similarly. For example, a new relationship and a new job may both lead to a decrease in neuroticism when they are perceived as impactful, positive events. Third, assessing how people perceive major life events has been a successful way to explain individual differences in event-related changes in other personality-relevant outcomes including subjective well-being, depressive symptoms, and anxiety (e.g., Fassett-Carman et al., 2020; Luhmann et al., 2021; Prizmić-Larsen et al., 2020). Thus, assessing perceived event characteristics may also be helpful to better understand event-related personality trait change.

2.1.3   *Assessment of the Perception of Major Life Events and Existing Empirical Evidence*

There are already a few studies that examined how people perceive major life events in the context of personality trait change. One common way of evaluating the perception of major life events is by using life event checklists that weight the subjective experience of each major life event on a given dimension. We refer to this approach of dimensionally assessing the subjective experience of major life events as the *perceived event characteristic* approach. For example, with the Life Experience Survey (Sarason et al., 1978), participants rate the positive and negative impact of experienced major life events; then the impact ratings are summed across all experienced events. These sum scores have been used to explain event-related personality trait change (e.g., Kandler et al., 2012; Lüdtke et al., 2011; Vaidya et al., 2002). For example, Vaidya et al. (2002) and Lüdtke et al. (2011) found that the sum score of negatively perceived events was associated with an increase in neuroticism. This approach has an important limitation, however, as these sum scores confound the effects of the number of experienced major life events with the effects of the perceived event characteristics.

Kandler and Ostendorf (2016) demonstrated that the effects of event occurrence and perceived event characteristics can be separated. They found that the perceived valence but

not the mere occurrence of specific major life events such as "religious crisis" or "serious illness or injury" was associated with neuroticism before and after these events. Similarly, Vries et al. (2021) examined the effects of the occurrence and the perceived valence of the major life events "graduating from school" and "moving away from home" on personality trait changes in young adulthood. Again, not the mere occurrence of these events but only their perceived valence was associated with changes in neuroticism and extraversion.

In sum, these studies support the notion that the perception of major life events is important for personality trait changes (and likely even more important than the mere event occurrence). However, the mentioned studies considered only one perceived event characteristic (i.e., valence), while other perceived event characteristics such as predictability, emotional significance, and extraordinariness of major life events may be important as well (Vries et al., 2021). Luhmann et al. (2021) developed the Event Characteristics Questionnaire—a dimensional taxonomy of nine empirically derived perceived event characteristics (*valence, impact, predictability, challenge, emotional significance, change in world views, socials status change, external control*, and *extraordinariness*). The idea of this taxonomy is to replace the categorical classification of major life events (and their limitations such as intracategorical variability; Monroe, 2008). Instead, perceived event characteristics should be used to capture psychological meaningful differences in the subjective experience of major life events (Luhmann et al., 2021; Rauthmann et al., 2014). This dimensional taxonomy of perceived event characteristics has already been used to explain event-related changes in subjective well-being, empathy, and prosociality (Fassbender et al., 2022; Luhmann et al., 2021). With the present study, we aimed to examine their utility to explain event-related changes in the Big Five personality traits (irrespective of the categorical classification of major life events).

2.1.4 Hypotheses and Research Questions

Based on existing empirical evidence and theoretical considerations, we had concrete hypotheses regarding the effects of two perceived event characteristics: *valence* and *impact*. Regarding the other seven perceived event characteristics that are assessed with the Event Characteristics Questionnaire, we formulated exploratory research questions.

Research Question 1: Valence

Several studies using different assessment methods (e.g., researcher-based classifications of positive versus negative events or participants' ratings of the perceived valence) have shown that the *valence* of major life events is important for personality trait change (Lüdtke et al., 2011; Spinhoven et al., 2011). In general, the results seem to be most consistent for the Big Five personality traits of extraversion and neuroticism (Kandler & Ostendorf, 2016; Lüdtke et al., 2011; Vries et al., 2021): Perceiving events as positive should be associated with a decrease in neuroticism and with an increase in extraversion (Hypothesis 1 and 2).

Research Question 2: Impact

Regarding the relevance of the perceived event characteristic *impact*, previous studies suggest that more impactful events lead to more change (Löckenhoff et al., 2009; Vries et al., 2021). For example, Löckenhoff et al. (2009) assumed that prior research on event-related personality trait change was limited by the fact that more and less impactful events were combined using sum scores. Therefore, they focused on extreme adverse events to predict personality trait change, and they indeed found changes in neuroticism, agreeableness, and openness in their study.

Additionally, theories such as Social Investment Principle (Roberts et al., 2005; Roberts & Nickel, 2017) and Integrative State Process Model (Geukes et al., 2018) suggest that event-related personality trait changes occur when a major life event leads to changes in social roles and everyday life. As the perceived event characteristic *impact* refers to perceived changes in social roles and everyday life, we hypothesized that perceived impact would be associated with the amount of personality trait change[2] (Hypothesis 3).

Research Question 3: Interaction of Impact and Valence

Based on findings in the context of event-related changes in subjective well-being (Luhmann et al., 2021), we also examined whether perceived *valence* and *impact* interact in predicting personality trait change. Luhmann et al. (2021) found that events perceived as negative and impactful were associated with more pronounced changes in subjective well-

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[2] For this hypothesis, we focus on the *amount of personality trait change* since the perceived event characteristic *impact* captures the perceived extent of changes in social roles and everyday life but not specific role gains or losses. Thus, when examining different major life events that are accompanied with changes in social roles in different directions, perceived impact should only be associated with the amount (i.e., absolute value of) but not with the direction of personality trait change.

being than events perceived as negative but not as impactful. Similarly, one could expect that events that are perceived as negative and impactful are associated with stronger increases in neuroticism than events that are perceived as negative but not as impactful. However, since this is rather speculative, we did not formulate hypotheses for this research question.

Research Question 4 and 5: Other Perceived Event Characteristics

To obtain a comprehensive picture of the relation between perceived event characteristics and personality trait change, we also explored whether the other seven perceived event characteristics assessed with the Event Characteristics Questionnaire (*predictability, challenge, emotional significance, change in world views, social status change, external control,* and *extraordinariness*) are associated with personality trait change. Since we did not have concrete hypotheses for these event characteristics, we explored their associations with both the amount and the direction of personality trait change.

Research Question 6: Combining Perceived Event Characteristics and Event Categories

The previously mentioned research questions focus on the relevance of perceived event characteristics irrespective of the categorical classification of major life events. However, perceived event characteristics do not only vary across different event categories but also within a certain event category (Kritzler et al., 2022). Therefore, we also explored whether combining perceived event characteristics and information on event categories can explain personality trait change. That is, we examined whether there is an interaction between perceived event characteristics and event categories in predicting personality trait changes. Combining both approaches to predict personality trait changes may be useful as they provide different perspectives on major life events. Event categories (e.g., "educational event" or "health-related event") usually describe the content of major life events (i.e., what participants experienced), whereas perceived event characteristics focus on the perceived causes, circumstances, and consequences of major life events.

2.1.5   *The Present Study*

With the present study, we examined the association between the perception of major life events and personality trait change. We extended existing research in two ways: First, we assessed the perception of major life events comprehensively using the dimensional taxonomy developed by Luhmann et al. (2021). Second, we used data from a longitudinal

study with five measurement occasions occurring every 3 months (henceforward referred to as T1 to T5). This study design allows us to better understand the unfolding of the associations between the perceived event characteristics and personality trait change over time. At T2, participants rated their perception of the most significant major life event that they had experienced between T1 and T2. This allowed us to investigate event-related personality trait change with one pre-event (T1) and four post-event (T2 to T5) assessments of personality traits.

2.2   Methods

This paper is based on data from the *What's Next? Study*, a longitudinal panel study conducted in 2018 and 2019. Data from this study have previously been analyzed by Fassbender et al. (2022), Haehner et al. (2022), Kritzler et al. (2022), and Luhmann et al. (2021), but none of these publications investigated event-related personality trait change. Data collection of the *What's NEXT? Study* was approved by local ethics committee of Ruhr-University Bochum. The study design was preregistered at https://osf.io/pm5xn, and analyses for the present paper were preregistered at https://osf.io/u5m7v. Deviations from this preregistration are summarized in the supplemental material (Table S2.1).

2.2.1   Procedure

The *What's Next? Study* is a five-wave longitudinal study focused on young adulthood since this is a sensitive phase for personality trait change in which major life events occur frequently (Lüdtke et al., 2011; Roberts, 2018). Participants were recruited online via social media or in person, for example, at welcome events at Ruhr-University Bochum. Participants could take part in voucher raffles after each measurement occasion as a compensation.

Participants first registered for the study. The registration included providing informed consent, an email address, and age verification (minimum age 18 years). After the registration, participants were invited via email to the following five online surveys that were spread over 1 year (i.e., 0, 12, 24, 36, and 48 weeks after registration). They were invited to the subsequent measurement occasions regardless of whether they had participated in previous measurement occasions.

At T2, participants freely named the most important major life event that they had experienced since T1 and rated this event with the Event Characteristics Questionnaire.

Furthermore, at each measurement occasion, participants were asked to complete various questionnaires assessing their subjective well-being and personality including the Big Five personality traits (see the study-design preregistration for a complete list of questionnaires).

2.2.2 Participants

A total of 857 people registered to take part in the *What's Next? Study*. Our sample included individuals who participated at least in T1 and T2 so that we have data on the participant's pre-event personality traits (assessed at T1) and on the rating of perceived event characteristics (assessed at T2). As preregistered, we further excluded participants' data from measurement occasions that were completed in less than 10 minutes (40% of expected duration) and with no or incorrect answers on the instructed response items (see below) to ensure data quality. Finally, only participants who named a major life event at T2 that occurred in the requested time frame (i.e., between T1 and T2) were included in our analyses. Applying these criteria, our final sample consisted of $N = 433$ participants (76% female, 93% with a high school degree). Participants' mean age at T1 was 21.77 years ($SD = 4.01$).

2.2.3 Measures

Naming of a Major Life Event and Event Categories (T2)

At T2, participants freely named the most important major life event they had experienced since T1. Furthermore, participants indicated which life domains were affected by these events (e.g., *relationship and partnership, job and applications*, or *finances*). Using information on the free-text descriptions and affected life domains, we categorized the named events into event categories. We created two categorizations with different purposes: a fine-grained categorization (35 categories; e.g., *starting college, important exam, cease education successfully*) and a broad categorization (7 categories; e.g., *educational events*). The broad categorization led to higher sample sizes for each event category and was created to address Research Question 6. The fine-grained categorization was used to provide more detailed information on the named events. More information regarding our event codings and the frequencies of the event categories can be found in the supplemental material (Table S2.2 and Table S2.3).

Event Characteristics Questionnaire (T2)

Participants were asked to rate the major life event they had experienced with the Event Characteristics Questionnaire (Luhmann et al., 2021; items as in Study 5). The Event Characteristics Questionnaire assesses nine perceived event characteristics: *challenge* (4 items, e.g., "The event was straining"), *change in world views* (4 items, e.g., "The event helped me to gain new perspectives"), *emotional significance* (4 items, e.g., "The event was emotionally significant to me"), *external control* (4 items, e.g., "Others were able to control the event"), *extraordinariness* (3 items, e.g., "Few people like me experience such an event in their lives"), *impact* (4 items, e.g., "The event led to changes in my social, family or work roles"), *predictability* (4 items, e.g., "I knew in advance that the event would be happening"), *social status change* (4 items, e.g., "My reputation suffered from the event"), and *valence* (6 items, e.g., "The event was positive"). All 37 items were answered on a five-point scale ranging from 1 (*not true at all*) to 5 (*absolutely true*) and items were presented in randomized order. We reversed responses if appropriate and calculated mean scores for our analyses.

Big Five Personality Traits (T1 to T5)

The Big Five Inventory-2 Extra Short Form (German version by Rammstedt et al., 2018; original version by Soto & John, 2017) was used to assess the Big Five personality traits: *conscientiousness* (3 items, e.g., "I am somebody who is reliable, can always be counted on"), *agreeableness* (3 items, e.g., "I am somebody who is compassionate, has a soft heart"), *extraversion* (3 items, e.g., "I am somebody who is dominant, acts as a leader"), *negative emotionality* (akin to neuroticism; 3 items, e.g., "I am somebody who tends to be depressed, blue"), and *open-mindedness* (akin to openness; 3 items, e.g., "I am somebody who is fascinated by art, music, or literature"). Items were rated on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) and items were presented in randomized order. We reversed responses if appropriate and calculated mean scores for descriptive purposes.

2.2.4   Data Analysis

Analyses were conducted in R (Version 4.0.3). The analyses for Research Questions 1 to 5 were preregistered and comprised three steps. First, we checked for longitudinal measurement invariance of the Big Five personality trait measure. Second, we estimated latent change score models using pre-event and post-event personality assessments to obtain estimates of within-person personality trait change. Third, we ran several multilevel models using the within-person personality trait change scores as dependent variables as

well as time intervals between the measurement occasions and perceived event characteristics as predictors. Research Question 6 was inspired by the comments of the anonymous reviewers during the revision of this manuscript and therefore not preregistered. For this research question, a slightly different modeling approach was used to test whether it leads to similar results as our analytic approach for Research Questions 1 to 5.

Testing Longitudinal Measurement Invariance

To ensure that the Big Five personality traits can be compared between the five measurement occasions, we examined longitudinal measurement invariance using R packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2020). Separately for each Big Five personality trait, we evaluated configural, metric, and scalar measurement invariance in a stepwise approach. Details on model specification and results are summarized in the supplemental material (Table S2.4). All Big Five personality traits showed scalar measurement invariance. However, it should be noted that the covariance matrix of latent variables was not positive definite for agreeableness and extraversion: The correlations of some latent variables' (i.e., correlations for a certain personality trait among the measurement occasions) were greater than one. This issue may be a symptom of model misspecification or sampling error (Kolenikov & Bollen, 2012). Since model fit was good and all confidence intervals of the correlations of the latent variables included plausible values, we assumed sampling error and the relatively short time interval between the measurement occasions to be the reasons for this issue.

Estimating Individual Personality Trait Change Scores with Latent Change Score Models

Latent change score models were computed to estimate within-person personality trait change scores. We used latent change score models since they allowed us to estimate personality trait change without accumulation of measurement error when calculating difference scores (McArdle, 2009). For each of the Big Five personality traits, we computed four latent change score models using the pre-event personality assessment (T1) and one of the post-event personality assessments (T2 to T5). Consequently, for each Big Five personality trait, these models provided four latent change scores that indicate personality trait change over 3 months (between T1 and T2), 6 months (T1 and T3), 9 months (T1 and T4), and 12 months (T1 and T5), respectively. This modeling procedure is illustrated in Figure 2.1.

Figure 2.1: *Illustration of Our Modelling Procedure: Latent Change Score Models (Panel A) and Data Structure for Multilevel Models (Panel B)*
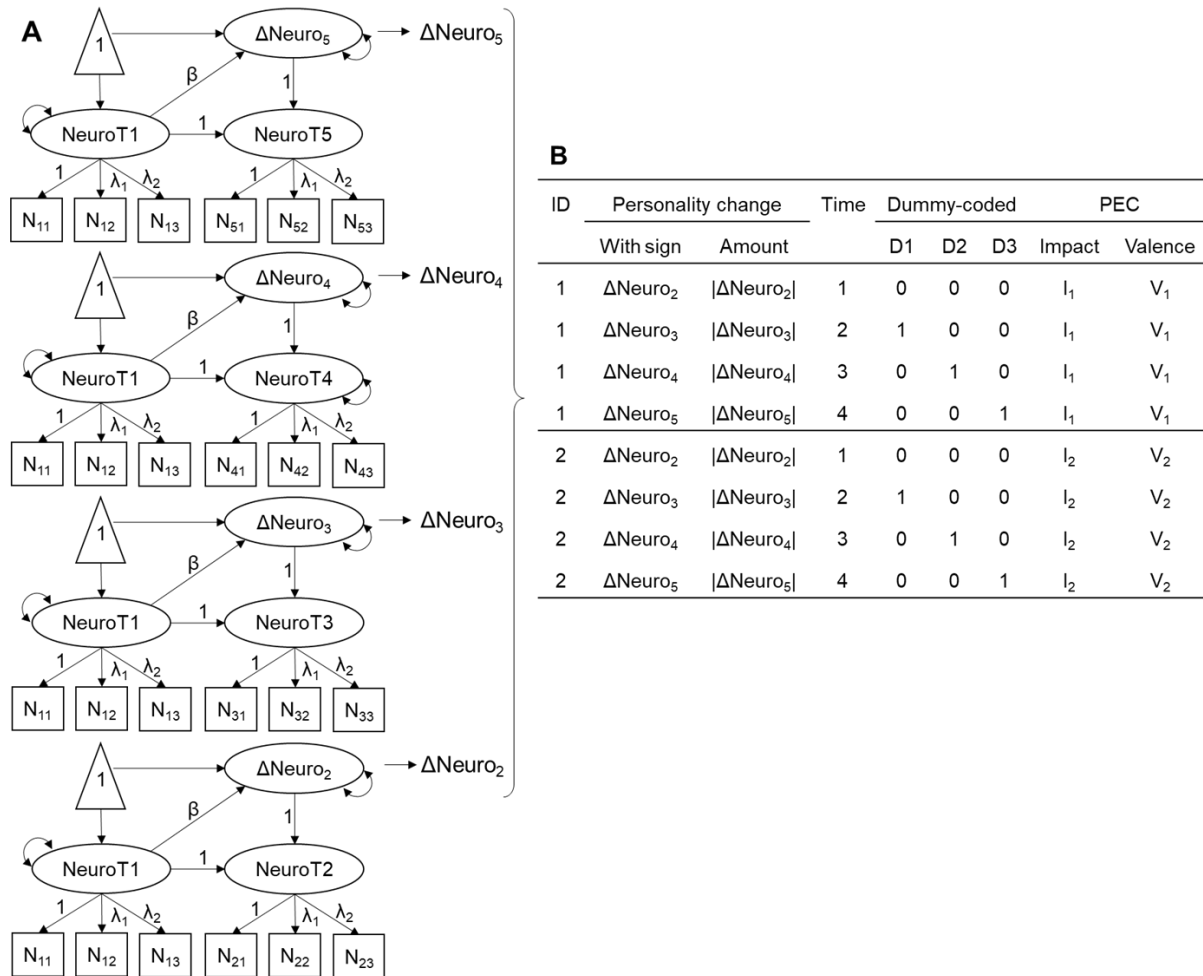
Note. Panel A: Illustration of the latent change score models to estimate within-person personality trait change variables (ΔNeuro$_t$). For each personality trait, we estimated four latent change score models: Each using the T1 data as pre-event personality assessment (NeuroT1) and one of the other measurement occasions as post-event personality assessment (NeuroT2 to NeuroT5). Intercepts of indicators, residual variances, and covariances are not depicted. Panel B: Data structure for multilevel models. Within-person personality trait change scores with sign or their absolute value (= amount) served as dependent variables in multilevel models. Time (dummy-coded as depicted), perceived event characteristics (only valence and impact depicted), and their cross-level interaction (not depicted) served as predictors. PEC = perceived event characteristic.

We estimated these latent change score models by using the indicator variable method (i.e., fixing the factor loading of the first indicator to one and its mean to zero). Furthermore, we set factor loadings and means to be equal across the different measurement occasions[3] and

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[3] We used the indicators' factor loadings and intercepts estimated with the latent change score model for T1 and T2 and restricted the indicators' factor loadings and intercept in the other latent change scores models to these values.

we allowed correlated residuals for the same repeatedly measured indicators. Regarding the latent variables, the mean and variance of the latent change variable and of the first latent factor (i.e., pre-event personality assessment) were freely estimated, whereas the autoregressive path was fixed to one (see also Figure 2.1). We used full information maximum likelihood estimation to address missing data issues.

Examining Perceived Event Characteristics and Personality Trait Change with Multilevel Models
To examine the associations between the perceived event characteristics and personality trait change over different time intervals (3, 6, 9, and 12 months), we computed several multilevel models with time intervals nested in participants. We estimated multilevel models with random intercepts only (i.e., no random slopes) to have overidentified models and to avoid estimation problems. We used Satterthwaite approximated degrees of freedom to evaluate significance of fixed effects as implemented in the R package *lmerTest* (Kuznetsova et al., 2017). In general, for Research Questions 1 to 5, the multilevel models were computed in a similar way: the personality trait change variables estimated with the latent change score models served as dependent variables; time intervals (treated categorically with four levels; Level 1), one of the perceived event characteristics (Level 2), and their cross-level interactions served as predictors. Examples for the model equations are presented in the supplemental material (Table S2.5).

Coding and Transformations of the Variables in the Multilevel Models. First, we standardized the perceived event characteristics and the personality trait change variables estimated with the latent change score models. The latter were standardized using the *SD* of the pre-event personality assessment so that personality trait change variables can be interpreted in T1 *SD* units. Second, for Research Questions 2 and 5, we calculated the absolute values of these standardized personality trait change scores to estimate the amount of personality trait change. Third, we dummy coded the Level-1 predictor time interval since we had no specific hypothesis regarding the functional form of within-person personality trait change for the different time intervals. Using dummy coding, the shortest interval between pre- and post-event personality assessment (3 months; between T1 and T2) served as reference category and the other time intervals (6, 9, and 12 months) were each represented by one dummy-variable (Figure 2.1). This coding allowed us to evaluate whether personality trait change occurred between T1 and T2 and whether these changes persisted over longer time intervals.

Modeling Strategy. The multilevel models for Research Questions 1 to 5 differed in two aspects: (1) which perceived event characteristic served as predictor, and (2) whether personality trait change scores with sign or their absolute values served as dependent variable. These differences are summarized in Table 2.1. To answer our research questions and to test our hypotheses, we used two analyses: model comparisons and estimation of simple slopes.

Table 2.1: *Summary of the Multilevel Models for Research Questions 1 to 5.*

RQ	Predictor of interest	Dependent variable: Personality change	Model comparison
1	Valence	With sign	A: Time [a] B: Time [a] + **Valence** + **Time [a] × Valence**
2	Impact	Absolute value	A: Time [a] B: Time [a] + **Impact** + **Time [a] × Impact**
3	Impact × Valence	With sign	A: Time [a] + Impact + Valence + Time [a] × Impact + Time [a] × Valence B: Time [a] + Impact + Valence + Time [a] × Impact + Time [a] × Valence + **Impact × Valence** + **Time [a] × Valence × Impact**
4	ECQother	With sign	A: Time [a] B: Time [a] + **ECQother** + **Time [a] × ECQother**
5	ECQother	Absolute value	A: Time [a] B: Time [a] + **ECQother** + **Time [a] × ECQother**

Note. For each research question, we conducted model comparisons (Model A vs. Model B) to evaluate whether a certain perceived event characteristic or the interaction between impact and valence improved model fit. In particular, we tested whether the fixed effects depicted in bold improved model fit. If these model comparisons were significant for a certain Big Five personality trait, we evaluated significance of single fixed effects. As the modelling strategy for Research Question 6 was different, it is not included in this table. More details on the analyses for Research Question 6 can be found in the supplemental material. RQ = research question; ECQother = one of the other perceived event characteristics assessed with the Event Characteristics Questionnaire (predictability, challenge, emotional significance, change in world views, socials status change, external control, and extraordinariness).

[a] Time interval was treated categorically. The 3-month interval served as reference category; the intervals 6, 9, and 12 months were each represented by one dummy variable.

Model comparisons were conducted as omnibus tests to evaluate whether specific predictors significantly improved model fit for a certain Big Five personality trait. For Research Questions 1, 2, 4, and 5, we compared a model that only included the time interval as predictor with a model that additionally included the perceived event characteristic of interest and its cross-level interactions with the time interval. Similarly, for Research Question 3, we compared models with and without the interaction between valence and impact (see Table 2.1 for details). If these model comparisons were not significant for a certain Big Five personality trait, the respective event characteristic (or the interaction between valence and impact) did not significantly improve model fit in the prediction of personality trait change. Consequently, no further inspections were made (besides looking at simple slopes as effect size estimates; see below). However, if a model comparison was significant, we more closely examined the fixed effects and simple slopes because a significant model comparison could be caused by the main effect of the perceived event characteristic and/or the interaction between that event characteristic and the time interval. A significant main effect of a certain perceived event characteristic (e.g., valence for Research Question 1) indicated that there is a significant association between this predictor and personality trait change over 3 months (since "3 months" was the reference category). Significant cross-level interactions (e.g., between time interval and valence) indicated that the strength of the association between the perceived event characteristic and personality trait change changed when considering longer time intervals between pre-event and post-event personality assessment. For example, for Research Question 1, a significant positive cross-level interaction would indicate that the association between valance and personality trait change becomes more positive over 6, 9, and 12 months compared to a 3-month interval.

Simple Slopes. Simple slopes were estimated using the *emtrends*-function of the R package *emmeans* (Lenth, 2021). Simple slopes indicate the association between a certain event characteristic and (the amount of) personality trait change for specific time intervals and served two purposes. First, simple slopes were used as effect size estimates since they can be interpreted in standard deviation units. For example, they indicate how a 1 *SD* increase in perceived impact is related to the amount of personality trait change (in T1 *SD* units) over 3, 6, 9, and 12 months. Therefore, we estimated simple slopes regardless of the significance of the above-described model comparisons. Second, the statistical significance

of these simple slopes indicated whether a perceived event characteristic was significantly associated with personality trait change over 3, 6, 9, and 12 months. However, we only evaluated and interpreted the statistical significance of simple slopes if the above-described model comparisons were significant. As preregistered, we used $\alpha = .05$ as level of significance for our literature-based Research Questions 1 to 3 and a more conservative level of significance of $\alpha = .01$ to reduce Type I error inflation for our exploratory Research Questions 4 and 5 (cf. Lakens et al., 2018).

Data Analysis for Research Question 6 (not Preregistered)

To examine whether combining event categories and perceived event characteristics can be used to predict personality trait change, a slightly different analysis strategy was used. Using a different analysis strategy for Research Question 6 also allowed us to test whether a similar result pattern regarding the association between perceived event characteristics and personality trait change emerged with different statistical methods.

Modeling Strategy. We computed multilevel models with measurement occasions nested in participants. The most important difference compared to the analyses of Research Questions 1 to 5 is that personality trait scores (instead of personality trait change scores estimated with the latent change score models) served as dependent variables. Personality trait scores were standardized on the pre-event mean and *SD*. First, we included time since the event (in weeks, *Time_lin*) and a pre-event dummy (*Time_pre*) as predictors. Second, we included the main effects of the perceived event characteristics (standardized using their grand-mean and *SD*) and information on the event category (dummy-coded with "educational events" as reference category) as predictors. Third, we included the cross-level interactions between *Time_lin*, perceived event characteristics, and event categories. The interactions between *Time_lin* and the perceived event characteristics and event categories allowed us to evaluate whether perceived event characteristics and/or event categories can explain individual differences in personality trait changes over time. We evaluated the statistical significance of these interactions using χ^2-tests as implemented in the *Anova*-function of the *car* package (Fox & Weisberg, 2019). If these tests were significant ($\alpha = .01$), we inspected the fixed effects. More details on the modeling strategy can be found in the supplemental material.

Comparison to Analysis of Research Questions 1 to 5. Using this modeling strategy allowed to directly test and compare different functional forms of personality trait change over time. For example, we tested whether a quadratic time effect improved model fit compared to a linear time effect. This was not the case for any of the Big Five personality traits. However, in contrast to the analysis of Research Questions 1 to 5, this modeling strategy does not allow to test whether the associations between personality trait change and the perceived event characteristics change over time and the amount of personality trait change cannot be estimated within these models.

2.3   Results

2.3.1   *Descriptive Statistics*

Descriptive statistics and internal consistencies for all scales are summarized in Table 2.2. Intercorrelations between all variables are reported in the supplemental material (Table S2.7 and S2.8).

2.3.2   *Latent Change Score Models*

The primary aim of the latent change score models was to estimate latent change variables that indicate within-person personality trait change over 3, 6, 9, and 12 months. Descriptive statistics of these personality trait change variables are summarized in Table 2.3: Personality trait change was most pronounced for neuroticism, which on average decreased 0.08 *SD* to 0.27 *SD*-units between T1 and the subsequent measurement occasions. Model fit indices for each latent change score model were acceptable or good (all CFI > .98, TLI > .96, and RMSEA < .05; Schermelleh-Engel et al., 2003; see supplemental material Table S2.9).

2.3.3   *Valence and Personality Trait Change*

To examine whether perceived valence is associated with personality trait change (Research Question 1), we computed multilevel models with the within-person personality change scores *with sign* as dependent variable and with time interval, perceived valence, and their cross-level interactions as independent variables. We compared these models with a model that included time interval as the sole predictor. As can be seen in Table 2.4, the inclusion of valence did not improve model fit for extraversion, openness, and conscientiousness. This result was inconsistent with Hypothesis 1 that valence is positively associated with changes in extraversion.

Table 2.2: *Descriptive Statistics and Internal Consistencies for the Big Five Personality Traits and the Nine Perceived Event Characteristics*

Variables	T1				T2				T3				T4				T5			
	N	*M*	*SD*	α	*N*	*M*	*SD*	α	*N*	*M*	*SD*	α	*N*	*M*	*SD*	α	*N*	*M*	*SD*	α
Neuroticism	433	3.13	0.86	.64	433	3.1	0.86	.68	343	3.02	0.87	.69	299	3.01	0.84	.68	293	2.96	0.85	.67
Extraversion	433	3.09	0.82	.62	433	3.08	0.78	.63	343	3.06	0.79	.66	299	3.06	0.78	.65	293	3.14	0.75	.58
Agreeableness	433	3.68	0.77	.55	433	3.65	0.73	.53	342	3.68	0.77	.62	299	3.64	0.78	.65	293	3.68	0.75	.62
Openness	433	3.68	0.74	.51	433	3.67	0.71	.51	343	3.65	0.73	.45	299	3.71	0.71	.50	293	3.73	0.72	.51
Conscientiousness	433	3.46	0.84	.61	433	3.39	0.82	.62	343	3.46	0.78	.61	299	3.44	0.81	.63	293	3.46	0.86	.67
Challenge					433	3.21	1.15	.87												
Change in world views					433	2.72	0.88	.76												
Emotional significance					433	3.83	0.91	.83												
External control					433	2.56	1.08	.85												
Extraordinariness					433	2.20	0.93	.83												
Impact					433	3.83	0.91	.75												
Predictability					433	3.53	1.23	.92												
Social status change					433	1.30	0.57	.86												
Valence					433	3.97	1.23	.96												

Note. The perceived event characteristics were assessed at T2 only. The Big Five personality traits were assessed at each measurement occasion (T1: pre-event personality trait assessment, T2-T5: post-event personality trait assessments).

Table 2.3: *Descriptive Statistics for the Within-Person Personality Trait Change Variables Over 3, 6, 9, and 12 Months Estimated With the Latent Change Score Models*

Personality trait	3 months (T1 and T2)					6 months (T1 and T3)					9 months (T1 and T4)					12 months (T1 and T5)				
	M	*SD*	Min	Max	*d*	*M*	*SD*	Min	Max	*d*	*M*	*SD*	Min	Max	*d*	*M*	*SD*	Min	Max	*d*
Agree	−0.03	0.13	−0.42	0.35	−0.04	−0.03	0.05	−0.25	0.10	−0.04	−0.02	0.07	−0.29	0.29	−0.03	0.02	0.17	−0.78	0.52	0.02
Consc	−0.08	0.13	−0.61	0.33	−0.09	−0.02	0.14	−0.48	0.54	−0.02	−0.03	0.16	−0.66	0.68	−0.03	−0.06	0.18	−0.70	0.75	−0.07
Extra	−0.02	0.10	−0.29	0.33	−0.03	−0.03	0.08	−0.29	0.29	−0.04	0.00	0.09	−0.25	0.38	0.01	0.06	0.10	−0.23	0.46	0.07
Neuro	−0.07	0.31	−1.01	0.72	−0.08	−0.14	0.28	−1.10	0.88	−0.16	−0.15	0.41	−1.56	1.59	−0.17	−0.21	0.34	−1.53	1.12	−0.24
Open	−0.01	0.16	−0.41	0.50	−0.01	−0.04	0.07	−0.25	0.22	−0.06	0.04	0.09	−0.33	0.41	0.05	0.04	0.09	−0.47	0.44	0.05

Note. Personality trait change variables were estimated over 3, 6, 9, and 12 months using T1 and one of the post-event personality assessments (T2-T5). *d* indicates the mean of the within-person personality trait change variables that were standardized using the T1 *SD* of the respective personality trait. Agree = Agreeableness; Consc = Conscientiousness; Extra = Extraversion; Neuro = Neuroticism; Open = Openness.

Table 2.4: *Results for Research Question 1: Associations Between Perceived Valence and Personality Trait Change*

Personality trait	Model comparison		Simple slopes			
	$\chi^2(df)$	p	3 months [95% CI]	6 months [95% CI]	9 months [95% CI]	12 months [95% CI]
Agreeableness	12.49(4)	**.014**	**0.020 [0.006, 0.034]**	0.002 [−0.012, 0.017]	0.010 [−0.005, 0.024]	**0.020 [0.006, 0.034]**
Conscientiousness	1.66(4)	.797	0.007	0.004	−0.004	0.004
Extraversion	6.69(4)	.153	−0.001	−0.004	−0.012	−0.007
Neuroticism	10.80(4)	**.029**	−0.036 [−0.073, 0.001]	−0.009 [−0.046, 0.028]	0.021 [−0.016, 0.058]	0.008 [−0.029, 0.045]
Openness	5.03(4)	.284	−0.009	−0.008	−0.015	−0.012

Note. To test whether the perceived valence was associated with personality trait change (Research Question 1), we computed several model comparisons. Model comparisons were based on deviance tests that compared two nested multilevel models: a model that only included time intervals as predictor and a model that additionally included perceived valence and the cross-level interaction with the time intervals as predictors. Significant model comparisons and significant simple slopes (based on a level of significance of α = .05) are depicted in bold. Simple slopes indicate the associations between perceived valence and changes in a certain personality trait over 3, 6, 9, and 12 months. Confidence intervals of simple slopes (presented in square brackets) are only given if the model comparison for the respective trait was significant.

However, model comparisons were significant for agreeableness ($\chi^2(4)$ = 12.49, p = .014) and neuroticism ($\chi^2(4)$ = 10.80, p = .029). Looking at the fixed effects for neuroticism, the main effect for valence was not significant but the cross-level interactions between valence and two time intervals (9 and 12 months) were significant (Table 2.5). These results indicate that valence is not significantly related to change in neuroticism over 3 months (as reflected in the non-significant main effect for valence), but that the strength of the association between valence and changes in neuroticism significantly changes when considering a 9- or 12-month interval (as reflected in the significant cross-level interactions). To examine how these associations changed, we looked at the simple slopes for neuroticism (Table 2.4). On a descriptive level, the association between valence and neuroticism switched signs from negative to positive when considering longer time intervals (Figure 2.2). However, simple slopes were not significantly different from zero for any time interval. Thus, results were not in line with Hypothesis 2 (valence is associated with a decrease in neuroticism) but indicate that the association between valence and change in neuroticism is time interval dependent.

For agreeableness, there was a significant main effect for valence, which indicates that valence is related to changes in agreeableness over 3 months (b = 0.020, SE = 0.007, 95% CI = [0.006, 0.034], $t(1341.43)$ = 2.732, p = .006). Considering that this trait in general decreased over the first 3 months, this result means that experiencing positive events instead of negative events is associated with smaller decreases in agreeableness. Perceiving events as 1 SD above the mean (i.e., a positive event perception) reduced decreases in agreeableness over 3 months by 0.02 SD. However, as indicated by the significant cross-level interactions and the confidence intervals of simple slopes, this positive association between valence and change in agreeableness is not significant over 6 and 9 months, but significant again over 12 months (Figure 2.2). In sum, positive valence of events is associated with less negative changes in agreeableness, but the strength (and significance) of this association is time interval dependent.

Table 2.5: *Fixed Effects for Multilevel Models Including Valence as Predictor and Change in Agreeableness and Neuroticism as Dependent Variable*

Predictor	Agreeableness					Neuroticism				
	Coefficient [95% CI]	SE	df	t	p	Coefficient [95% CI]	SE	df	t	p
(Intercept)	−0.045 [−0.059, −0.030]	0.007	1341.43	−6.077	**< .001**	−0.079 [−0.116, −0.042]	0.019	949.14	−4.205	**< .001**
Time_6M	0.001 [−0.016, 0.018]	0.009	1293	0.138	.890	−0.086 [−0.122, −0.050]	0.018	1293	−4.667	**< .001**
Time_9M	0.014 [−0.003, 0.031]	0.009	1293	1.667	.096	−0.090 [−0.125, −0.054]	0.018	1293	−4.874	**< .001**
Time_12M	0.068 [0.051, 0.085]	0.009	1293	7.852	**< .001**	−0.165 [−0.201, −0.129]	0.018	1293	−9.003	**< .001**
Valence	0.020 [0.006, 0.034]	0.007	1341.43	2.732	**.006**	−0.036 [−0.073, 0.001]	0.019	949.14	−1.924	.055
Time_6M × Valence	−0.018 [−0.035, −0.001]	0.009	1293	−2.053	**.040**	0.028 [−0.008, 0.063]	0.018	1293	1.496	.135
Time_9M × Valence	−0.011 [−0.027, 0.006]	0.009	1293	−1.222	.222	0.057 [0.021, 0.093]	0.018	1293	3.096	**.002**
Time_12M × Valence	0.000 [−0.017, 0.017]	0.009	1293	−0.012	.990	0.044 [0.008, 0.080]	0.018	1293	2.399	**.017**

Note. We tested the association between perceived valence and change in agreeableness and neuroticism over different time frames. Time intervals were dummy coded using the shortest interval (3 months, between T1 and T2) as reference category. These models indicate whether the perceived valence predicts change in agreeableness and neuroticism over 3 months (main effect of valence) and whether the strength of this association changes when considering longer time intervals (cross-level interactions between time and valence). We used Satterthwaite-approximated degrees of freedom to evaluate significance of fixed effects. Significant fixed effects (α = .05) are depicted in bold. Time_6M = 6-month interval (between T1 and T3); Time_9M = 9-month interval (between T1 and T4); Time_12M = 12-month interval (between T1 and T5).

Figure 2.2: *Change in Neuroticism and Agreeableness Compared to the Pre-event Personality Assessment for Events Perceived as Positive and Events Perceived as Negative*
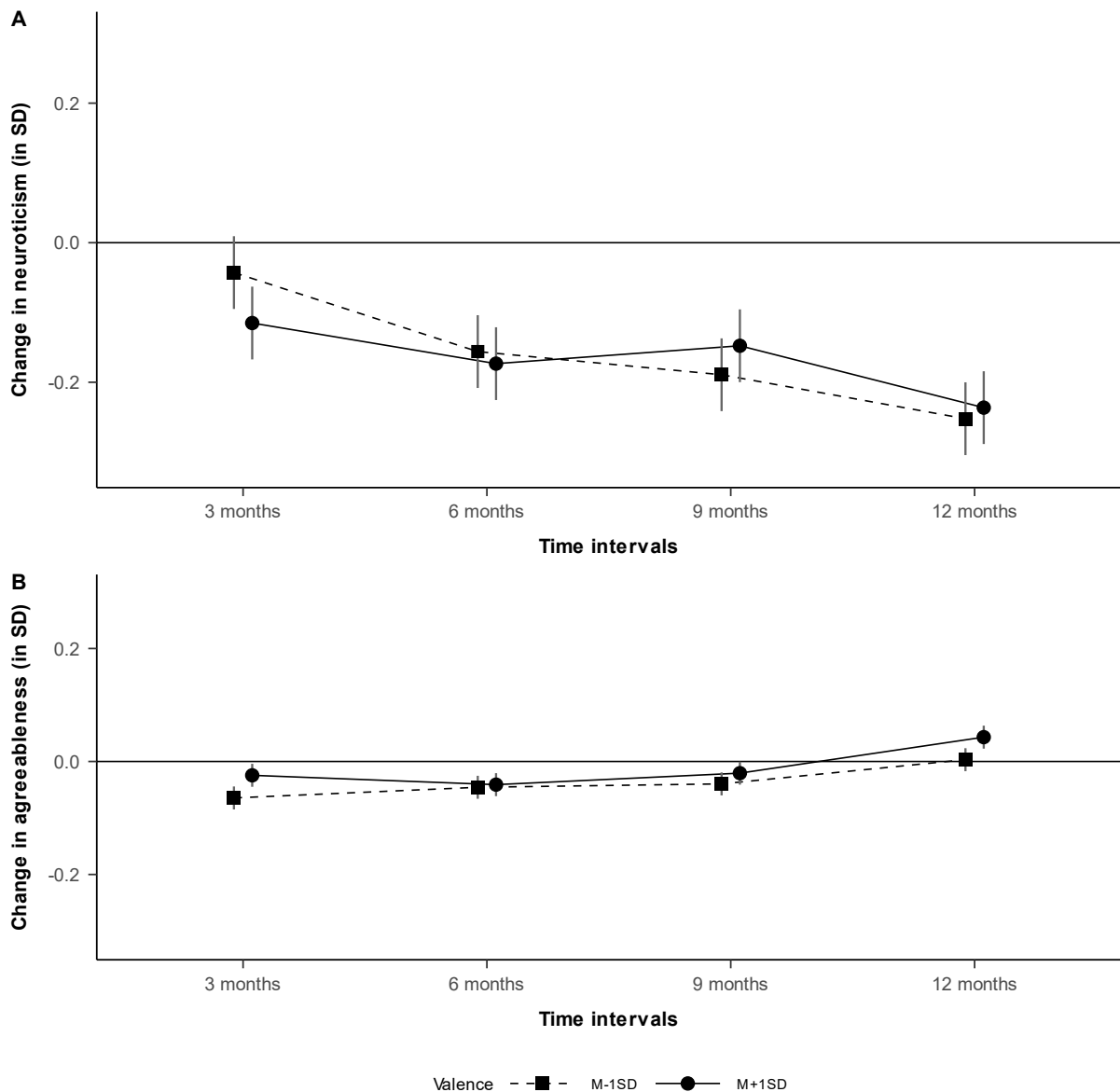
Note. Panel A: Change in neuroticism compared to pre-event personality assessments for positive events (valence: $M + 1\ SD$) and negative events (valence: $M - 1\ SD$). Over 3 months, positive perceived valence is associated with stronger decreases in neuroticism, over 12 months positive perceived valence was associated with smaller decreases in neuroticism. Whiskers indicate the 95% confidence interval for the estimated adjusted means. Panel B: Change in agreeableness compared to pre-event personality assessments for positive events (valence: $M + 1\ SD$) and negative events (valence: $M - 1\ SD$). Positive events lead to more positive changes in agreeableness, but the strength of this association is changing over time. Whiskers indicate the 95% confidence interval for the estimated adjusted means.

2.3.4 Impact and the Amount of Personality Trait Change

To examine whether the perceived impact of an event is associated with the amount of personality trait change (Research Question 2), we computed multilevel models with the *absolute values* of the within-person personality trait change variables as dependent variables and with time interval, impact, and their cross-level interactions as independent variables. We again compared these models with a model that only included the time interval as predictor. Since none of these model comparisons were significant (all $p > .085$, Table 2.6), we concluded that perceived impact is unrelated to the amount of personality trait change—at least for a 1-year time frame. This conclusion is also supported by inspecting the simple slopes that indicate the association between perceived impact and the amount of personality trait change over 3, 6, 9, and 12 months. As can be seen in Table 2.6, these simple slopes fluctuate unsystematically around zero. Thus, results were inconsistent with Hypothesis 3 according to which higher perceived impact is associated with a higher amount of personality trait change.

Table 2.6: *Results for Research Question 2: Associations Between Perceived Impact and the Amount of Personality Trait Change*

Personality trait	Model comparison		Simple slopes			
	$\chi^2(df)$	p	3 months	6 months	9 months	12 months
Agreeableness	8.19(4)	.085	0.001	−0.000	−0.001	−0.014
Conscientiousness	1.29(4)	.863	0.003	0.004	0.007	0.001
Extraversion	5.76(4)	.218	−0.004	0.003	0.002	−0.005
Neuroticism	1.43(4)	.840	0.001	0.006	−0.011	0.004
Openness	2.35(4)	.671	0.001	0.005	−0.003	−0.003

Note. To test whether the perceived impact was associated with the amount of personality trait change (Research Question 2), we computed one model comparison for each Big Five personality trait. Model comparisons were based on deviance tests that compared two nested multilevel models: a model that only included time intervals as predictors and a model that additionally included perceived impact and the cross-level interaction with the time intervals as predictors. For all Big Five personality traits, model comparisons were not significant ($\alpha = .05$) indicating that perceived impact is not associated with the amount of personality trait change. Simple slopes indicate the associations between perceived impact and the amount of change in a certain personality trait over 3, 6, 9, and 12 months.

2.3.5   Interaction of Valence and Impact

To examine whether the interaction between perceived valence and impact predicts personality trait change (Research Question 3), we computed multilevel models that included the interaction of these two perceived event characteristics and compared them with multilevel models without this interaction. Since none of these model comparisons were significant for any of the Big Five personality traits (all p > .091, Table 2.7), we concluded that the interaction of perceived valence and impact does not predict personality trait change in our sample.

Table 2.7: *Results for Research Question 3: Interaction of Impact and Valence*

Personality trait	Model comparison	
	$\chi^2(df)$	p
Agreeableness	5.91(4)	.206
Conscientiousness	5.03(4)	.285
Extraversion	1.98(4)	.739
Neuroticism	7.52(4)	.111
Openness	8.01(4)	.091

Note. To test whether the interaction between perceived valence and impact was associated with personality trait change (Research Question 3), we computed several model comparisons. Model comparisons were based on deviance tests that compared two nested multilevel models: with and without the interaction of perceived valence and impact. Non-significant model comparisons (α = .05) indicate that the interaction of valence and impact is not improving model estimation for the respective trait.

2.3.6   Other Perceived Event Characteristics and Personality Trait Change

To examine whether the other perceived event characteristics assessed with the Event Characteristics Questionnaire were associated with personality trait change (Research Question 4), we used the within-person personality trait change variables *with sign* as dependent variables. We compared a model that only included time intervals as predictors with models that additionally included one of the other perceived event characteristics and its cross-level interactions with time. Results for these model comparisons are summarized in Table 2.8. No model comparison reached our stricter threshold of significance (α = .01)

indicating that the other perceived event characteristics did not predict personality trait change in our sample.

2.3.7 Other Perceived Event Characteristics and Amount of Personality Trait Change

To examine whether the other perceived event characteristics assessed with the Event Characteristics Questionnaire were associated with the *amount of* personality trait change (Research Question 5), we computed multilevel models with the absolute value of personality trait change as dependent variables and time intervals, one perceived event characteristic, and their cross-level interactions as independent variables. We again compared these models with models that included time intervals as sole predictors. Results are summarized in Table 2.9. Based on our stricter level of significance of $\alpha = .01$ for Research Questions 4 and 5, there were two statistically significant effects for agreeableness, one for neuroticism, and one for openness. Simple slopes for these models with significant effects are summarized in Table 2.10. Fixed effects for these models and simple slopes for all other models can be found in the supplemental material (Tables S2.11 and S2.12).

For agreeableness, change in world views and external control were associated with the amount of personality trait change. Simple slopes indicate a similar result pattern for both perceived event characteristics: While these two perceived event characteristics were either positively related or unrelated to the amount of personality trait change over 3, 6 and 9 months, they became negatively associated with the amount of change in agreeableness over 12 months. Over 12 months, perceiving events as a 1 *SD* above the mean in external control and change in world views were each associated with a 0.02 *SD* decrease in the amount of personality trait change.

For neuroticism and openness, predictability was related to the amount of personality trait change. However, the result pattern differed for these two personality traits. For neuroticism, predictability was negatively associated with the amount of personality trait change. Over the 9-month interval, perceiving events as 1 *SD* above the mean in predictability was associated with a 0.05 *SD* decrease in the amount of change in neuroticism. For openness, perceived predictability was positively associated with the amount of personality trait change. Over the 3-months interval, perceiving events as 1 *SD* above the mean in predictability was associated with a 0.02 *SD* increase in the amount of

change in openness. To sum up, there were some associations between the other perceived event characteristics assessed with the Event Characteristics Questionnaire and the amount of personality trait change, but these associations were small and time interval dependent.

2.3.8   Combining Perceived Event Characteristics and Event Categories (not Preregistered)

To examine whether the combination of perceived event characteristics and event categories predicts personality trait changes (Research Question 6), we computed multilevel models with personality traits scores (and not change or amount of change in personality traits) as dependent variables. Time since the event occurrence (in weeks), perceived event characteristics, and event categories as well as their interactions served as predictors. In these models, the cross-level interactions between time and the perceived event characteristics and/or event categories were the effects of interest.

For neuroticism, two significant cross-level interactions were found: Social status change and valence showed a significant three-way interaction with time and event category (Table 2.11). In general, these three-way interactions indicate that the association between a perceived event characteristics and (linear) personality trait change over time differs between event categories. In particular, for social status change, fixed effects indicated that the association between social status change and change in neuroticism was significantly more positive within the event categories "living situation" ($b = 0.011$, $SE = 0.004$, 99% CI = [0.001, 0.021], $t(1379.90) = 2.77$, $p = .006$) and "health-related events" ($b = 0.010$, $SE = 0.004$, 99% CI = [0.001, 0.020], $t(1374.72) = 2.87$, $p = .004$) than within the reference event category "educational event". To illustrate the meaning of these cross-level interactions with an example: People who experienced an educational event and who perceived this event as social status threatening (1 SD above the mean) decreased in their neuroticism by 0.31 SD over 1 year, whereas people who experienced a health-related event and perceived this event as social status threatening increased in their neuroticism by 0.47 SD over 1 year. Similarly, within the event category "occupational events" the association between valence and change in neuroticism was significantly stronger than in the event category "educational event" ($b = 0.012$, $SE = 0.004$, 99% CI = [0.001, 0.022], $t(1389.14) = 2.72$, $p = .007$). For the other Big Five personality traits, no significant cross-level interactions were found (Tables S2.14 to S2.17).

Table 2.8: *Results of Model Comparisons for Research Question 4: Other Perceived Event Characteristics and Personality Trait Change*

Perceived event characteristic	Agreeableness		Conscientiousness		Extraversion		Neuroticism		Openness	
	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p
Challenge	0.77(4)	.942	7.74(4)	.101	2.89(4)	.577	8.03(4)	.091	10.12(4)	.038
Change in world views	1.29(4)	.864	5.76(4)	.218	2.49(4)	.647	4.33(4)	.363	4.96(4)	.292
Emotional significance	3.80(4)	.434	1.84(4)	.765	0.64(4)	.958	1.21(4)	.877	10.15(4)	.038
External control	1.08(4)	.897	3.04(4)	.551	2.19(4)	.701	4.79(4)	.310	6.88(4)	.142
Extraordinariness	9.77(4)	.045	3.51(4)	.477	4.84(4)	.304	6.28(4)	.179	2.62(4)	.623
Predictability	12.78(4)	.012	6.27(4)	.180	9.28(4)	.054	2.69(4)	.612	11.86(4)	.018
Social status change	13.04(4)	.011	2.68(4)	.612	8.13(4)	.087	8.92(4)	.063	1.72(4)	.787

Note. To test whether the other perceived event characteristics were associated with personality trait change (Research Question 4), we computed several model comparisons. Model comparisons were based on deviance tests that compared two nested multilevel models: a model that only included time intervals as predictors and a model that additionally included one of the other perceived event characteristics and its cross-level interaction with time intervals as predictors. Non-significant model comparisons indicate that the respective event characteristics is not improving model estimation. Based on our stricter level of significance for Research Question 4 (α = .01), none of the model comparisons was significant.

Table 2.9: *Results of Model Comparisons for Research Question 5: Other Perceived Event Characteristics and the Amount of Personality Trait Change*

Perceived event characteristic	Agreeableness		Conscientiousness		Extraversion		Neuroticism		Openness	
	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p
Challenge	1.53(4)	.822	1.99(4)	.737	3.22(4)	.522	4.65(4)	.325	1.48(4)	.831
Change in world views	18.57(4)	**.001**	1.81(4)	.772	0.91(4)	.923	1.95(4)	.744	5.12(4)	.276
Emotional significance	5.97(4)	.201	4.03(4)	.403	0.59(4)	.964	8.26(4)	.082	1.93(4)	.749
External control	18.68(4)	**.001**	6.47(4)	.167	2.41(4)	.660	3.83(4)	.429	8.16(4)	.086
Extraordinariness	7.95(4)	.094	2.12(4)	.714	2.03(4)	.729	2.89(4)	.576	3.95(4)	.413
Predictability	6.93(4)	.140	0.94(4)	.919	2.17(4)	.705	17.94(4)	**.001**	13.32(4)	**.010**
Social status change	1.52(4)	.823	5.38(4)	.251	6.47(4)	.166	0.34(4)	.987	3.34(4)	.503

Note. To test whether the other perceived event characteristics were associated with the amount of personality trait change (Research Question 5), we computed several model comparisons. Model comparisons were based on deviance tests that compared two nested multilevel models: a model that only included time intervals as predictors and a model that additionally included one of the other perceived event characteristics and its cross-level interaction with the time intervals as predictors. Non-significant model comparisons indicate that the respective perceived event characteristics is not improving model estimation. Significant model comparisons based on our stricter level of significance for Research Question 5 (α = .01) are depicted in bold.

Table 2.10: *Simple Slopes for Research Question 5 for all Models with Significant Model Comparisons*

Predictor	Dependent variable	3 months [99% CI]	6 months [99% CI]	9 months [99% CI]	12 months [99% CI]
Change in world views	Agreeableness	0.011 [−0.002, 0.024]	−0.003 [−0.015, 0.010]	> −0.001 [−0.013, 0.012]	**−0.016 [−0.029, −0.003]**
External control	Agreeableness	0.001 [−0.012, 0.013]	0.001 [−0.012, 0.013]	−0.004 [−0.016, 0.009]	**−0.021 [−0.034, −0.008]**
Predictability	Neuroticism	−0.028 [−0.062, 0.006]	−0.028 [−0.062, 0.006]	**−0.054 [−0.088, −0.020]**	−0.024 [−0.058, 0.010]
Predictability	Openness	**0.016 [0.004, 0.028]**	0.002 [−0.010, 0.014]	> −0.001 [−0.012, 0.012]	> −0.001 [−0.012, 0.012]

Note. Simple slopes indicate the associations between a certain perceived event characteristics and the amount of change in a certain personality trait over 3, 6, 9, and 12 months. Significant simple slopes (α = .01) are depicted in bold.

Table 2.11: *Results of Models for Research Question 6 for Neuroticism: Perceived Event Characteristics, Event Categories, and Personality Change*

Perceived event characteristic	*Time_lin* × Event Category		*Time_lin* × Perceived Event Characteristic		*Time_lin* × Event Category × Perceived Event Characteristic	
	$\chi^2(df)$	p	$\chi^2(df)$	p	$\chi^2(df)$	p
Challenge	6.79(6)	.341	0.00(1)	.945	5.45(6)	.487
Change in world views	6.70(6)	.350	0.57(1)	.448	2.42(6)	.877
Emotional significance	7.24(6)	.299	1.32(1)	.250	1.11(6)	.981
External control	6.04(6)	.418	1.18(1)	.277	5.75(6)	.451
Extraordinariness	5.47(6)	.485	1.67(1)	.196	3.19(6)	.784
Impact	7.67(6)	.264	0.74(1)	.390	5.90(6)	.434
Predictability	7.00(6)	.321	0.10(1)	.750	7.40(6)	.285
Social status change	6.52(6)	.367	5.17(1)	.023	**19.12(6)**	**.004**
Valence	9.41(6)	.152	3.36(1)	.067	**20.79(6)**	**.002**

Note. Results of multilevel models that used neuroticism as dependent variables and time (*Time_lin*), event categories, and perceived event characteristics as predictors. Depicted are the results of the cross-level interactions between time, event categories, and perceived event characteristics as these effects indicate whether event categories and/or perceived event characteristics moderate (linear) personality trait change. Significant effects (α = .01) are depicted in bold.

2.4   Discussion

We used a longitudinal dataset with five measurement occasions spread over 1 year to examine whether and how the perception of major life events was related to personality trait change. Perceived valence of events was significantly related to changes in agreeableness and neuroticism. Furthermore, there were a few, small associations between the other perceived event characteristics assessed with the Event Characteristics Questionnaire and the amount of personality trait change. For example, change in world views and external control were negatively related to the amount of change in agreeableness. However, all mentioned relationships were time interval dependent. That is, the size, significance, and/or sign of the associations changed when considering different time intervals between pre-event and post-event assessment. Additionally, we found some interactions between the perceived event characteristics and event categories in predicting changes in neuroticism. However, contrary to our hypotheses, we neither found significant associations between perceived impact and the amount of personality trait change nor significant interactions between perceived impact and valence in predicting personality trait change. Nonetheless, our findings indicate that considering the perception of major life events may be useful to better understand event-related personality trait change.

2.4.1   Perceived Valence and Personality Trait Change

Perceived valence was associated with changes in agreeableness and neuroticism, but not with changes in openness, conscientiousness, or extraversion. Thus, our findings were not in line with Hypothesis 1 that positive valence predicts an increase in extraversion. Furthermore, they were also not in line with our Hypothesis 2 (positive valence predicts a decrease in neuroticism) since the association between valence and changes in neuroticism switched its sign over time. Furthermore, our exploratory analyses for Research Question 6 suggest that the association between perceived valence and changes in neuroticism may differ across event categories. That is, perceived valence was more strongly associated with changes in neuroticism for occupational events than for educational events.

Although the findings for neuroticism were not in line with our hypothesis, they are worth a closer inspection. The fact that the association between perceived valence and changes in neuroticism was time interval dependent leads to the question why this association was

changing over time. One explanation may be that neuroticism returns to its set point after an event (Ormel et al., 2017): Negative events might cause short-term increases in neuroticism; but this effect may fade over time, eventually returning to a baseline—a result that is consistent with all three types of set-point models (Immutable, Experience-Dependent, and Mixed Set-Point Models). In this context, one must address the question whether changes in personality traits over 3 months that fade over time qualify as "personality trait change". As discussed by Roberts et al. (2017), such short-term changes in personality trait measures may just reflect state-level variance in these measures. To further explore this explanation, it would be interesting to investigate how the association between perceived valence and neuroticism develops over even longer time frames (e.g., multiple years) and whether and how personality states change in the same time frame.

For agreeableness, positive events were associated with positive changes in this trait, but the size (and statistical significance) of this association were again time interval dependent. Positive changes in agreeableness after positive events are in line with several studies that used perceived valence ratings in sum scores (e.g., Lüdtke et al., 2011; Vaidya et al., 2002). However, there are also studies that did not find such an effect (e.g., Specht et al., 2011). Since our study provides initial evidence that the associations between the perceived event characteristics and personality trait change are time-interval dependent, such diverging findings might be explained by the fact that event-related changes in agreeableness were examined over different time intervals in the respective studies (e.g., Vaidya et al., 2002: 2.5 years; Specht et al., 2011: 4 years). However, it should also be noted that in the analyses of Research Question 6, perceived valence was not associated with (linear) changes in agreeableness, questioning the robustness of this association. Thus, a replication of our findings in future research is needed.

2.4.2 Perceived Impact and Personality Trait Change

We did not find any evidence for our hypotheses that perceived impact was associated with the amount of personality trait change or that the interaction between perceived impact and valence predicted personality trait change. These hypotheses were based on theoretical claims that changes in social roles and everyday life should lead to personality trait change (Geukes et al., 2018; Roberts et al., 2005; Roberts & Nickel, 2017).

A possible explanation of our findings may be the difference between perceived and actual changes. For example, post-traumatic growth research has shown that *perceived* changes in social relationships and character growth do not necessarily correspond to *actual* changes in these domains (Jayawickreme & Blackie, 2014). Similarly, *perceived* changes in social roles and everyday life may only partly correspond to their actual changes and assessing perceived impact may thus not be sufficient to predict personality trait change. Indeed, testing the correspondence between perceived and actual changes in social roles and everyday life as well as their joint contribution to predict personality trait change would be an interesting question for future research. For this purpose, a longitudinal study that incorporates experience sampling assessments (maybe combined with mobile sensing) to capture actual changes in everyday life would be needed (Bleidorn et al., 2020). Furthermore, investment in new social roles should be assessed to fully capture the prediction of Social Investment Principle (Lodi-Smith & Roberts, 2007).

2.4.3   Other Perceived Event Characteristics

In our exploratory analyses, the other perceived event characteristics beyond impact and valence did not predict the direction of personality trait change, however, there were some associations with the amount of personality trait change. Perceived predictability was positively associated with the amount of change in openness over 3 months and negatively associated with the amount of change in neuroticism over 9 months. Furthermore, change in world views and external control were negatively associated with the amount of change in agreeableness over 12 months. Finally, in the analyses for Research Question 6, there were association between social status change and changes in neuroticism which differed across event categories.

Given the exploratory nature of these analyses, further investigations should be conducted before attributing too much importance to the specific associations. Nonetheless, these findings allow some general conclusions. First, they highlight once again that the associations between the perceived event characteristics and personality trait change depend on the time interval. Second, the fact that only perceived valence predicted the direction of personality trait change might indicate that valence is a central property of major life events. Third, although perceived valence of an event is an important perceived characteristic, it was not the only one associated with personality trait change. Thus,

considering multiple perceived event characteristics may provide a more comprehensive picture of event-related personality trait change (Vries et al., 2021).

In general, the perceived event characteristics were most closely related to changes in agreeableness and neuroticism in our study. A possible reason why the associations were strongest for these two personality traits may be that the major life events that were experienced by our participants particularly promote changes in agreeableness and neuroticism. The events that were experienced most frequently were events such as starting college, new friendship, relocation, and starting a new job. All these events require establishing new social relationships—a typical developmental task for young adults (Hutteman et al., 2014). To establish new social relationships, an increase in agreeableness and a decrease in neuroticism may thus be adaptive (Roberts & Nickel, 2017; Specht, 2017). An alternative explanation for the fact that the perceived event characteristics were most closely related to changes in agreeableness and neuroticism may be the nature of the perceived event characteristics. The perceived event characteristics may in general be most suitable to predict changes in agreeableness and neuroticism. For example, they were most strongly associated with these traits in a cross-sectional study (Rakhshani et al., 2022).

2.4.4   *Effect Sizes of Perceived Event Characteristics for Predicting Personality Trait Change*

In general, the found associations between perceived event characteristics and personality trait change were small: A 1 *SD* difference in a certain perceived event characteristic was at maximum associated with a 0.05 *SD* change in personality traits. To contextualize this effect size, the associations found between the perceived event characteristics and personality trait change are about as strong as the associations between perceived event characteristics and changes in empathy and prosociality (Fassbender et al., 2022) but only about half the size of the association between the perceived event characteristics and changes in subjective well-being (Luhmann et al., 2021). Furthermore, the associations found are approximately as strong as effect sizes in studies that examined event-related personality trait change by assessing major life events through life event checklists or changes in demographic information (e.g., Denissen et al., 2019; Wagner et al., 2015; see Table S2.18 and S2.19 for more information on effect sizes in other studies). Thus, although we used a different perspective on major life events by considering the perception of major life events, the result pattern was similar: The effect of major life events on

personality trait change is small and a single event might have a weaker effect than initially assumed (Bleidorn et al., 2020; Vries et al., 2021).

2.4.5 Considering Perceived Event Characteristics in the Context of Personality Trait Change

In our analyses regarding Research Questions 1 to 5, we examined whether perceived event characteristics are related to personality trait change irrespective of the categorical classification of events. Addressing this question is relevant as the perceived event characteristics have been proposed as alternative to the categorical classification of major life events (Luhmann et al., 2021). In line with this idea, we found a few, weak associations between the perceived event characteristics and personality trait changes irrespective of event categories.

However, the results of Research Question 6 indicate that additionally including information on event categories may be useful to better understand event-related personality trait changes. As outlined in the introduction, event categories usually provide descriptive information on the "content" of major life events (i.e., what the participants experienced), while perceived event characteristics provide information on perceived causes, consequences, and circumstances of major life events. For future research, it might be best to combine (1) the assessment of a wide range of perceived event characteristics (as used in our study; maybe enriched with even more specific perceived event characteristics regarding perceived changes in certain trait demands); and (2) detailed descriptions of the content of major life events (i.e., moving beyond the assessment of broad event categories as in our study). Assessing major life events more comprehensively may thus help to explain event-related personality trait changes. A possible way to combine these two kinds of event information may be their assessment in the recently proposed *Longitudinal Experience-Wide Association Studies* (Bleidorn et al., 2020). This term describes a research design to examine personality trait change by using multiple measurement occasions, assessing a broad array of life experiences, and employing a range of change-sensitive methods. Hence, major life events can and should be captured comprehensively by assessing their perceived characteristics as well as detailed information on the event content (e.g., including implications for everyday life).

Examining perceived event characteristics may also be relevant in the context of missed events (i.e., the non-occurrence of an expected event). Missed events have been discussed

as potential cause of changes in subjective well-being, personality traits, and mental health (Luhmann et al., 2014; Luhmann et al., 2021). There is initial evidence that missed positive events may be related to decreases in mental health and subjective well-being. In this context, examining individual differences in the expected characteristics (e.g., expected impact, expected emotional significance, and expected valence) of missed events may help to better understand individual differences in reactions to these missed events.

2.4.6 *Limitations and Future Directions*

The present investigation had several limitations. First, our study was based on a highly educated, predominantly female sample recruited in a democratic Western industrialized country (Germany). Consequently, it remains a question for future research whether the associations found between perceived event characteristics and personality trait change generalize to other cultural backgrounds. For example, major life events are not equally frequent in different cultures (Ngo & Le, 2007). One might expect that this frequency influences the ratings of some perceived event characteristics (e.g., extraordinariness, predictability) and possibly also their associations with personality trait change.

Second, the participants in our study rated the experienced major life events as quite impactful (since participants rated their most important event of the past 3 months), rather positive, and relatively normative (as indicated by the descriptive statistics of the perceived event characteristics valence and extraordinariness). Although all perceived event characteristics still showed substantial variability, our results possibly depend on the sampled events and the associated perceived event characteristics. One factor that is closely related to the sampled events and the associated perceived event characteristics is the life phase of our participants. In this study, we used a sample of young adults as this life phase is a sensitive phase for personality trait change in which major life events occur frequently (Lüdtke et al., 2011; Roberts, 2018). For this life phase, the sampled events seem to be quite representative (e.g., starting college, relocation, or break up with partner; see frequencies reported by Lüdtke et al., 2011). However, during other life phases (e.g., older adulthood), other major life events will occur more frequently (e.g., retirement, widowhood, becoming a grandparent). Consequently, future research should address the question whether the associations found can be replicated in other age groups as well.

Third, in Research Question 6, we combined information on perceived event characteristics and event categories. We did this using a broad classification of events to increase the sample size for each event category. However, using such a broad classification relatively different major life events are combined to one category (e.g., in our case the event "end of a relationship" and "divorce of parents" were both classified as social events). For future research, more detailed information on the event content should be used for a more comprehensive picture of major life events.

Fourth, with five measurement occasions spread over one year, we were able to examine personality trait change on a rather short time scale compared to other studies (Bleidorn et al., 2020). Examining this shorter time frame was interesting because personality traits may change quickly (Roberts et al., 2017). However, it remains unclear how lasting the observed personality trait change was or whether other event-related changes would occur in the long run. Therefore, an optimal study would combine both: multiple measurement occasions within the first year after a major life event and then additional measurement occasions in the following years (Luhmann et al., 2014).

2.4.7 Conclusion

Major life events are a possible cause for personality trait change. However, effects are small and results of previous studies are at least partly heterogeneous (Bleidorn et al., 2018; Specht, 2017). We aimed for a better understanding of these effects by considering how major life events were perceived. Perceived event characteristics, in particular perceived valence, were related to personality trait change, but these associations were small and time interval dependent. Nonetheless, considering the perception of major life events in context of personality trait change may help to further clarify a complex puzzle of inconsistent and small associations.

2.5 Data Accessibility Statement

The study materials, data, and analysis scripts used for this article can be accessed at https://osf.io/783px/. The preregistration for this study can be found at https://osf.io/u5m7v.

2.6 Author Contribution Statement

The contributions of each author according to the CRediT Classifaction:

Peter Haehner:	Conceptualization (*lead*), Data Curation (*lead*), Formal Analysis (*lead*), Investigation (*supporting*), Methodology (*lead*), Project Administration (*lead*), Software (*lead*), Visualization (*lead*), Writing – Original Draft Preparation (*lead*), Writing – Review and Editing (*equal*)
Andrew Rakhshani:	Conceptualization (*supporting*), Writing – Review and Editing (*equal*)
Ina Fassbender:	Conceptualization (*supporting*), Data Curation (*supporting*) Investigation (*lead*), Writing – Review and Editing (*equal*)
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3

Examining Individual Differences in Personality Trait Changes After Negative Life Events

3. Examining Individual Differences in Personality Trait Changes After Negative Life Events

Abstract: Personality traits can change throughout the entire life span, but people differ in their personality trait changes. To better understand individual differences in personality changes, we examined personal (personality functioning), environmental (environmental changes), and event-related moderators (e.g., perceived event characteristics) of personality trait changes. Therefore, we used a sample of 1,069 participants who experienced a negative life event in the last 5 weeks and assessed their personality traits at five measurement occasions over 6 months. Employing preregistered multilevel lasso estimation, we did not find any significant effects. While exploratory analyses generally confirmed this conclusion, they also identified some effects that might being worth to be considered in future research (e.g., perceived impact and perceived social status changes were associated with changes in agreeableness after experiencing a relationship breakup). In total, our moderators explained less than 2% of variance in personality traits. Nonetheless, our study has several important implications for future research on individual differences in personality change. For example, future research should consider personal, environmental, and event-related moderators, use different analytical methods, and rely on highly powered samples to detect very small effects.

Keywords: personality change, individual differences, life events, level of personality functioning, perceived event characteristics

3.1   Introduction

Personality traits are enduring patterns of thoughts, feelings, and behaviors (Allport, 1961). Although they are relatively stable compared to other constructs, it is now widely acknowledged that personality traits change over the life span (Bleidorn et al., 2021; Bleidorn et al., 2022). Existing research identified patterns of normative personality trait changes (e.g., people become more agreeable and less neurotic in young adulthood; Bleidorn et al., 2022; Roberts et al., 2006) and personality trait changes in reaction to strong environmental influences such as negative life events (Bleidorn et al., 2018; Denissen et al., 2019). Beyond significant mean-level changes in personality traits, these studies also consistently pointed to the fact that people differ in their personality trait changes (Bleidorn et al., 2020; Denissen et al., 2019; Schwaba et al., 2023). However, so far, relatively little attention has been paid at these individual differences in personality trait changes (e.g., which factors can explain individual differences in personality trait changes, why people differ in their reaction to negative life events; Blackie & Jayawickreme, 2022; Jayawickreme et al., 2020).

As personality traits are powerful predictors of various life outcomes (e.g., work satisfaction or relationship satisfaction), understanding individual differences in personality trait changes is highly relevant (Bleidorn et al., 2019). For example, understanding which factors might explain individual differences in personality trait changes would help to identify people at risk for potentially unwanted personality trait changes (e.g., becoming more neurotic). Furthermore, knowledge about personal, environmental, and event-related factors that shape individual differences in personality trait changes could inform us about the process and mechanisms of these changes and may thus advance theories of personality development.

In this study, we examined individual differences in personality trait changes in a sample of participants who recently experienced a negative life event (death of a loved one, relationship breakup, job loss, friendship dissolution, or failing an important exam). Examining personality trait changes after the occurrence of negative life events might be a particularly interesting context to uncover individual differences in personality trait changes for several reasons. First, negative events can cause personality trait changes (Jayawickreme & Blackie, 2014; Specht, 2017), and individual differences in personality

trait changes might occur due to individual differences in the experienced events (e.g., people may differ in their perception of the experienced negative events; *event-related factors*; Luhmann et al., 2021). Second, individual differences in people's ability to cope and navigate through their lives (*personal factors*) that might generally be important to understand individual differences in personality traits under any circumstances might become particularly relevant after the occurrence of negative events (Bender et al., 2011). Third, life events often do not occur in isolation but as part of predictable sequences of major and minor environmental changes (Bleidorn et al., 2020; Luhmann et al., 2014). Thus, examining individual differences after the occurrence of a negative life event is an interesting context as further environmental changes (*environmental factors*) might be particularly likely.

In summary, we aimed to advance our understanding of individual differences in personality trait changes by examining such individual differences in a psychologically salient context (i.e., after the occurrence of negative life events). In line with theories and research on individual differences in other variables such as subjective well-being and depression (e.g., Abramson et al., 1989; Beck & Bredemeier, 2016; Stroebe et al., 2006; Vieth et al., 2022), we examined possible personal, environmental, and event-related moderators of personality trait changes. By simultaneously including these different moderators, we aimed to gain a detailed understanding of individual differences in these changes.

3.1.1   *Personal Factor: Level of Personality Functioning*

We propose that the level of personality functioning is an important personal factor moderating people's personality trait changes. The level of personality functioning is defined as impairments in self and interpersonal functioning. The concept plays a central role in the Alternative Model for Personality Disorders in DSM-5 (American Psychiatric Association, 2013) as it is proposed to be the common core of all personality disorders, albeit with significant variation at sub-clinical levels as well (Sharp & Wall, 2021). This concept is similar to constructs such as ego strength or psychological maturity, in providing a general dimension of adaptability to the stresses of life (Bender et al., 2011; Hopwood et al., 2022). Thus, it integrates several aspects that have proven to be relevant to explain

individual differences in psychological health, adjustment, and adaptivity (Asselmann et al., 2021; Bender et al., 2011; Einav & Margalit, 2020; Holahan & Moos, 1986).

People low in personality functioning tend to have a distorted self-image, impairments in their sense of agency and autonomy, difficulties in setting goals, and non-satisfying interactions with others (Sharp & Wall, 2021). As such, the level of personality functioning represents a prime candidate moderator of personality changes—particularly following negative life events, in that people with a low level of personality functioning are likely to have a more difficult time dealing with negative life events (Pagano et al., 2004; Sharp & Wall, 2021; Updegraff & Taylor, 2000). We hypothesized that after the occurrence of a negative life event, a lower level of personality functioning is associated with less favorable personality trait changes (i.e., increases in neuroticism, decreases in agreeableness, conscientiousness, extraversion, and openness) (Hypothesis 1).

3.1.2 *Environmental Factor: Environmental Changes*

A negative life event may cause further minor and major changes in the environment. For example, a relationship breakup may be followed by a relocation, friendship dissolutions, and/or changes in one's financial situation. These associated environmental changes may transmit the effect of the initial negative event but they may also be individually associated with personality trait changes (Bleidorn et al., 2020; Luhmann et al., 2014). Thus, examining the associations between environmental changes and personality trait changes might be particularly fruitful after the occurrence of a negative event. Different theoretical approaches such as Neo-Socioanalytic Theory (Roberts & Nickel, 2017), the TESSERA framework (Wrzus & Roberts, 2017), or the Integrative State Process Model (Geukes et al., 2018) converge on the idea that environmental changes trigger personality trait changes. Thus, a less stable environment should be associated with more pronounced personality trait changes. Notably, however, the opposite effect of environmental changes has also been proposed as a possible mechanism explaining *stability* of personality traits. The Paradoxical Theory of Personality Coherence suggests that under unstable environmental conditions personality traits should be more stable (Caspi & Moffitt, 1993; Caspi & Roberts, 2001). From this perspective, existing individual differences in personality traits should play out in explaining how people deal with changing environmental conditions.

In summary, the common theme across different theoretical perspectives is that environmental changes should be able to explain individual differences in personality changes. However, the suggested directions of associations between environmental changes and personality trait changes diverge. To test these conflicting suggestions, we explored whether and how different environmental changes (major life events and minor life events) are associated with individual differences in personality trait changes.

3.1.3   Event-Related Factor: Event Characteristics

There is emerging evidence that different types of negative life events (e.g., a job loss or the death of a loved one) can have different implications for personality trait changes (e.g., Denissen et al., 2019; Lüdtke et al., 2011). However, previous studies focused on the mere occurrence of different event types. Recently, attention has turned to a more detailed assessment of life events: understanding how specific subjective and objective characteristics of life events might affect personality change and stability (Blackie & Jayawickreme, 2022; Bleidorn et al., 2020; Haehner, Kritzler, & Luhmann, 2023; Jayawickreme et al., 2020; Luhmann et al., 2021)

Perceived Event Characteristics

Perceived event characteristics can be assessed along several dimensions such as valence, predictability, or impact (Haehner et al., 2022; Luhmann et al., 2021). There is robust evidence that people differ in the way they perceive negative life events (Kandler & Ostendorf, 2016; Kritzler et al., 2022; Luhmann et al., 2021), and several authors proposed that perceived event characteristics should be considered to better understand personality trait changes (Bleidorn et al., 2020; Jayawickreme et al., 2020; Luhmann et al., 2021; Vries et al., 2021). Initial evidence supports the role of perceived event characteristics in predicting individual differences in personality trait changes (Haehner et al., 2022; Schwaba et al., 2023; Vries et al., 2021). The most consistent result across these studies was that perceiving events more negatively was associated with less favorable changes in neuroticism from pre- to post-event (i.e., either a stronger increases or less pronounced decrease in neuroticism). Building on this evidence, we hypothesized that perceiving the examined life events more negatively is associated with less favorable trajectories in neuroticism after the event (Hypothesis 2).

Other perceived event characteristics may also help to explain individual differences in personality trait changes (Haehner et al., 2022; Schwaba et al., 2023; Vries et al., 2021). The perceived impact of a life event refers to perceived changes in social roles and everyday life. As changes in social roles and everyday life are supposed to convey personality trait changes (Geukes et al., 2018; Roberts et al., 2005; Roberts & Nickel, 2017), perceiving negative events as more impactful should be associated with more pronounced personality trait changes in reaction to these events. We hypothesized that perceiving negative events as more impactful is associated with less favorable personality trait changes (i.e., increases in neuroticism, decreases in agreeableness, conscientiousness, extraversion, and openness) (Hypothesis 3). Further perceived event characteristics that might help to explain individual differences in personality trait changes include the perceived predictability, extraordinariness, challenge, social status change, change in world views, emotional significance, and external control of an event (Haehner et al., 2022; Luhmann et al., 2021; Rakhshani et al., 2021).

Objective-Descriptive Event Characteristics

Life events vary not only in their perceived characteristics but also in their objective characteristics. Objective-descriptive event characteristics reflect the causes, content, and circumstances of a life event and are (more or less) not subject to interpretation[4] (Haehner, Kritzler, & Luhmann, 2023). However, whereas perceived event characteristics such as valence or impact could apply to any life event, objective-descriptive event characteristics are specific to a certain life event. For example, objective-descriptive characteristics of a job loss involve the reason for the job loss and the type of employment, whereas objective-descriptive features for a breakup involve the relationship duration and the initiator status of the breakup (see Table 3.1). A methodological consequence is that subjective experiences of life event can be examined across people who experienced different kinds of events, whereas objective-descriptive event characteristics must be examined within groups who experienced the same kind of event.

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[4] In this chapter, we used a rather broad conceptualization of objective-descriptive event characteristics. That is, we also included characteristics of major life events that may not be completely independent of the perspectives and views of the participant (e.g., information on who initiated a separation or information on the reasons for a friendship dissolution).

There is convincing evidence that objective-descriptive event characteristics can explain individual differences in changes in subjective well-being (e.g., having a joint apartment with the ex-partner: Rhoades et al., 2011), loneliness (e.g., initiation of a breakup: Halford & Sweeper, 2013; cause of death: van der Houwen et al., 2010), depression (e.g., cause of death: Boelen, 2012; Wijngaards-de Meij et al., 2005; initiation of breakup: Samios et al., 2014), and grief (e.g., the cause of death: Boelen, 2012; Wijngaards-de Meij et al., 2005). In contrast to these results, Allemand, Hill, and Lehmann (2015) found that the objective-descriptive event characteristic "having children or not" was not associated with personality trait changes in the context of divorce.

However, there are theoretical reasons to assume that objective-descriptive characteristics are relevant for personality trait changes. First, objective-descriptive event characteristics provide important details about life events and may thus indicate the relevance of an event for people's everyday life and the associated behavioral, affective, and cognitive changes (Haehner, Kritzler, & Luhmann, 2023; Halford & Sweeper, 2013; van der Houwen et al., 2010). For example, think again about a relationship breakup and its possible consequences. Breaking up after a long-term relationship with joint children, a joint circle of friends, and a joint apartment will probably affect one's life more than breaking up after a relationship that just started. Thus, the objective-descriptive event characteristics *relationship duration* and *interconnectedness* (see Table 3.1 for details) should explain whether and how personality traits change after experiencing a breakup. Second, objective-descriptive event characteristics provide information about the causes of a life event (e.g., the cause of death, the reasons for a job loss, the initiation of a breakup). There is initial evidence that information on the causes of negative life events are relevant for the resulting personality trait changes (e.g., Kandler et al., 2012; Shiner et al., 2017). For example, uncontrollable but not controllable negative life events were associated with an increase in neuroticism (Kandler et al., 2012). It follows that a partner-initiated breakup may lead to greater increases in neuroticism than a self-initiated breakup. In summary, there are theoretical and empirical reasons to expect that objective-descriptive event characteristics are relevant to better understand individual differences in post-event personality trait changes. In Table 3.1, we provide an overview on the 22 objective-descriptive event characteristics that we explored in the present study.

Table 3.1: *Assessment of the Objective-Descriptive Event Characteristics*

Life Event	Objective-descriptive event characteristic	Assessment
Death of a loved one	Relationship to the deceased person	Categorical variable, six levels: *first-degree relative, partner, grandparent, other relative, friend, another close person*
	Cause of death	Dichotomous variable, two levels: *natural death, non-natural death*
	Age of deceased person	Metric variable (assessed in years)
	Frequency of contact before death	Metric variable (ranging from *daily* to *less than monthly*)
Relationship breakup	Relationship duration	Metric variable (assessed in month and years)
	Marriage	Dichotomous variable, two levels: *not married, married*
	Interconnectedness	Metric variable (sum score of variables indicating whether the couple had joint children, a joint apartment, joint finances, joint pets, and a joint circle of friends)
	Initiation of breakup	Categorical variable, four levels: *amicably, self-initiated, partner-initiated, other*
	Current contact	Metric variable (mean of variables assessing current digital and current personal contact)
Job loss	Duration of employment	Metric variable (assessed in month and years)
	Only employment	Dichotomous variable, two levels: *no, yes*
	Type of employment	Categorical variable, three levels: *full time, part time, mini-job or other*
	Registered as unemployed	Dichotomous variable, two levels: *no, yes*
	Reason for end of employment	Categorical variable, three levels: *dismissed, resigned or no extension, other*
	Looking for new employment	Dichotomous variable, two levels: *no, yes*
Friendship dissolution	Duration of friendship	Metric variable (assessed in years)
	Initiation of dissolution	Categorical variable, four levels: *amicably, self-initiated, friend-initiated, other*
	Current relationship	Categorical variable, four levels: *distanced, no contact, at odds, other*
	Reason for friendship dissolution	Categorical variable, five levels: *dispute, contact loss, no trust, new friends, other*
Failing an important exam	Type of exam	Categorical variable, five levels: *important college exam, final attempt of college exam, state exam, vocational exam, other*
	Consequence of not passing	Categorical variable, four levels: *none, extended education period, change education, other*
	Duration of education path	Metric variable (assessed in years)

Note. This table was adopted from Haehner, Kritzler, and Luhmann (2023). For all categorical variables, the category that is named first was used as reference category in the analyses. We also included characteristics of major life events in this table that may not be completely independent of the perspectives and views of the participant (i.e., strict objectiveness was not required).

3.1.4 The Present Study

In the present study, we simultaneously examined event-related factors (objective-descriptive and perceived event characteristics), personal factors (level of personality functioning), and environmental factors (environmental changes) that may explain individual differences in post-event personality traits changes. We had three specific hypotheses: 1) a lower level of personality functioning is associated with less favorable personality trait changes after the occurrence of a negative life event; 2) perceiving the considered life events more negatively is associated with less favorable trajectories in neuroticism after the event; and 3) perceiving the considered life events as more impactful is associated with less favorable personality trait changes. We examined these hypotheses and the relevance of other potential moderators using a 5-wave longitudinal study conducted with participants who recently experienced one of five negative life events (death of a loved one, relationship breakup, job loss, friendship dissolution, failing an important exam). As all measurement occasions took place after the occurrence of the negative event, we could not differentiate between event-related personality changes and normative personality trait changes. Instead, we considered the repeated post-event personality assessments as an interesting context to examine individual differences in personality trait changes.

3.2 Methods

3.2.1 Transparency and Openness

This article is based on data from the *Post-Event Changes Study*—a 5-wave longitudinal online study conducted in 2021 and 2022. Data collection of the *Post-Event Changes Study* was approved by local ethics committee of Ruhr-University Bochum. The study design was preregistered at https://osf.io/yacuh. Analyses and hypotheses for the present article were preregistered at https://osf.io/4z6m7. Deviations from this preregistration are summarized in Table S3.1. Furthermore, we conducted several not preregistered exploratory analyses (as indicated below). All data, analysis scripts, a codebook, and a HTML-document containing additional results can be retrieved from https://osf.io/twhgs.

3.2.2 Procedure

The *Post-Event Changes Study* was addressed to people who had experienced the death of a loved one, a relationship breakup, a friendship dissolution, a job loss, or failing an important exam in the last 5 weeks. People interested in the *Post-Event Changes Study* first

had to register for it. This registration comprised providing informed consent, providing an email address, and verifying the inclusion criteria (German-speaking, being of legal age, and experience of one of the above-mentioned life events in the last 5 weeks). Thereafter, participants were invited via email to the five measurement occasions of the study (T1 to T5; 0, 4, 8, 16, 24 weeks after registration).

At T1, participants indicated how many weeks ago the negative life event occurred, rated the perceived characteristics of this event, and answered questions regarding the objective-descriptive characteristics of this event. Furthermore, the level of personality functioning and the Big Five personality traits were assessed at T1. Participants' personality traits were also assessed at T2 to T5. In addition, at T2 to T5, participants indicated which major and minor life events they had experienced since the last assessment using a checklist (see the study-design preregistration for a complete list of all measures used in the *Post-Event Changes Study*).

3.2.3   *Participants*

In total, 1,673 people registered to take part in the *Post-Event Changes Study*. As preregistered, we excluded data from measurement occasions where participants provided no or incorrect answers to the instructed response items (e.g., "To ensure data quality, please select the response option *not true at all*"). Furthermore, we excluded participants who provided either no information on the timing of the experienced negative life event or who indicated that event occurred outside the requested time frame (i.e., more than 6 weeks ago: 5 weeks before registration plus up to 1 week to complete T1).

Applying these exclusion criteria led to a final sample size of $N = 1,069$. 74% of the sample identified as female, 24% as male, and approximately 1% as non-binary. The mean age of participants was 29.10 years ($SD = 9.19$). 74% of the participants reported to have a high school graduation and 12% indicated that they were not born in Germany. Demographic characteristics separately for the five negative life events are summarized in Table 3.2.

Table 3.2: *Demographic Characteristics Separately for the Five Considered Negative Life Events*

Demographics	Relationship breakup	Friendship dissolution	Failing an important exam	Death of a loved one	Job loss
N_{T1}	339	237	106	307	80
M_{Age} (*SD*)	28.49 (7.94)	28.46 (9.08)	27.27 (6.47)	30.49 (10.95)	30.71 (9.45)
% female	71.98	78.90	63.21	79.15	65.00
% male	27.43	18.57	35.85	19.54	32.50
% non-binary	0.59	2.53	0.94	1.30	2.50
% high school graduation	73.75	75.53	77.36	71.99	67.50
% not born in Germany	11.87	12.24	16.98	12.09	11.25

3.2.4 Measures

Big Five Personality Traits (T1 to T5)

Big Five personality traits were assessed using the German BFI-2-XS (Rammstedt et al., 2018; Soto & John, 2017). Each Big Five personality trait was assessed with three items (e.g., for extraversion: "I am somebody who is full of energy"). Participants rated the items on a 5-point scale ranging from 1 (*not true at all*) to 5 (*absolutely true*). We reversed answers if appropriate and calculated mean scores for the analyses.

Perceived Event Characteristics (T1)

We used the Event Characteristics Questionnaire (Luhmann et al., 2021) to assess nine perceived event characteristics: *challenge* (4 items, e.g., "The event exhausted me"), *change in world views* (4 items, e.g., "The event changed my attitudes"), *emotional significance* (4 items, e.g., "The event was emotionally significant to me"), *external control* (4 items, e.g., "The event was in the hands of other people"), *extraordinariness* (4 items, e.g., "The event was extraordinary"), *impact* (4 items, e.g., "I had to change my life because of the event"), *predictability* (4 items, e.g., "I knew in advance that the event would be happening"), *social status change* (4 items, e.g., "The event impaired my social status), *valence* (6 items, e.g., "The event was beneficial"). Items were rated on a 5-point scale ranging from 1 (*not true at*

all) to 5 (*absolutely true*). We reversed answers if appropriate and calculated mean scores for the nine perceived event characteristics.

Objective-Descriptive Event Characteristics (T1)

The objective-descriptive event characteristics that were assessed for the five negative life events are summarized in Table 3.1.

Level of Personality Functioning (T1)

The level of personality functioning was assessed using the LPFS-BF 2.0 (Spitzer et al., 2021; Weekers et al., 2019). This measure comprises 12 items assessing two dimensions of personality functioning: impairments in self-functioning (e.g., "I often do not know who I really am") and impairments in interpersonal functioning (e.g., "I often feel very vulnerable when relations become more personal"). The items were rated on a 4-point scale ranging from 1 (*not true at all*) to 4 (*absolutely true*). We used a mean score of all 12 items in the analyses since the two subscales are highly interrelated and since a unidimensional scoring is in line with the theoretical conceptualization of the level of personality functioning (Hopwood et al., 2018; Spitzer et al., 2021).

Indicators of Environmental Changes (T2 to T5)

At T2 to T5, participants received a checklist including 33 major and minor environmental changes and life events (e.g., relocation, changes in working situation, or financial changes). This checklist was based on other inventories such as the Life Experience Survey (Sarason et al., 1978) and the List of Threatening Experiences (Brugha et al., 1985). Participants were asked to indicate all environmental changes they had experienced since the last measurement occasion. In the analyses, we considered each environmental change as a separate dichotomous predictor (0 = *event not experienced since the last measurement occasion*, 1 = *event experienced since the last measurement occasion*). However, to ensure that each predictor had at least some variance, we only included predictors for environmental changes that have been experienced at least 20 times within the overall sample—leaving, in total, 21 indicators of environmental changes.

3.2.5 Data Analysis

Analyses were conducted in R (Version 4.1.2). As first step, we checked measurement invariance of our scales to allow valid comparisons over time and across events. Second, we

used longitudinal multilevel models with measurement occasions (Level 1) nested in participants (Level 2) to address our research questions and test our hypotheses.

Measurement Invariance

To ensure valid comparisons of Big Five trait scores from different measurement occasions, strong longitudinal measurement invariance of the different traits is required (Putnick & Bornstein, 2016). We tested this precondition using R packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2020). As described in detail in the supplemental material all traits fulfilled the precondition of strong measurement invariance (Table S3.2).

Additionally, we tested measurement invariance of all metric scales across events (perceived event characteristics, personality traits, and level of personality functioning) as our analyses required at least weak invariance across events. All personality traits and the level of personality functioning fulfilled this requirement. However, for five perceived event characteristics, misfits and issues with weak measurement invariance were found (see the supplemental material for details; Tables S3.3 and S3.4). To deal with this finding, we ran all analyses twice: once using the perceived event characteristics as originally proposed, once using modified versions of these five perceived event characteristics which excluded certain non-invariant items. The results of both versions were nearly identical (see the HTML-document for details). Thus, in the following, we only report findings using the original version of the perceived event characteristics.

Modeling Strategy for Multilevel Models

We estimated separate multilevel models for the different Big Five personality traits. In each multilevel model, one of the Big Five personality traits served as dependent variable. Time since the event occurrence served as Level 1-predictor. Indicators of environmental changes served as Level-1 moderators; level of personality functioning, perceived event characteristics, and objective-descriptive event characteristics or event type were included as Level-2 moderators. For all moderators, we simultaneously estimated their main effects and their cross-level interactions with time. Additionally, we included the main effect of age in all models to control for age-graded personality differences.

Our analyses were two-fold. First, we conducted a combined analysis across all five negative life events to maximize power and detect factors that can explain individual differences in personality trait changes after the occurrence of different negative events. In this combined

analysis, event type was included as moderator. Second, we conducted five event-specific analyses. These analyses allowed a closer look at the factors that explain individual differences after the occurrence of a specific negative life event. Furthermore, as the objective-descriptive event characteristics are nested within event types, they could only be included in these event-specific analyses.

Multilevel Lasso Estimation

We estimated our multilevel models using a *multilevel lasso* approach as implemented in the R package *splmm* (Yang & Wu, 2021). We chose this approach for model estimation and variable selection as it is supposed to be more rigorous compared to standard *restricted maximum likelihood* estimation (REML) when there are many predictors and sample sizes are relatively low (Finch, 2018; Schelldorfer et al., 2011). In particular, in a simulation study by Finch (2018), multilevel lasso yielded better control of the Type I error and better parameter coverage than REML-estimation in a scenario similar to our study.

The multilevel lasso regression estimates fixed effects using a penalty to the standard least squares estimator. This penalty pushes fixed effects closer to zero. Furthermore, variables which are not important for the prediction of the dependent variable obtain a fixed effect of exactly zero and are thus eliminated from the model (i.e., variable selection; Finch, 2018; Finch et al., 2019). The penalty that is applied to the fixed effects depends on the tuning parameter λ. As recommended by Schelldorfer et al. (2011), we used the BIC to compare a range of different tuning parameters ($0.00 \leq \lambda \leq 0.65$) and to select the optimal tuning parameter.

Currently, estimation of standard errors and significance tests is not implemented for the multilevel lasso approach and sometimes researchers treat all selected variables as important (i.e., all variables that received a non-zero estimate by the multilevel lasso estimator; Finch et al., 2019). However, a non-zero estimate alone is not sufficient for statistical inference (Hastie et al., 2015; Kammer et al., 2020; Zhao et al., 2021). Therefore, we additionally applied a 6-step block-bootstrapping approach to estimate confidence interval for fixed effects as recently introduced by Finch (2018). First, we estimated the multilevel model with all moderators using the original sample and the optimal tuning parameter selected through the BIC-criterion. Second, we created a new dataset by drawing N participants with replacement from our original sample (where N is the number of

participants in the original sample). Third, in this new dataset, we estimated the same multilevel models with the same tuning parameter as in Step 1 and extracted the fixed effects. Fourth, we repeated Step 2 and Step 3 1,000 times and extracted the fixed effects from each model to obtain bootstrapped distributions of fixed effects. Fifth, we computed the 99%-confidence intervals for all fixed effects based on these bootstrapped distributions. If the 99%-confidence interval of the cross-level interaction between a Level-2 predictor and time does not include zero, this Level-2 predictor can explain significant individual differences in personality trait changes. Furthermore, as suggested by Hastie et al. (2015), we also computed the probability that a certain predictor obtains a non-zero estimate across the 1,000 bootstrapped re-samples ($P_{selected}$) with high probabilities indicating that a predictor was consistently selected.

We computed multilevel models with random intercepts only as random slopes did not converge in any of the estimated multilevel lasso models. As highlighted by Heisig and Schaeffer (2019), omitting random slopes may lead to overly liberal statistical inference (e.g., t-tests) of cross-level interactions but coefficients of fixed effects are not systematically biased. Thus, the non-convergence of random slopes should not affect our block-bootstrapping approach.

Furthermore, multilevel lasso estimation requires all variables in the model to have a mean of zero and a standard deviation of one. As this has also to apply for categorical variables and time, parameter interpretation may be less intuitive compared to standard REML-estimation (Huang & Montoya, 2020). Hence, standardized fixed effects are better extracted from a standard REML-estimation in which categorical variables and time can be coded as desired to improve interpretation (as done in our exploratory analyses below).

Power Analysis

To estimate our power to detect significant cross-level interactions, we ran several power simulations using the R package *simr* (P. Green & MacLeod, 2016). These power simulations suggested that—based on the conventions by Funder and Ozer (2019)—we had sufficient power to detect strong effects for all examined life events (i.e., cross-level interactions explaining a 0.63 *SD* difference in personality trait changes over 6 months between individuals who differ by 1 *SD* on a metric moderator such as a perceived event characteristic). Furthermore, we had sufficient power to detect medium-sized effects for

the three examined negative life events with the largest sample sizes (i.e., cross-level interactions explaining a 0.41 *SD* difference in personality trait changes between individuals who differ by 1 *SD* on a metric moderator). Finally, we had sufficient power to detect even small effects in the combined event analysis (i.e., cross-level interactions explaining a 0.20 *SD* difference in personality trait changes between individuals who differ by 1 *SD* on a metric moderator; Figure S3.1).

## 3.3   Results

3.3.1   Descriptive Statistics

Correlations among all metric study variables are summarized in Table 3.3. Additionally, we computed correlations between personality traits at T1 and the occurrence of environmental changes at later measurement occasions to gain an impression of selection effects for these environmental changes. Extraversion was, for example, associated with changes in work situation ($r = .08$, $p = .0008$), going on vacation ($r = .08$, $p = .013$), and starting a new friendship ($r = .08$, $p = .010$), whereas neuroticism was associated with friendship dissolutions ($r = .08$, $p = .012$) and problems with law ($r = .06$, $p = .036$). A complete table with the correlations between personality traits and environmental changes is included in the HTML-document. Further descriptive statistics can be found in the supplemental material (Table S3.5 to S3.13). Changes in the Big Five personality traits over the time course of the study for 100 randomly selected participants are illustrated in Figure 3.1. All five traits had a relatively stable mean-level in the 6 months after the experience of a negative life event. However, the figure also shows substantial individual differences in change: Some people do not change within in the time frame of the study, some change in a positive direction, and others in a negative direction.

Table 3.3: *Correlations Among Metric Study Variables and Gender at T1*

No.	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Agreeableness																
2	Conscientiousness	.18															
3	Extraversion	.06	.24														
4	Neuroticism	-.20	-.28	-.27													
5	Openness	.16	.06	.29	-.19												
6	Personality functioning	-.27	-.34	-.25	.59	-.16											
7	Challenge	.01	-.12	-.09	.28	-.02	.23										
8	Change in world views	.11	.00	-.03	.11	-.03	.14	.32									
9	Emotional significance	.09	-.01	-.05	.20	-.04	.10	.55	.34								
10	External control	-.04	-.06	.05	.08	.09	.14	.11	.13	.02							
11	Extraordinariness	-.06	-.01	-.05	.11	-.05	.12	.26	.23	.21	.26						
12	Impact	-.01	-.12	-.08	.21	.01	.19	.53	.48	.45	.22	.28					
13	Predictability	-.08	-.04	.03	-.04	.04	-.03	-.15	-.15	-.21	-.24	-.29	-.12				
14	Social status change	-.01	-.15	-.05	.21	.03	.27	.31	.25	.12	.44	.31	.52	-.16			
15	Valence	.01	.02	.07	-.10	.02	-.04	-.35	.00	-.49	-.02	-.12	-.15	.36	-.03		
16	Age	.05	.10	.08	-.11	.07	-.11	-.03	-.07	.08	.04	.05	.02	-.06	-.01	-.06	
17	Gender [a]	.06	.09	-.04	.20	-.10	.05	.14	.09	.17	-.05	-.01	.05	-.05	-.08	-.03	-.06

[a] We dichotomized gender (0 = *male*, 1 = *female*) to estimate point-biserial correlations with other variables.

Figure 3.1: *Descriptive Changes in the Big Five Personality Traits for 100 Randomly Selected Participants*
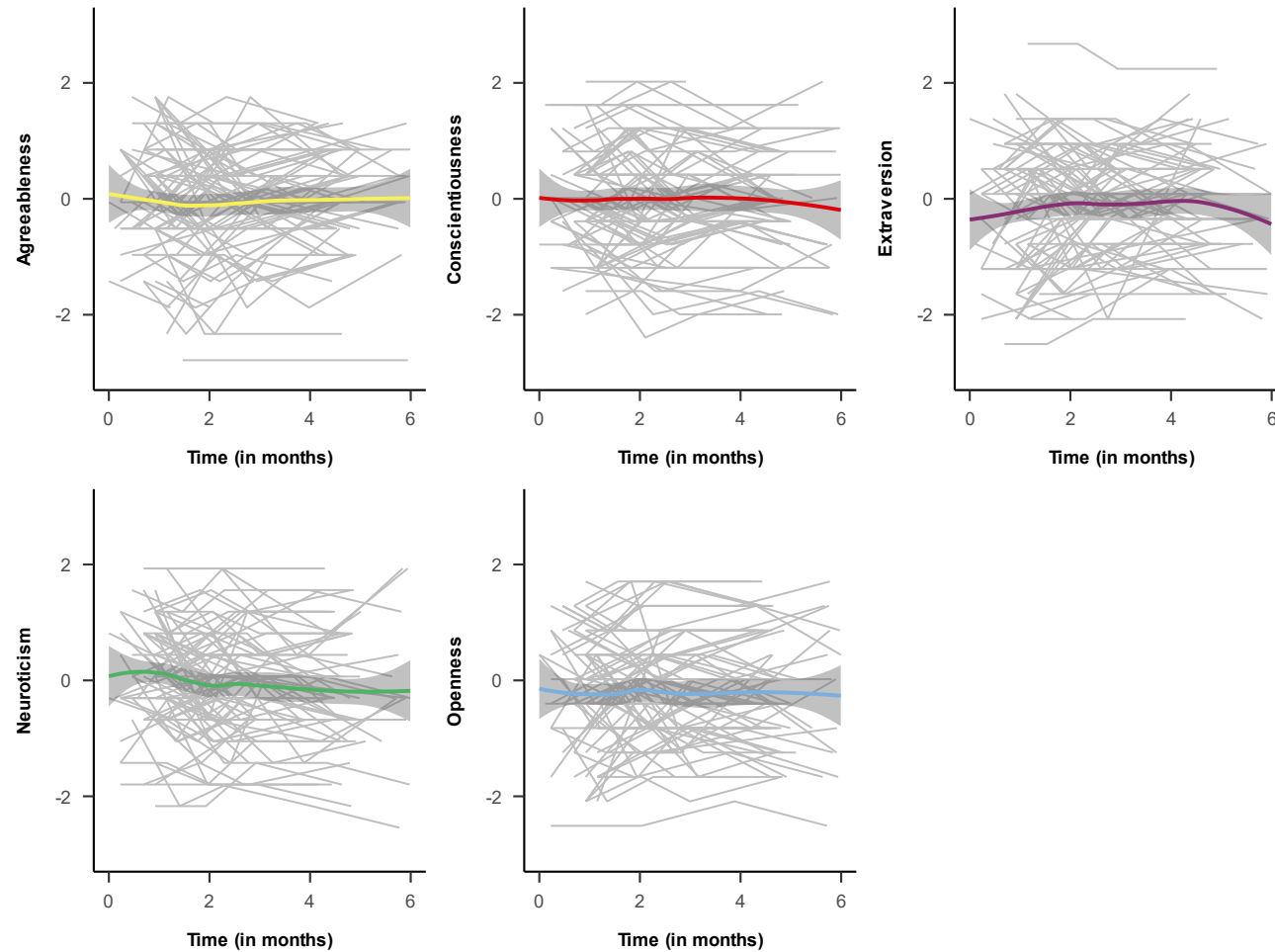
Note. Big Five personality traits were standardized using their overall grand mean and standard deviation across all measurement occasions. Furthermore, a LOESS curve with confidence interval is depicted for each trait.

3.3.2 Combined Analysis Across All Five Negative Life Events

To examine which variables can explain individual differences across all five negative life events, we estimated multilevel models using the level of personality functioning, indicators of environmental changes, perceived event characteristics, and event type as moderators. Complete results of this analysis can be found in the HTML-document. Based on the bootstrapped confidence intervals, few significant effects emerged. Higher personality dysfunction was associated with lower agreeableness ($b = -0.159$, 99% CI = [-0.228, -0.089], $P_{selected} = 1.000$), lower conscientiousness ($b = -0.143$, 99% CI = [-0.217, -0.070], $P_{selected} = 1.000$), lower extraversion ($b = -0.093$, 99% CI = [-0.162, -0.024], $P_{selected} = 1.000$), and higher neuroticism ($b = 0.438$, 99% CI = [0.380, 0.496], $P_{selected} = 1.000$). Furthermore, higher perceived challenge of negative life events was associated with higher neuroticism ($b = 0.069$, 99% CI = [0.003, 0.1134], $P_{selected} = .997$). Neuroticism was also the only trait that significantly changed over time ($b = -0.052$, 99% CI = [-0.082, -0.022], $P_{selected} = 1.000$). Most pertinent to the study goals, no significant cross-level interactions were found, indicating that none of our potential moderators was able to explain individual differences in personality trait change across all five negative events.

3.3.3 Event-Specific Analyses

To examine which variables can explain individual differences after specific negative life events, we estimated five event-specific models using the level of personality functioning, indicators of environmental changes, perceived event characteristics, and objective-descriptive event characteristics as moderators. The results are summarized in the HTML-document. In general, the pattern of findings was similar to the combined analysis. Higher personality dysfunction was associated with lower consciousness (for the death of a loved one), and higher neuroticism (for all events except for failing an important exam). Furthermore, neuroticism on average decreased in the months after experiencing a relationship breakup ($b = -0.072$, 99% CI = [-0.131, -0.013], $P_{selected} = .997$). However, there were again no significant interactions between time and any of our personal, environmental, and event-related moderators.

3.3.4 Exploratory Analyses

In summary, using our preregistered criteria, none of the examined moderators significantly explained individual differences in personality trait changes and thus our

findings were also not in line with our three preregistered hypotheses. However, as the multilevel lasso estimation is a rather new approach (Finch et al., 2019; Schelldorfer et al., 2011), we conducted several additional (not preregistered) analyses to test whether these null finding were attributable to the employed statistical method. We estimated multilevel models employing the standard and commonly used REML-estimation. In these exploratory analyses, we coded time in months since event occurrence, standardized all metric variables using their overall grand mean and standard deviation, and dummy-coded all categorical variables.

We also varied several aspects of the model specification inspired by existing studies examining individual differences in event-related changes (e.g., Luhmann et al., 2021; van der Houwen et al., 2010; Vries et al., 2021). First, we estimated a multilevel model with random intercepts only, which simultaneously included the main effects and interaction effects of all moderators (e.g., as done by Rhoades et al., 2011). This model (Model 1) was the most direct equivalent of our multilevel lasso estimation. Second, when possible, we additionally included random slopes in these multilevel models (Model 2). Third, we estimated multilevel models including the main effects and interaction effects of our moderators domain-wise (i.e., separate models for person-related factors, environment-related factors, perceived event characteristics, and objective-descriptive event characteristics) (e.g., as done by Halford & Sweeper, 2013; van der Houwen et al., 2010; Model 3). Fourth, we estimated multilevel models using latent factor scores for personality traits instead of manifest mean scores as dependent variables (e.g., as done by Haehner et al., 2022; Vries et al., 2021; Model 4).

We used these different model specifications to test the robustness of effects across different analytical approaches that are typically used in research on individual differences in change. Furthermore, we also used these different multilevel models to estimate and compare standardized fixed effects of interactions (see the HTML-document for details) and to compute R^2 measures for multilevel models (Rights & Sterba, 2019, 2021) to gain a better insight in the size and consistency of the estimated effects.

For each approach, between 978 and 1,160 interactions between time and the different personal, environmental, and event-related moderators were tested, and on average only 2.31% of these interactions were significant (ranging from 1.23% for Model 2 to 3.79% for

Model 4). Thus, while the overall proportion of significant effects was still low in all models, we tended to find more effects in these exploratory analyses than in our preregistered bootstrapped multilevel approach, and the proportion of significant effects was larger than our level of significance (1%). This may indicate that our preregistered approach was more conservative or less powerful/sensitive than other approaches commonly used to examine these kinds of effects. However, our exploratory analyses also show that models without random slopes tend to detect more significant cross-level interactions then models with random slopes. Models without random slopes may thus have been too liberal (Heisig & Schaeffer, 2019). In terms of effect sizes, together, all interactions between time and our moderators on average explained 1.61% of variance in personality traits ($\Delta R_{f1}^2 = 0.30\%$ in the combined event analysis to $\Delta R_{f1}^2 = 3.06\%$ for job loss; see Table S3.14 for details), which corresponds to a very small effect based on the conventions of Funder and Ozer (2019). The overall conclusion of our exploratory analyses is thus similar to the one obtained with the multilevel lasso estimation: we found very limited evidence for moderators of personality trait changes following negative life events.

Nonetheless, there were some interaction effects that consistently obtained non-zero effect sizes and that were quite consistently significant across the different analytical approaches[5]. First, in the combined event analyses, perceiving events as more threatening to social status was consistently associated with less favorable agreeableness trajectories over time (i.e., a stronger decrease or less pronounced increase). Across the different model specifications, the size of the standardized fixed effect varied between β = −0.010 and β = −0.026, indicating that perceiving an event as 1 *SD* more social status threatening was associated with a 0.010 to 0.026 *SD* stronger decrease (or less pronounced increase) in agreeableness over 1 month. Second, changes in neuroticism over time depended on the event type, with friendship dissolutions (β = [0.046, 0.061]) and job losses (β = [0.057, 0.074]) being associated with less favorable neuroticism trajectories (i.e., a stronger increase or a less pronounced decrease) than relationship breakups. Third, for the death of a loved one, we found less favorable changes in agreeableness if the deceased person was a friend instead of a first-degree relative, β = [0.516, 0.584]. Fourth, perceiving a relationship breakup as

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[5] To account for the fact that models without random slopes may be not conservative enough in significance testing of cross-level interactions (Heising & Schaeffer, 2019), we only discuss effects in this section that were also significant in multilevel models with random slopes.

less threatening to one's social status (β = [−0.026, −0.054]) and as more impactful (β = [0.018, 0.042]) was associated with more favorable changes in agreeableness. Fifth, failing an important exam after experiencing a relationship breakup was associated with less favorable trajectories in agreeableness, β = [−0.161, −0.310]. Sixth, graduating after experiencing a relationship breakup was associated with more favorable trajectories in openness (i.e., stronger increase or a less pronounced decrease), β = [0.144, 0.285]. Seventh, after experiencing a job loss, a lower level of personality functioning was associated with less factorable conscientiousness trajectories (i.e., a stronger decrease or a less pronounced increase), β = [−0.040, −0.110]. As an example, we illustrated the two cross-level interactions that were consistently found in the combined event analyses in Figure 3.2. Graphical illustrations of all other promising effects can be found in the HTML-document. In summary, while keeping in mind that our preregistered analyses did not identify any significant moderators of personality change following negative life events, these effects that emerged quite consistently across the different analytical approaches might being worth to be considered in future research.

In a further exploratory analysis, we examined whether our moderators could explain individual differences in common change across different Big Five domains as the effects of most moderators were relatively consistent across different Big Five traits (especially neuroticism, agreeableness, and conscientiousness). In line with DeYoung (2006), we explored whether our predictors explained individual differences in a stability meta-trait composite score reflecting high conscientiousness, high agreeableness, and low neuroticism. In general, findings of this analysis were consistent with the results described above: using a multilevel lasso approach no significant interactions emerged, using more traditional multilevel models a few significant effects were found resembling the above-described promising candidates for future research. More detailed results for this exploratory analysis can be found in the HTML-document.

Figure 3.2: *Illustration of Most Promising Moderators in the Combined Event Analyses*
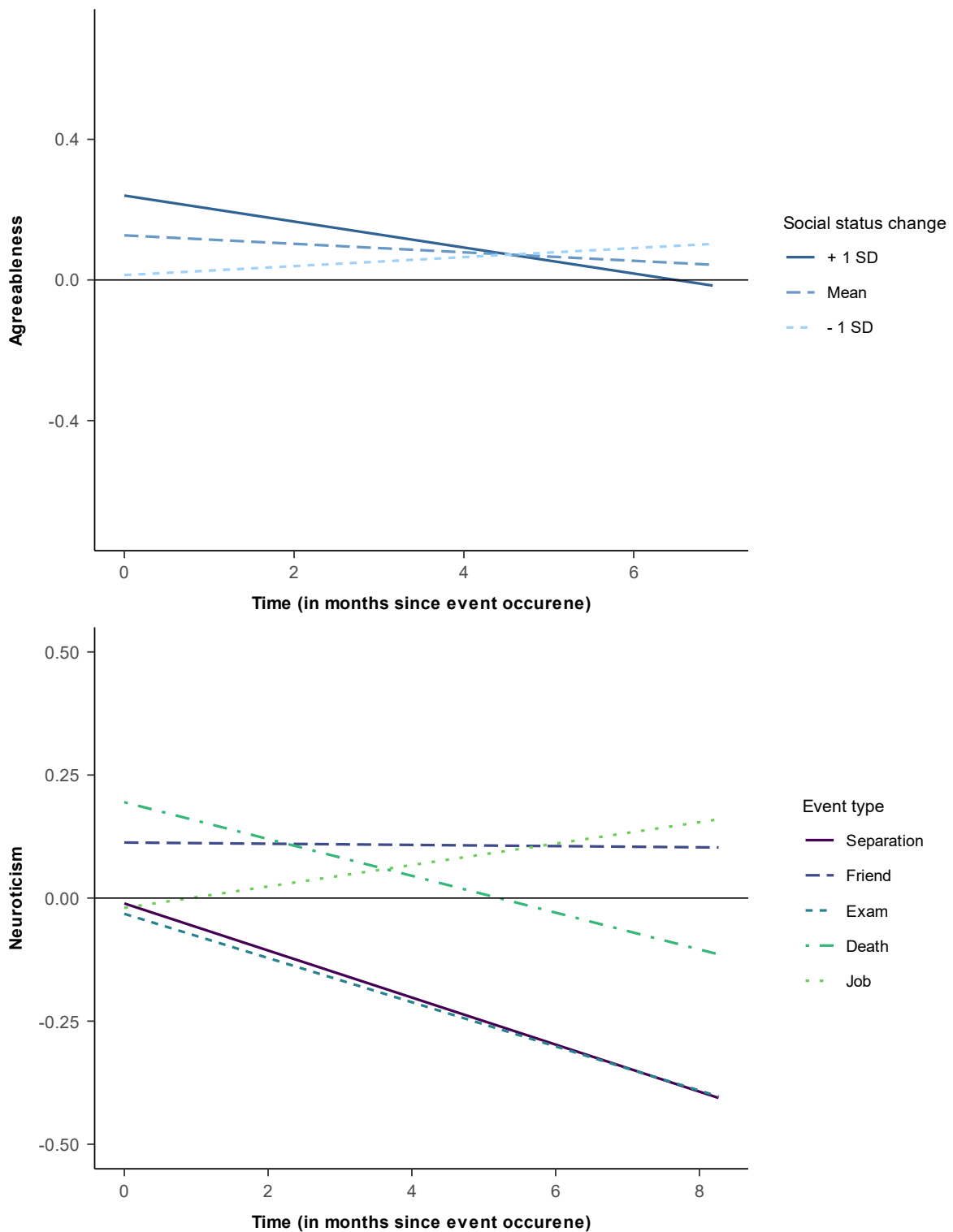
Note. Depicted are simple slopes illustrating individual differences in changes in agreeableness and neuroticism depending on perceived social status changes or the event type, respectively. Illustrations are based on Model 1 (a multilevel model without random slopes in which all moderators were included simultaneously).

3.4   Discussion

Which factors can explain individual differences in personality trait changes after the occurrence of a negative life event? In the present study, we examined the effects of personal, environmental, and event-related moderators in over 1,000 participants who experienced the death of a loved one, a relationship breakup, a friendship dissolution, or failing an important exam in the last 5 weeks. Surprisingly, using our preregistered analyses, we did not find any significant predictors of individual differences in personality trait changes. However, while exploratory analyses generally confirmed this conclusion, they also identified a few effects that might being worth to be considered in future research.

3.4.1   *Explaining Individual Differences in Personality Trait Change*

Although there is robust evidence for individual differences in personality trait changes, factors explaining these individual differences have rarely been examined (Bleidorn et al., 2020; Bleidorn et al., 2021; Denissen et al., 2019; Schwaba et al., 2023). Drawing on theories and research from different areas of psychology (e.g., Abramson et al., 1989; Bender et al., 2011; Jayawickreme et al., 2020; Stroebe et al., 2006; van der Houwen et al., 2010; Wilson & Gilbert, 2008), we proposed several personal, environmental, and event-related factors that might help to better understand individual differences in personality trait changes. However, the overall result of our study is that using our preregistered analysis method these variables did not significantly explain these individual differences.

3.4.2   *Possible Explanations for Our Null Findings*

There are different possible explanations for these null findings. First, perhaps we chose the wrong variables to explain individual differences in personality trait changes. There are indeed potentially relevant variables that we did not examine in the present study (e.g., social support or early life stress; Beck & Bredemeier, 2016; Stroebe et al., 2006). However, the chosen variables were promising candidates to better understand these individual differences. For example, as event-related factors, we examined event types, perceived event characteristics, and objective features of life events. Together, these variables offer a detailed understanding of the experienced negative life event and different authors made the prediction that these variables should be relevant for individual differences in change (Bleidorn et al., 2020; Haehner, Kritzler, & Luhmann, 2023; Jayawickreme et al., 2020; Luhmann et al., 2021; Vries et al., 2021).

Second, perhaps our study period was too short to identify individual differences in change as we only examined the first 6 months after the occurrence of a negative life event. While it is of course important to also understand long-term personality trait changes, it has been shown that personality traits can change quickly (Roberts et al., 2017). Furthermore, as can be seen in Figure 3.1, there were substantial individual differences in personality trait changes within the time frame of our study. Finally, as indicated by research on other constructs such as subjective well-being (Doré & Bolger, 2018; Haehner, Pfeifer, et al., 2023; Suh et al., 1996), the first months after the occurrence of an event might even be particularly relevant to better understand the implications of such an event.

Third, perhaps our study was under-powered. We were able to detect medium-sized effects for three of the examined life events and small effects in the combined analyses (Figure S3.1). Thus, based on standard conventions (Funder & Ozer, 2019) and also compared to research on perceived event characteristics explaining individual differences in other constructs (Fassbender et al., 2022; Luhmann et al., 2021), our study seems to be reasonably powered. However, it may be the effects of individual moderators explaining individual differences in personality changes may be very small and thus even larger sample sizes would be needed to detect these effects (e.g., as also suggested by Fassbender et al., 2022).

Fourth, our limited findings may have had to do with our statistical approach. We used a multilevel lasso estimation to identify relevant variables for individual differences in change. Multilevel lasso estimation is supposed to be well suited for cases like our study where a larger number of possible effects is examined (Finch, 2018; Finch et al., 2019; Schelldorfer et al., 2011). However, our results indicated that the multilevel lasso estimation is likely more conservative than other methods that are currently used to examine individual differences in change (e.g., Fassbender et al., 2022; Haehner et al., 2022; Halford & Sweeper, 2013; van der Houwen et al., 2010).

3.4.3 Effects Identified by Our Exploratory Analyses

In our exploratory analyses, several effects emerged consistently and are thus worthy candidates for future research. We present these effects ranked from most to least confident that they would replicate in future research.

First, perceiving events as more threatening to one's social status was associated with a decrease or a less pronounced increase in agreeableness both in the combined analyses and after experiencing relationship breakups specifically. In line with research on social dominance orientation, perceiving one's social status to be threatened could indeed be related to less agreeable behavior (Nicol & France, 2016; Perry & Sibley, 2012).

Second, after a relationship breakup two environmental changes moderated personality trait changes: Failing an important exam was associated with less factorable changes in agreeableness, and graduating was associated with more favorable openness trajectories. Regarding the latter association, being single after a graduation may allow people to more feely explore new interest, meet new people, and make new experiences. Generally, the finding that certain environmental changes were only significant after experiencing a relationship breakup may be explained by the fact that our sample size was largest for this event.

Third, perceiving a relationship breakup as more impactful was associated with more favorable changes in agreeableness. Maybe, people experiencing a relationship breakup as more impactful are more motivated to engage with new people (e.g., to find a new partner or new friends). Thus, becoming more agreeable could be an adaptive strategy to deal with the relationship breakup (Tashiro & Frazier, 2003).

Fourth, a higher level of personality functioning was associated with more favorable changes in conscientiousness after experiencing a job loss. This finding was in line with our general hypothesis that a higher the level of personality functioning is associated with more favorable personality trait changes after experiencing negative events (Hopwood et al., 2022; Pagano et al., 2004; Sharp & Wall, 2021). However, the level of personality functioning could be particularly relevant for people experiencing a job loss because compared to the other examined events a job loss possibly requires more active coping and behavior (e.g., looking for a new employment, reducing one's expenses). Thus, people low in personality functioning could find it particularly challenging to deal with this negative event (Hopwood et al., 2022; Sharp & Wall, 2021).

Fifth, less favorable changes in agreeableness over time were found when the deceased was a friend rather than a first-degree relative. It may be that when a friend dies, people lose opportunities to show agreeable behavior in their everyday life and thus experience a

decrease in their agreeableness (J. P. Green et al., 2019; Kritzler et al., 2020; Selfhout et al., 2010). However, depending on the relationship with the first-degree relative, the same argument could also be made for them. Thus, sampling error could also be an alternative explanation for this finding.

In general, in this study, our moderators (especially the perceived event characteristics) where best in explaining individual differences in changes in agreeableness and neuroticism. For this reason, we also explored whether we could increase power by looking at the stability meta-trait (high conscientiousness, high agreeableness, and low neuroticism; DeYoung, 2015). While no additional effects were identified by looking at the stability meta-trait, the finding that the perceived event characteristics are most closely related to changes in agreeableness and neuroticism seems to be consistent across studies (Haehner et al., 2022).

3.4.4 *Implications for Future Research on Individual Differences in Change*

The primary goal of our study was to identify factors explaining individual differences in personality changes. However, we did not find any significant effects using our preregistered analyses. Nonetheless, our study has several important implications for future research on individual differences in change.

First, with more than 1,000 participants, our study had sufficient power to detect small to medium sized effects and effect sizes that were expected based on research on individual differences in change in other constructs (Fassbender et al., 2022; Funder & Ozer, 2019; Luhmann et al., 2021). However, our results indicate that the effect sizes for explaining individual differences in personality change may be even more subtle. Research on event-related mean-level changes in personality traits has led to a similar conclusion: The effect of individual life experiences may be smaller than initially expected (Bleidorn et al., 2018; Bleidorn et al., 2020). However, very small effects are not specific for research on personality traits. For example, individual genes can only account for a very small proportion of variance and individual differences in these effects based on epigenetic variants may be even harder to detect (Holland et al., 2016; Morimoto et al., 2020; Mott, 2022; Sullivan, 2010). Thus, learning from this area of research, we probably need large-scale, multi-lab, multi-national studies with many more participants than are customary in

personality change research to better understand the implications of life events (Bleidorn et al., 2020).

Second, such large-scale collaborations would also help to address even more comprehensive sets of moderators. In this study, all moderators together explained on average less than 2% of variance in personality trait changes. Thus, future research needs to broaden the scope, and examine additional potentially relevant variables (e.g., social support, biological factors, engagement in social roles; Allemand, Schaffhuser, & Martin, 2015; Bleidorn et al., 2020; Lodi-Smith & Roberts, 2007). We think that examining personal, environmental, and event-related moderators is a useful framework to study individual differences in change in the context of life events. In the long-term, however, a more holistic assessment of personal, environmental, and event-related factors is needed to understand individual differences in (personality) changes (Bleidorn et al., 2020). New technological and methodological advancements (e.g., smartphone sensing, deep learning) could help to address this issue. Along these lines, with large scale collaborations and methodological advancements, it would also be possible to examine statistically more complex patterns of moderation effects (Harari et al., 2021). For example, moderators might interact with each other, or they might only play a role within a specific time frame after the occurrence of a negative event. Generally, we have only started to better understand individual differences in personality trait changes, and future research on this topic is highly needed.

Third, our exploratory analyses showed that different analytical methods lead to different findings in terms of statistical significance. While this information is not necessarily new (Schweinsberg et al., 2021; Silberzahn et al., 2018; Wijngaards-de Meij et al., 2005), the demonstration in the context of research on personality change is still important. Researchers tend to use different analytical methods across groups or studies, even though each individual study typically sticks to one method (e.g., Fassbender et al., 2022; Halford & Sweeper, 2013; Luhmann et al., 2021; van der Houwen et al., 2010). Thus, diverging findings between studies can be attributed to different samples and different designs but also to different analytical methods. To make the findings of different studies more comparable and to test robustness of effects, robustness checks using different analytical methods should routinely be included (even if the preregistered method led to the desired result). For research on individual differences in change, this is particularly important

given that effects are likely quite small. Furthermore, while statistical significance differed across different analytical approaches, estimation of effect sizes (e.g., standardized fixed effects) was in fact pretty consistent (see HTML-document for details).

Fourth, we preregistered a multilevel lasso approach for model estimation and variable selection. We chose this method as there was initial evidence that multilevel lasso is well suited to test the effects of many potential moderators (Finch, 2018; Schelldorfer et al., 2011). So far, few simulation studies are available, and our study was one of the first that used this method with real data (Finch, 2018; Schelldorfer et al., 2011; Yang & Wu, 2021). Our findings suggest that compared to other estimation methods, multilevel lasso estimation might be a rather conservative approach. Furthermore, computing these multilevel lasso models, we noticed that the selection of the optimal tuning parameter (λ) is not necessarily consistent (e.g., λ seemed to depend on the used seed). Thus, more research on this relatively new estimation method is needed.

3.4.5   Limitations

In addition to the possible reasons for our null findings discussed above, a few further limitations of this study should be considered. First, participants for this study were recruited after they experienced a negative life event, and we considered the repeated post-event personality assessments as an interesting context to examine individual differences in personality trait changes. However, this design implied that we were not able to differentiate between event-related personality changes (selection effects, anticipatory effects, socialization effects) and normative personality trait changes. Second, our sample was predominantly female and recruited in a democratic, western country (Germany). Thus, a replication in other cultures is necessary. Third, we encountered a few issues with measurement invariance of the perceived event characteristics across events. While our robustness checks suggest that these issues likely did not influence our result pattern, the finding that perceived event characteristics are at most weakly invariant across events adds another complexity to research on event-related changes. From a conceptual perspective, it makes sense that perceived event characteristics are understood differently for different events (e.g., maybe people implicitly compare their own perception to other people who experienced the *same* event), however, this issue may impair comparisons across events. Finally, we only used brief self-report measures of personality traits. To gain a complete understanding of individual differences in personality trait changes, other assessment

methods (e.g., informant reports) should be used as findings might differ between these different assessment methods. Furthermore, using longer personality traits inventories would allow moving beyond the broad Big Five trait domains and examining narrower trait facets.

3.4.6 Conclusion

Which factors can explain individual differences in personality trait changes after the occurrence of a negative life event? The main finding of our study is that this question is difficult to answer empirically. However, given that better understanding personality trait changes is of critical practical relevance (Bleidorn et al., 2019; Bleidorn et al., 2020), this study should be seen as a starting point to address this question with important implications for future research. Future research on individual differences in change should consider personal, environmental, and event-related moderators, use different analytical methods, be sufficiently powered to detect very small effects, and focus on promising candidates identified in our exploratory analyses.

3.5 Data Accessibility Statement

The study materials, data, and analysis scripts used for this article can be accessed at https://osf.io/twhgs/. The preregistration for this study can be found at https://osf.io/4z6m7.

3.6 Author Contribution Statement

The contributions of each author according to the CRediT Classifaction:

Peter Haehner: Conceptualization (*lead*), Data Curation (*lead*), Formal Analysis (*lead*), Investigation (*lead*), Methodology (*lead*), Project Administration (*lead*), Software (*lead*), Visualization (*lead*), Writing – Original Draft Preparation (*lead*), Writing – Review and Editing (*equal*)

Wiebke Bleidorn: Conceptualization (*supporting*), Methodology (*supporting*), Supervision (*equal*), Writing – Review and Editing (*equal*)

Christopher J. Hopwood: Conceptualization (*supporting*), Methodology (*supporting*), Supervision (*equal*), Writing – Review and Editing (*equal*)

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4

The Relationship Between the Perception of Major Life Events and Depression in Adulthood: A Scoping Review

4. The Relationship Between the Perception of Major Life Events and Depression in Adulthood: A Scoping Review

Abstract: Major life events can lead to depression in adulthood. However, as predicted by several depression theories (e.g., Hopelessness Theory of Depression), not only the mere occurrence of major life events but also the way people perceive them determines the onset of a depression. This scoping review aims to provide an overview of how the relationship between the perception of major life events and depression has been examined. Furthermore, we present a narrative integration of the available evidence, with a special focus on longitudinal research. Based on a systematic literature search, we identified 276 studies (N_{total} = 89,600) that examined the relationship between the perception of major life events and depression. Most studies relied on college student samples, were cross-sectional, and were conducted in the United States. An important methodological difference was the one between hypothetical event studies (i.e., studies requiring imagining the occurrence of a major life event) and autobiographical event studies (i.e., studies assessing the perception of experienced major life events). Regarding the former, most studies applied measures developed in the context of the Hopelessness Theory of Depression (e.g., the Attributional Style Questionnaire). Regarding the latter, studies assessed a more diverse set of perceived event characteristics—often with non-validated ad-hoc questionnaires. Generally, results seem to support that the perception of major life events is cross-sectionally associated with depression. However, longitudinal research on the relationship between these constructs was relatively rare. Thus, further longitudinal research considering a range of different perceived event characteristics, using non-Western heterogeneous samples, and validated questionnaires is needed to better understand the association between the perception of major life events and depression.

4.1 Introduction

Depression[6] is one of the greatest threats to health in adulthood. Worldwide, more than 300 million people suffer from a depressive disorder (James et al., 2018; World Health Organization, 2017). Furthermore, prevalence rates of depressive disorders have increased over the last years and are expected to further increase in the next years, partly because of the Covid-19 pandemic (e.g., Moreno-Agostino et al., 2021; Taquet et al., 2021). Hence, it is of critical importance to understand factors triggering depression to prevent its onset from an early stage onwards.

Major life events such as a job loss or the death of a loved one can be such triggering factors (e.g., Hammen, 2005; Kraaij et al., 2002; Recksiedler & Stawski, 2019; Yan et al., 2011). However, as suggested by several depression theories, not only the mere occurrence of major life events but also the way people perceive these events is relevant for the onset of depression (Abramson et al., 1989; Beck & Bredemeier, 2016; Bedi, 1999; Ingram, 1984; Slavich & Irwin, 2014). For example, people may differ in their perception of the death of a loved one in terms of its impact, predictability, or distress, and such individual differences in the event perception may explain why some people become depressed after such events whereas others do not (e.g., Eckholdt et al., 2017).

Although depression theories and empirical evidence converge on the idea that the perception of major life events is important to understand the onset of depression, different theories and empirical evidence differ with respect to which perceived event characteristics (e.g., valence, threat, loss, or internality) are assumed to be relevant. Furthermore, in depression research, the perception of major life events has been examined using a variety of methods (e.g., using different questionnaires, samples, and study designs), which complicates drawing clear-cut conclusions. Accordingly, a systematic overview of the assessment methods, samples, and study designs used to examine the relationship between the perception of major life events and depression is needed. Furthermore, an initial integration of findings obtained for different perceived event characteristics using different

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[6] In this review, we refer to both categorical conceptualizations (i.e., a clinical diagnosis) and dimensional conceptualizations of depression (i.e., depressive symptoms). To keep the review concise, we use the term *depression* as an umbrella term for both conceptualizations. When we explicitly refer to depression as a categorical disorder, we use the term *depressive disorder*. When we explicitly refer to dimensional conceptualizations, we use the term *depressive symptoms*.

research methods may help to uncover the most promising directions for future research. In this scoping review, we hence addressed two research questions: (1) How has the perception of major life events been examined in depression research? (2) What is known about the association between the perception of major life events and depression?

4.1.1 Definitions

The term *depression* describes a state of depressed mood, reduced interest and/or the inability to enjoy activities one previously enjoyed. It also comprises several vegetative (e.g., loss of energy and appetite) and cognitive symptoms (e.g., negative evaluation of the self) (American Psychiatric Association, 2013; Otte et al., 2016). Based on these symptoms, both the *ICD-11* and the *DSM-5* propose certain diagnostic criteria for a *Major Depressive Disorder*—a categorical diagnosis for which the described symptoms must be present for at least 2 weeks (American Psychiatric Association, 2013; World Health Organization, 2019). However, depression has also been conceptualized dimensionally, that is, as a continuous variable describing individual differences in the experience of depressive symptoms (Hankin et al., 2005). In this review, we cover both categorical and dimensional assessments of depression.

Major life events are events that are clearly timed, disrupt people's everyday routine, and are personally memorable (Luhmann et al., 2021). The *perception of major life events* refers to people's subjective experience of an event (Haehner, Pfeifer, et al., 2023; Luhmann et al., 2021) and can be evaluated via self-reports on different dimensions, also called *perceived event characteristics* (e.g., perceived valence, predictability, or extraordinariness of an event). For example, the perceived valence of a major life event describes the extent to which an event is perceived as positive or negative.

4.1.2 Theoretical Perspectives on the Association Between the Perception of Major Life Events and Depression

Several depression theories suggest that the perception of major life events is an important factor explaining the onset of a depression. In Figure 4.1, we summarized predictions from different theories regarding which perceived event characteristics are assumed to explain the onset of a depression.

Figure 4.1: *Overview of Different Theoretical Predictions on the Relevance of Perceived Event Characteristics for Explaining the Onset of a Depression*
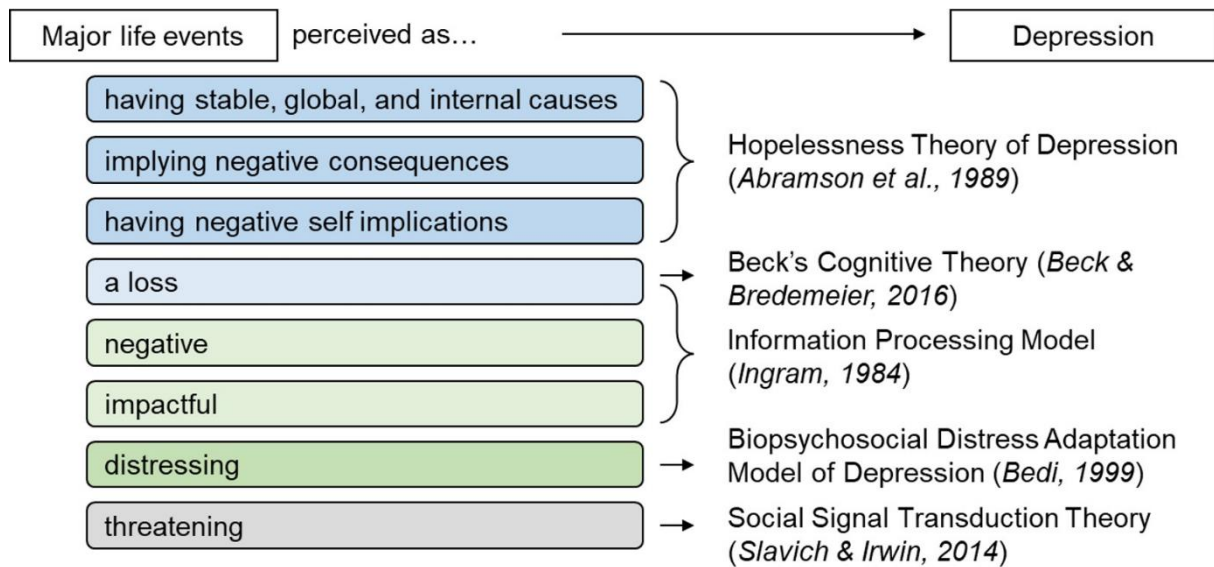
Note. In this figure, we summarized predictions of different depression theories regarding the relevance of certain perceived event characteristics for explaining the onset of a depression. All mentioned theories include additional mediators and moderators to explain the onset of depression, but a detailed discussion of each theory is beyond the scope of this review.

First, the *Hopelessness Theory of Depression* (Abramson et al., 1989) predicts that hopelessness is the decisive proximal cause of depression. Hopelessness, in turn, emerges if a negative major life event is perceived as having stable, global, and internal causes (i.e., perceived event characteristics *stability*, *globality*, and *internality*), and as having negative consequences as well as negative implications for the self (i.e., perceived event characteristics *inferred negative consequences* and *negative self-implications*). Furthermore, the Hopelessness Theory of Depression puts forward that such a way of perceiving major life events depends on situational cues (i.e., information on the major life event) and depressogenic attributional or cognitive styles (i.e., personal tendencies to perceive major life events in a dysfunctional way).

Second, in the most recent version of Beck's *Cognitive Theory* (Beck & Bredemeier, 2016), perceived loss of a vital resource (e.g., an important social relationship) is seen as a triggering factor explaining the onset of a depression after negative major life events. According to this theory, perceiving an event as a loss of a vital resource (i.e., perceived

event characteristic *loss*) will activate negative beliefs about the self, the environment, and the future, which, in turn, cause various depressive symptoms.

Third, the *Information Processing Model* (Ingram, 1984) predicts that a major life event leads to the onset of a depression by chronically activating a depression-emotion network in the brain. Whether the depression-emotion network becomes activated after experiencing a major life event is supposed to depend on whether the event is perceived as negative, personally impactful, and as a significant loss (i.e., perceived event characteristics *valence*, *impact*, and *loss*).

Fourth, in the *Biopsychosocial Distress Adaptation Model of Depression* (Bedi, 1999), perceived distress due to negative life events is supposed to predict the onset of a depression if coping resources to deal with this perceived distress are lacking (i.e., perceived event characteristic *distress*).

Finally, the *Social Signal Transduction Theory* (Slavich & Irwin, 2014) suggests that the onset of a depression depends on a sequence of biological processes (e.g., activation of the hypothalamic-pituitary-adrenal axis leading to inflammation leading to depressive symptoms). This biological sequence, in turn, is initiated if negative life events are perceived as threatening (i.e., perceived event characteristic *threat*).

In summary, different theories predict that the perception of major life events has to be taken into account to understand the onset of a depression. However, these theories differ in their claims regarding *which* perceived event characteristics are relevant. Consequently, an overview of the methods used to examine the perception of major life events in depression research, as well as a synopsis of the existing empirical evidence on the relationship between different perceived event characteristics and depression is needed.

4.1.3   *Empirical Perspectives on the Association Between the Perception of Major Life Events and Depression*

Over the last five decades, the association between the perception of major life events and depression has been examined in various empirical studies (e.g., Brewin & Furnham, 1986; Kwon, 1997; Neeren, 2007; Neumann & Schultheiss, 2015; Ratner et al., 2022). Two aspects of this existing empirical research further underline the relevance of an integrative overview. First, in addition to the different perceived event characteristics that have been

discussed in the above-mentioned depression theories, empirical depression research has examined further perceived event characteristics such as perceived *extraordinariness* or *predictability* to explain the onset of a depression (e.g., Flett et al., 1991; Rubin et al., 2009), which are not theoretically embedded. Thus, an overview of the empirical research is needed to address the question whether there are relevant perceived event characteristics that are not covered in contemporary depression theories. Second, existing studies employed a variety of different study designs and assessment methods to examine the relationship between the perception of major life events and depression (e.g., Bartelstone & Trull, 1995; Brewin & Furnham, 1986; Martin, 1986; Rubin et al., 2009). Consequently, an overview of these different research designs is needed to uncover knowledge gaps and directions for future research.

In this context, three methodological distinctions regarding the existing empirical evidence on this topic are particularly important as they influence whether and how inferences on the different theoretical predictions can be drawn:

1. distinction between *confounded studies* and *non-confounded studies*
2. distinction between *hypothetical event studies* and *autobiographical event studies*
3. distinction between *cross-sectional studies* and *longitudinal studies*

First, the distinction between confounded and non-confounded studies targets the question whether the effects of the number of experienced major life events and the perception of these events can be separated (as many studies do not allow to detangle these effects; e.g., Bartelstone & Trull, 1995). For example, it is a common approach in research on major life events that participants mark all experienced events of a life event checklist and rate these events regarding a certain perceived event characteristic (e.g., the perceived impact; Sarason et al., 1978). These impact ratings are then summed to provide an overall impact score. However, using such a sum score confounds the effects of the number of experienced events with their perception as a higher sum score could reflect both having experienced more events and having perceived the experienced events as more impactful. In contrast, non-confounded studies allow separating the effects of the event perception and the number of experienced events (e.g., by considering the event perception and the number of experienced events as separate predictors in the analyses or by focusing on the perception of a single major life event; e.g., Boals, 2014). Thus, only non-confounded studies can help

to better understand the relevance of perceived event characteristics to explain the onset of a depression (Hammen, 2005).

Second, regarding the difference between autobiographical and hypothetical event studies, autobiographical event studies require that participants rate their perception of one or several major life events they have already experienced (e.g, Boals, 2014; Sarason et al., 1978). In contrast, hypothetical event studies require that participants imagine the occurrence of an event and then rate how they expect to perceive it (e.g., "Imagine you experience the event *job loss*, how would you rate this event …"; Haeffel et al., 2008). Although these two methods differ conceptually, both hypothetical and autobiographical event ratings are supposed to be relevant for understanding the onset of depression (Abramson et al., 1989; Haeffel et al., 2008). In particular, the Hopelessness Theory of Depression makes such a prediction and has been examined using both approaches (e.g., Haeffel et al., 2008; Hankin et al., 2004). According to this theory, hypothetical event ratings allow the assessment of depressogenic attributional or cognitive styles (i.e., a diathesis for depression), whereas depressogenic autobiographical event ratings are a more proximal cause of depression resulting from a stressor-diathesis interaction (i.e., the interaction between the occurrence of negative events and depressogenic attributional/cognitive styles; Abramson et al., 1989).

Finally, regarding the distinction between cross-sectional and longitudinal studies, cross-sectional studies can provide information on whether certain perceived event characteristics are associated with depressive symptoms, or whether there is a significant difference in the perception of major life events between patients with a depressive disorder and non-depressed control groups (e.g., Neumann & Schultheiss, 2015; Rubin et al., 2009). However, only longitudinal studies allow insights in the temporal order of these effects (i.e., whether perceiving events in a certain way predicts the onset of a depression or whether being depressed predicts a certain way of perceiving major life events). Thus, longitudinal studies provide a better indication of the direction of effects and are superior to test the theoretical propositions described above (that perceiving events in a certain way leads to depression).

4.1.4 The Present Review

This scoping review had two aims. First, we wanted to summarize how the perception of major life events has been examined in depression research (e.g., which questionnaires have been used, which perceived event characteristics have been assessed, and which study designs have been employed) in order to uncover gaps in the literature and derive directions for future research. Such an overview could also guide future systematic reviews and meta-analyses (e.g., whether a quantitative integration is possible for certain perceived event characteristics and study designs). Second, we aimed to provide an initial (narrative) integration of the empirical evidence on the association between the perception of major life events and depression in adulthood (e.g., which perceived event characteristics are associated with depression, which perceived event characteristics can predict the onset of a depressive disorder or changes in depressive symptoms over time). This initial integration could be used to identify the most promising perceived event characteristics for understanding the onset of a depression that should be targeted in future research.

4.2 Methods

This review was preregistered on PROSPERO prior to abstract scanning (protocol number: CRD42021266248). We had to deviate in a few aspects from the preregistered protocol (Table S4.1). Most importantly, we initially planned to conduct a systematic review with a focus on the narrative integration of the empirical evidence on the association between the perception of major life events and depression. However, as the literature search revealed a more extensive but also a more diverse set of studies addressing this topic, we decided to summarize the findings as a scoping review, which allowed us to focus on research methods and research gaps in the literature on the association between the perception of major life events and depression. Additional information on the coding procedure, the extracted data, and our analyses can be found at https://osf.io/dyr8z/.

4.2.1 Search Strategy

We conducted a systematic literature search in *PsycINFO* and *Medline* on July 22, 2021, and updated this literature search on September 9, 2022. We used the following search terms: ("life event*" OR "life experience*" OR "major event*") AND ("depress*" OR "dysphoric*" OR "affective disorder*" OR "dysthym*" OR "mood disorder*") AND ("perception*" OR "perceive*" OR "apprais*" OR "attribut*" OR "evaluat*" OR "judge*" OR "judgment*" OR "interpret*"). Furthermore, we conducted a forward search based on the original

publications of questionnaires measuring the perception of major life evens that were identified through the database literature search. We also executed a backward search by screening the reference lists of included articles using the above-mentioned search terms regarding major life events and depression. Finally, we asked the scientific community for additional (unpublished) literature (e.g., using mailing lists of the *Society for Personality and Social Psychology* and the *German Association of Psychology*). Figure 4.2A summarizes our literature search and study selection. A more detailed description of our search strategy can be found in the supplemental material (Tables S4.2 and S4.3).

4.2.2 Inclusion Criteria

Studies were eligible to be included in this review if they fulfilled the following inclusion criteria: (1) empirical, quantitative study design (e.g., no reviews or qualitative studies), (2) written in English or German, (3) based on the human adult population (mean age of the sample > 18 years), (4) empirical information on the association between the self-rated perception of major life events and depression provided, (5) no intervention before assessing the association between the perception of major life events and depression (i.e., intervention studies were only included if they provided information about the relationship before the intervention). If two or more studies relied on the same data, we included the study with the largest sample size and the most comprehensive information on the association between the perception of major life events and depression.

4.2.3 Coding Procedure

Coding was done using a two-step procedure. In Step 1, we evaluated eligibility for inclusion based on titles and abstracts. In this step, we decided to be rather overinclusive: We included all studies in Step 2 that mentioned life event-related terms *or* depression-related terms in their abstract or title. In Step 2, we evaluated eligibility for inclusion based on full texts and coded whether studies confounded the effects of the number of experienced life events and the event perception or not. For confounded studies, we only extracted information on the measures(s) to assess perceived event characteristics (as these studies can only provide information for Research Question 1). For non-confounded studies, we coded information about the sample, the study design, the measure(s) to assess perceived event characteristics, the depression measure(s), the results on the association between perceived event characteristics and depression, and formal study aspects. More details on the coding procedure can be found at https://osf.io/dyr8z/.

Figure 4.2: *Flowchart on Study Inclusion*
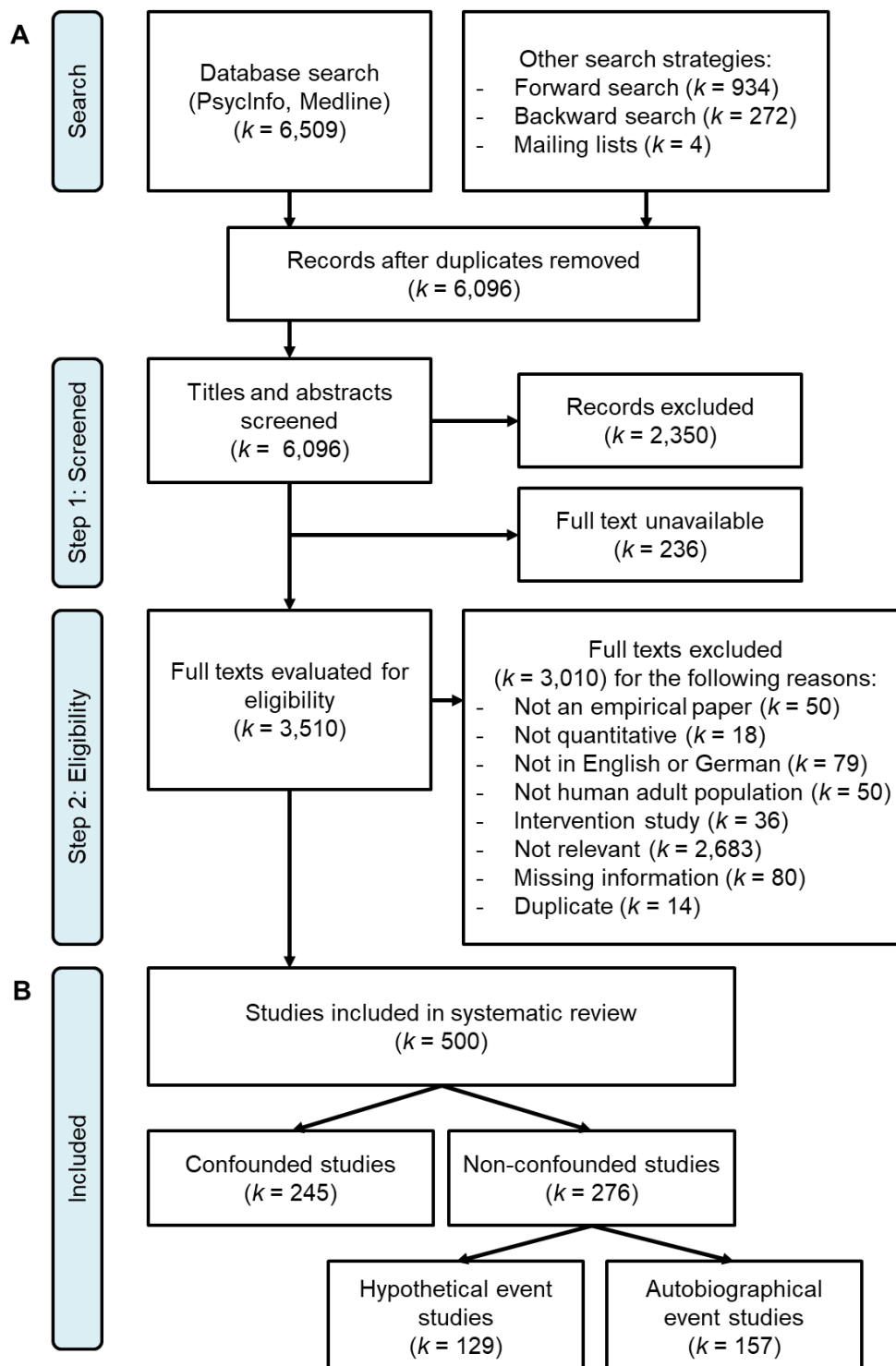
Note. Panel A: PRISMA flowchart on study inclusion and exclusion at each stage. Panel B: Further details on the methods of the included studies. Confounded studies confound the effects of the number of experienced major life events with the perception of these events, whereas non-confounded studies allow separating these effects. In hypothetical event studies, participants rate their perception of a hypothetical, imagined event, whereas in autobiographical event studies, participants rate their perception of an event that they had actually experienced. Numbers in Panel B do not add up as some studies used different methods.

Coding was done by four independent, trained coders (PhD students; authors PH, FW, SK, and MK). One third of the studies was double coded in each step applying a rotation principle (i.e., Coder 1 double coded studies that were originally coded by Coder 2, Coder 2 double coded studies that were originally coded by Coder 3, and so on). The intercoder agreement regarding study inclusion was 89% across all pairs of coders in Step 1 and 96% in Step 2. Regarding the extraction of information from included studies, intercoder agreement ranged from 89% (e.g., for mean age) to 99% (e.g., for coding whether event perceptions were rated retrospectively or not). Divergent coding was resolved through discussion.

4.3   Results

4.3.1   *Research Question 1: How Has the Perception of Major Life Events Been Examined in Depression Research?*

In total, 500 studies were included in the present review. These studies were published between 1974 and 2022 ($M = 2005.18$, $SD = 11.15$). Of the included studies, 85% ($k = 425$) were published journal articles and 14% ($k = 71$) were dissertations. As illustrated in Figure 4.2B, 276 included studies did not confound the effects of the number of experienced life events and the event perception, whereas 245 studies did[7].

For confounded and non-confounded studies, we extracted the name and example items for all assessed perceived event characteristics. Based on this information, we developed definitions for different perceived event characteristics and categorized the perceived event characteristics that were assessed in each study by using these definitions. Table 4.1 summarizes these definitions of perceived event characteristics as well as the assessment frequencies of the different event characteristics in confounded and non-confounded studies.

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[7] The numbers on confounded and non-confounded studies exceed the total number of included studies as some studies provided both confounded and non-confounded information. In general, if in the following numbers do not add up, this can be explained by the fact that some studies employed different measures to assess the perception of major life events or relied on several samples.

Table 4.1: *Overview of the Assessed Perceived Event Characteristics*

Dimension	Definition	Assessment frequency		
		Total	Non-confounded	Con-founded
Internality [a, b]	degree to which a person perceives an event to be caused by internal factors (e.g., personal incompetence)	132	129	3
Stability [a, b]	degree to which a person perceives an event to be caused by stable rather than volatile factors	160	160	0
Globality [a, b]	degree to which a person perceives an event to be caused by global rather than specific causes	160	160	0
Inferred negative consequences [b]	degree to which a person thinks that a certain life event elicits negative consequences in the future	46	46	0
Negative self-implications [b]	degree to which a person believes that the occurrence of an event implies negative characteristics of the self	45	45	0
Controllability	degree to which a person perceives that they can actively influence the occurrence of an event	39	33	6
Importance	degree to which a person perceives an event as begin personally important	17	15	2
Valence	degree to which a person perceives an event as positive or desirable	82	26	56
Impact [c]	degree to which a person perceives an event as influential and severe	188	86	102
Distress	degree to which a person perceives an event as stressful and upsetting	78	43	35
Threat	degree to which a person perceives an event as dangerous or scaring	15	15	0
Challenge	degree to which a person perceives an event stimulating and exciting	13	13	0
Loss	degree to which a person perceives an event as being associated with losses of any kind	13	12	1
Extraordinariness	degree to which a person perceives an event uncommon and extraordinary	12	12	0
Predictability	degree to which a person perceives the occurrence of an event occurrence as expected	15	13	2
Event-related self-blame	degree to which a person believes that the occurrence of a (negative) event was their fault	7	7	0
Adjustment	degree to which a person perceives an event as requiring adjustment and personal change	12	8	4
Event centrality	degree to which a person perceives an event as being a central part of one's identity	36	36	0
Relating to others [d]	degree to which a person perceives an event as having changed existing relationship to others	9	9	0
Spiritual change [d]	degree to which a person perceives an event as having caused spiritual change	9	9	0

Table 4.1 (continued)

Dimension	Definition	Assessment frequency		
		Total	Non-confounded	Con-founded
Personal strength [d]	degree to which a person perceives an event led to higher personal strength	12	12	0
New relationships [d]	degree to which a person perceives an event as having caused new relationships	9	9	0
Appreciation of life [d]	degree to which a person perceives an event as having caused a higher appreciation of life	10	10	0
Change in world views	degree to which a person perceives an event as changing one's global meaning system and world views	10	10	0
Other	e.g., perceived closure, social status change, and unspecific blends of other event characteristics	45	39	6

Note. This table summarizes definitions of perceived event characteristics and absolute frequencies of how often these perceived event characteristics were assessed in the included confounded and non-confounded studies. Most studies assessed more than one perceived event characteristics. However, not all perceived event characteristics that were assessed in a certain study were later used in the analyses.

[a] These perceived event characteristics were combined in many studies to capture a depressogenic attributional style.

[b] These perceived event characteristics were combined in many studies to capture a depressogenic cognitive style.

[c] In most studies, impact ratings were combined with a valence assessment (e.g., by assessing impact on a bipolar scale from *very negative* to *very positive*).

[d] These perceived event characteristics were combined in many studies to capture perceived growth.

Confounded Studies

Studies that confounded the effects of the number of experienced major life events and the perception of these events were usually conducted using life event checklists (i.e., measures that require participants to mark all experienced life events of a given list). By definition, confounded studies are thus autobiographical event studies as they assess perceived characteristics of experienced major life events.

Most confounded studies ($k = 108$) employed the *Life Experiences Survey* (Sarason et al., 1978), which comprises 50 events. With this measure, participants rate all experienced events regarding their perceived impact (from *extremely negative* to *extremely positive*). Furthermore, 34 studies applied non-validated ad-hoc questionnaires. In confounded studies, the perceived event characteristics impact and valence were assessed most

frequently (Table 4.1). Finally, confounded studies mostly assessed the perception of life events that occurred in the last year (M = 11.13 months, SD = 14.07 months), and used a dimensional assessment of these perceived event characteristics (70%, k = 174).

Non-Confounded Studies

As confounded studies are limited in their ability to address the relationship between the perception of major life events and depression, we focus on non-confounded studies for the remainder of the manuscript (i.e., studies that allow separating the effects of the number of experienced major life events and the event perception) and describe them in more detail.

Samples and Study Designs. The sample size in non-confounded studies ranged from N = 12 to N = 6,195, with a total sample size of N = 89,600 participants. A large proportion of samples was recruited in the United States (44%, k = 145), followed by other industrialized Western countries such as Australia (5%, k = 18), United Kingdom (5%, k = 18), Germany, (4%, k = 12), and Canada (3%, k = 11). Only about 8% of the included studies (k = 23) were conducted in non-Western countries. Most studies relied on college student samples (43%, k = 141) or convenience samples (27%, k = 89). Clinical samples were used in 24% of the studies (k = 78). Samples' mean age ranged from 18 to 77.34 (M = 32.06, SD = 14.22), and on average samples consisted of 66% female participants. Finally, regarding the study design, most studies were cross-sectional (62%, k = 169).

Assessment of Depression. Most non-confounded studies used self-report measures of depressive symptoms (84%, k = 278) and thus they mostly favoured a dimensional perspective on depression (81%, k = 268). To assess depressive symptoms, the *Beck Depression Inventory* (Beck et al., 1996; 55%, k = 166) and the *Center for Epidemiological Studies Depression* (Radloff, 1977; 17%, k = 52) were used most frequently. Clinical depression diagnoses were assessed in 14% of the studies (k = 45).

Assessment of the Perception of Major Life Events. More than 70 different questionnaires were employed to assess the perception of major life events. The most frequently used questionnaire was the *Attributional Style Questionnaire* (Peterson et al., 1982; 22%, k = 73). In addition, non-validated ad-hoc questionnaires were also relatively common to assess the perception of major life events (15%, k = 50). In non-confounded studies, the perceived event characteristics internality, stability, and globality were assessed most frequently

(Table 4.1). Furthermore, non-confounded studies partly focused on specific major life events (34%, $k = 114$; e.g., bereavement, a serious illness, or childbirth) allowing to test whether the perception of these specific major life events is relevant for the onset of a depression. Finally, similar as confounded studies, non-confounded studies mostly relied on a dimensional assessment of perceived event characteristics (96%, $k = 319$)[8].

Differences Between Autobiographical Event Studies and Hypothetical Event Studies. Of the 276 non-confounded studies, 157 studies assessed the perception of experienced major life events (autobiographical event studies), whereas 129 studies assessed hypothetical major life events (hypothetical event studies)[9]. As summarized in Table 4.2, hypothetical and autobiographical event studies differed in several design characteristics. First, regarding the samples, hypothetical event studies relied more often on student samples than autobiographical event studies (60% student samples vs. 28% student samples), and sample sizes tended to be smaller in hypothetical event studies ($Md = 122$ participants vs. $Md = 190$ participants). Second, hypothetical event studies more often had a longitudinal design than autobiographical event studies (45% longitudinal vs. 21% longitudinal). Third, autobiographical and hypothetical event studies differed in the employed measures used to assess the perception of major life events. Hypothetical event studies often used measures belonging to the Hopelessness Theory of Depression such as the *Attributional Style Questionnaire* (45%; Peterson et al., 1982) or the *Cognitive Style Questionnaire* (30%; Haeffel et al., 2008). In contrast, autobiographical event studies most frequently employed non-validated ad-hoc questionnaires (24%). Finally, autobiographical event studies focused more often on single major life events than hypothetical event studies (59% single events vs. 2% single events). In particular, the most impactful or distressing life event that participants experienced in a certain time frame was often examined in autobiographical event studies.

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[8] The number of employed dimensional measures in non-confounded studies exceeds the total number of non-confounded studies as several studies employed multiple measures to assess perceived event characteristics.

[9] The numbers of hypothetical and autobiographical event studies exceed the total number of non-confounded studies as some studies considered ratings of experienced and hypothetical events.

Table 4.2: *Comparison of the Design of (Non-Confounded) Hypothetical and Autobiographical Event Studies*

Domain	Coded information	Hypothetical event studies	Autobiographical event studies
Sample and design	Sample type	60% student samples 22% clinical samples	36% convenience samples 28% student samples
	Sample size	$Md = 122$, Range = [12, 950]	$Md = 190$, Range = [12, 6195]
	Mean age	$M = 26.93$, $SD = 10.95$	$M = 35.69$, $SD = 14.98$
	Percentage female	$M = 65.68$, $SD = 22.47$	$M = 66.29$, $SD = 26.20$
	Country of data collection	50% United States 6% Australia 5% United Kingdom	38% United States 6% Germany 6% United Kingdom
	Longitudinal?	45% longitudinal	21% longitudinal
Assessment of perceived event characteristics	Measures	45% Attributional Style Questionnaire 30% Cognitive Style Questionnaire	24% Ad-hoc questionnaires 18% Centrality of Event Scale
	Perceived event characteristics	28% globality 27% stability	9% distress 9% event centrality
	Single event?	98% combined different events	39% combined different events
	Dimensional?	100% dimensional	92% dimensional
Assessment of depression	Type of depression assessment	81% self-report	87% self-report
	Dimensional?	83% dimensional	79% dimensional

Summary

In summary, regarding our first research question (assessment of the perception of major life events in depression research), several conclusions can be drawn. First, approximately half of the included studies confounded the effects of the number of experienced major life events and the perception of these events (e.g., by using life event checklists such as the *Life Experiences Survey*). Second, in non-confounded studies, the association between the perception of major life events and depression was often assessed in student samples, recruited in industrialized, Western countries (mostly the United States). Third, most research was cross-sectional and used self-report measures of depressive symptoms. Fourth, autobiographical and hypothetical event studies differed in several design characteristics such as the used samples or the employed measures to assess the perception of major life events. Particularly striking, autobiographical event studies frequently relied on non-validated ad-hoc questionnaires.

4.3.2   *Research Question 2: What is Known About the Association Between the Perception of Major Life Events and Depression?*

To address Research Question 2, we provide a narrative synthesis of the existing empirical evidence on the relationship between the perception of major life events and depression. Therefore, we only used information from non-confounded studies, focused on perceived event characteristics that have been examined in at least ten studies, and focused on longitudinal studies since they are superior to examine the theoretical proposition that a certain way of perceiving major life events leads to depression. We structured our results according to the different perceived event characteristics, separately for hypothetical and autobiographical event studies.

Non-Confounded Hypothetical Event Studies

Information on study characteristics of hypothetical event studies and a tabular presentation of all results can be found in the supplementary material (Tables S4.4 and S4.5).

Internality, Stability, and Globality. In most studies, the perceived event characteristics internality, stability, and globality were assessed together using measures such as the *Attributional Style Questionnaire*. Cross-sectionally, all three perceived event characteristics

were moderately to strongly[10] correlated with depressive symptoms. For example, Hirsch and Rabon (2015) found in a student sample ($N = 135$) that perceiving negative hypothetical events as having more internal ($r = .28$), more stable ($r = .44$), and more global causes ($r = .39$) was associated with higher levels of depressive symptoms (for similar results see, e.g., Ball et al., 2008; Persons & Rao, 1985). These associations also remained significant when other variables such as education, anxiety, or number of experienced life events were controlled for (e.g., Martin, 1986; O'Sullivan et al., 2017).

In longitudinal studies, the picture was less clear. Several studies found significant longitudinal correlations between internality, stability, and globality (assessed at time t, henceforward called T1) and depression at later measurement occasions (assessed at time $t + 1$, henceforward called T2) (e.g., Martin, 1986; Priester & Clum, 1992). However, only few studies examined the research question whether these perceived event characteristics can also predict changes in depressive symptoms over time (e.g., using multiple regression models predicting depressive symptoms at T2 while controlling for depressive symptoms at T1). For example, Priester and Clum (1992) found in a student sample ($N = 269$) that perceived stability and perceived globality of negative events (but not perceived internality) predicted changes in depressive symptoms over 2 weeks. In contrast to these results, Alvarado (1988) found in their sample ($N = 122$, college students) that neither perceived stability nor globality or internality predicted changes in depressive symptoms over 6 weeks. Thus, results addressing the question whether perceived internality, stability, and globality can predict changes in depressive symptoms over time seem to be inconclusive. The diverging findings may be attributable to different sample sizes (leading to different power) and different retest intervals.

Inferred Negative Consequences and Negative Self-Implications. Inferred negative consequences and negative self-implications of hypothetical events were usually assessed together using measures such as the *Cognitive Style Questionnaire*. Both perceived event characteristics were consistently and strongly associated with higher levels of depressive symptoms in cross-sectional studies (e.g., Kleiman et al., 2014: $r = .48$ for inferred negative consequences, $r = .42$ negative self-implications, $N = 193$). However, similar to results on

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[10] Our classifications of effect sizes are based on the conventions by Funder and Ozer (2019), that is, *very small*: $r \approx .05$, *small*: $r \approx .10$, *moderate/medium*: $r \approx .20$, *strong*: $r \approx .30$.

perceived internality, stability, and globality, findings were less consistent regarding the question whether inferred negative consequences and negative self-implications can also predict changes in depressive symptoms over time. In three studies, inferred negative consequences and negative self-implications did not predict changes in depressive symptoms over time (Abela et al., 2004; Lam, 2001; Stone et al., 2010). Similarly, Kwon (1997) reported mixed findings depending on the time interval between assessments. For example, in this study, inferred negative consequences predicted changes in depressive symptoms over a 6-weeks interval but not over a 12-weeks interval.

Composite Scores Reflecting a Depressogenic Attributional or Cognitive Style. In line with the theoretical propositions of the Hopelessness Theory of Depression, the perceived event characteristics internality, stability, and globality were combined in several studies to capture a depressogenic attributional style. Similarly, the perceived event characteristics internality, stability, globality, inferred negative consequences, and negative self-implications were often combined to assess participants' depressogenic cognitive style (i.e., perceiving negative events as being caused by internal, stable, and global factors as well as having negative consequences and self-implications).

Cross-sectionally, the results for these composite scores were similar to the results for the individual perceived event characteristics described above. That is, a more depressogenic attributional/cognitive style was strongly associated with higher levels of depressive symptoms (e.g., Alatorre et al., 2020: $r = .32$ for a depressogenic cognitive style, $N = 130$). Furthermore, most studies found that individuals with a depressive disorder had a more depressogenic attributional/cognitive style for hypothetical events than individuals without a depressive disorder (e.g., Ball et al., 2008; Harrington, 1998).

Several longitudinal studies examining composite scores reflecting a depressogenic attributional or cognitive style were available. First, in most studies, a more depressogenic attributional/cognitive style correlated strongly and significantly with higher levels of depressive symptoms at later measurement occasions (e.g., Haeffel, 2010: $r = .26$, $N = 251$). Second, several studies found that a more depressogenic attributional/cognitive style predicted increases in depressive symptoms over time or the onset of a depressive disorder longitudinally (e.g., Ciesla et al., 2011; Feng & Yi, 2012; Haeffel, 2017). Finally, a depressogenic attributional/cognitive style interacted with the number of experienced

negative life events in predicting changes in depressive symptoms or the onset of a depressive disorder over time (e.g., Haeffel, 2010; Joiner et al., 1995). For a more depressogenic attributional/cognitive style, there was a stronger positive association between the number of experienced negative life events and depressive symptoms compared to a more positive attributional/cognitive style.

However, there were also several studies without statistically significant effects of attributional/cognitive style on changes in depressive symptoms (e.g., Abela et al., 2004; Lam, 2001) as well as studies with mixed findings (e.g., Kwon, 1997). These diverging findings can at least partly be explained by different sample sizes (studies not finding statistically significant effects mostly had low sample sizes, e.g., Johnson et al., 1996), different sample compositions (studies finding statistically significant effects mainly used student samples, e.g., Ciesla et al., 2011), and different retest intervals (statistically significant effects rather found over shorter retest intervals, e.g., Kwon, 1997).

Summary. Hypothetical event studies focused on those perceived event characteristics that have been proposed in the Hopelessness Theory of Depression (i.e., internality, stability, globality, inferred negative consequences, and negative self-implications; Abramson et al., 1989). There was robust evidence that each of these characteristics is cross-sectionally associated with depression (Table 4.3). However, evidence was limited regarding the question whether a single dimension can also predict the onset of a depressive disorder or changes in depressive symptoms over time. Using composite scores of these perceived event characteristics capturing a depressogenic attributional style or depressogenic cognitive style, there was sufficient evidence that they can predict changes in depressive symptoms (Table 4.3). In particular, studies identified both main effects of these composite scores as well as interactions with the number of experienced life events in predicting changes in depressive symptoms (matching the theoretically proposed diathesis-stress interaction). Finally, diverging findings across studies may at least partly be explained by different sample sizes, different retest intervals, and different sample compositions.

Non-Confounded Autobiographical Event Studies

Information on study characteristics of the included autobiographical event studies and a tabular presentation of results can be found in the supplementary material (Tables S4.6 and S4.7).

Internality, Stability, and Globality. For autobiographical events, the associations between depression and perceived internality, stability, and globality seemed to be smaller and less robust than the respective associations for hypothetical events. For example, in a study with college students (N = 313) by Reiland (2017), perceived globality (r = .25) and stability (r = .13) were associated with higher levels of depressive symptoms, but perceived internality (r = .06) was not. Indeed, the finding that of these three perceived event characteristics perceived globality has the strongest association with depression for experienced events is consistent with findings from other studies (e.g., Flett et al., 1991; C. J. Robins & Block, 1989)

Longitudinal research on the relationship between depression and perceived internality, stability, and globality was scarce. In two studies, perceiving negative experienced events as having more internal, stable, or global causes was moderately to strongly associated with higher levels of depressive symptoms at later measurement occasions (.18 ≤ r ≤ .50; Brewin & Furnham, 1986; Kleim et al., 2012). However, in a study by Hummer and Hokanson (1990) in currently depressed students (N = 60), none of these perceived event characteristics was able to predict changes in depressive symptoms over time. While the non-significance of these latter effects may be explained by the relatively small sample size in the respective study, perceived internality, stability, and globality explained only a minor proportion of variance in depressive symptoms (i.e., ΔR^2 = 3% for predicting depressive symptoms at T2 controlled for depressive symptoms at T1). Furthermore, it should be noted that longitudinal research examining a composite score reflecting a depressogenic attributional/cognitive style of experienced events was virtually absent (see Butters et al., 1997 for one exception).

Controllability. Evidence on the cross-sectional relationship between perceived controllability and depression was mixed. For example, in a recent study by Fassett-Carman et al. (2019), lower perceived controllability of negative events was moderately associated with higher levels of depressive symptoms (r = −.21; N = 356 treatment-seeking college students). In contrast, Neeren (2007) did not find such an association (r = −.03; N = 250 female college students).

Similar to these cross-sectional findings, research on the longitudinal relationship between perceived controllability and depression also seemed to be inconclusive. On the one hand,

Eways (2020) did not find significant longitudinal correlations between perceived controllability and depressive symptoms assessed 6 weeks later ($r = -.12$; $N = 85$ cancer patients). On the other hand, in a study based on a relatively large convenience sample ($N = 632$), lower perceived controllability predicted an increase in depressive symptoms over a 12-weeks interval (Haehner & Pfeifer, 2022). Thus, more (longitudinal) research on the relevance of perceived controllability is needed, and different sample sizes (i.e., power) may be one explanation for diverging findings.

Valence. Cross-sectionally, perceiving autobiographical events more negatively was moderately associated with higher levels of depressive symptoms in most studies (e.g., Del Palacio-Gonzalez & Berntsen, 2018: $r = .18$, $N = 220$). Furthermore, König et al. (2018) found that the average perceived valence of all life events that participants had experienced in their lives was associated with a higher likelihood of developing a depressive disorder (Odds Ratio = 2.96, $N = 2,265$; see also Gómez-Maquet et al., 2022). However, as indicated by some studies with non-significant findings, the cross-sectional associations between perceived valence and depression seems to depend, for example, on the included covariates (e.g., no significant effect for valence when emotional regulation strategies were included in the model; Del Palacio-Gonzalez & Berntsen, 2020).

Evidence on the longitudinal association between perceived valence and depression was mixed. In a sample of college students ($N = 242$), Hong et al. (2006) found significant correlations between perceived valence and depressive symptoms assessed 4 weeks later ($r = .30$) and 6 weeks later ($r = .21$; perceiving events more negatively was associated with higher depressive symptoms). Furthermore, Del Palacio-Gonzalez and Berntsen (2018) found that perceived valence predicted changes in depressive symptoms over 7 weeks ($N = 220$). However, in another study, perceived valence did not predict changes in depressive symptoms over 12 weeks (Haehner & Pfeifer, 2022; $N = 632$). Perhaps, the null finding in the latter study could be explained by the fact that other perceived event characteristics (e.g., controllability, distress) were also included in the model so that changes in depressive symptoms were already explained by these other event characteristics.

Impact. Perceiving negative events as more impactful was moderately to strongly associated with higher levels of depressive symptoms (e.g., Coelho et al., 2021: $r = .30$, $N = 400$).

Furthermore, similar to findings for perceived valence, the average perceived impact of all negative life events that participants had experienced in their lives was associated with a higher likelihood of developing a depressive disorder (Odds Ratio = 2.80, N = 2,265; König et al., 2018). The association between impact and depression also seemed to be robust across a range of different covariates such as demographic variables, religiosity, or social support (e.g., Nan et al., 2012).

Longitudinally, the picture was once again less clear. While Maguen et al. (2004) found a significant positive correlation between perceived impact of negative events and depressive symptoms at a later measurement occasion (r = .35, N = 203), Espejo et al. (2010) did not find such an association (r = .12, N = 76). Furthermore, perceived impact did not predict changes in depressive symptoms over 12 weeks (Haehner & Pfeifer, 2022, N = 632). Differences in the way of assessing perceived impact or different retest intervals may be two possible explanations for the diverging findings.

Distress. Cross-sectional studies provided consistent evidence that higher perceived distress is associated with higher levels of depressive symptoms (e.g., Anding et al., 2016; Bhutwala, 2003). For example, higher perceived distress of negative events was moderately associated with higher levels of depressive symptoms in a sample of treatment-seeking college students (Fassett-Carman et al., 2019: r = .17, N = 356).

Similarly, in two longitudinal studies, higher perceived distress of negative life events was significantly associated with depressive symptoms 6 months later (Austin et al., 2005: r = .15, N = 970; Kleim et al., 2012: r = .17, N = 222). Furthermore, perceived distress predicted increases in depressive symptoms over 12 weeks (Haehner & Pfeifer, 2022; N = 632). In contrast, Park (2006) found a non-significant partial correlation between perceived distress and depressive symptoms at T2 while controlling for depressive symptoms 1 month before (r = .21, N = 83). However, the sample size in this latter study was relatively small and the partial correlation still had a medium size so that existing evidence rather seems to support the relevance of perceived distress in predicting changes in depressive symptoms over time.

Threat, Challenge, and Loss. In several studies, perceived threat, challenge, and loss have been examined together for example using measures such as the *Appraisal of Life Events Scale* (Ferguson et al., 1999). Furthermore, these perceived event characteristics were often

examined in context of specific life events such as cancer or a spinal cord injury (e.g., Dean & Kennedy, 2009; Kennedy et al., 2010). Cross-sectionally, higher threat ($r = .14$) and loss ratings ($r = .30$)—but not lower challenge ratings ($r = -.06$)—were moderately to strongly associated with higher levels of depressive symptoms (e.g., Ferguson et al., 2000).

Longitudinally, perceived threat ($r = .53$), loss ($r = .55$), and challenge ($r = -.34$) of a spinal cord injury (assessed 6 weeks after the injury) were strongly associated with depressive symptoms 1 year later (Kennedy et al., 2010; $N = 237$). These findings were replicated in a recent study by Galvis Aparicio et al. (2021) using a similar sample (207 patients with a spinal cord injury). However, neither perceived threat nor perceived challenge of the most distressing life event that participants experienced in their lives predicted changes in depressive symptoms over time ($N = 83$, Park, 2006; perceived loss was not examined in this study). Taken together, there is sufficient evidence that at least perceived threat and loss are associated with depression (cross-sectionally and longitudinally). However, it is unclear whether these findings apply to all kinds of life events and whether these perceived event characteristics can predict the onset of a depressive disorder or changes in depressive symptoms over time.

Event Centrality. Perceived event centrality was mostly examined in relation to the most distressing event that participants experienced in a certain time frame (e.g., Del Palacio-Gonzalez & Berntsen, 2020; Parnes et al., 2020). Cross-sectionally, there was consistent evidence that perceiving the most distressing event as more central to one's identity was moderately to strongly associated with higher levels of depressive symptoms ($.20 \leq r \leq .40$; e.g., Allbaugh et al., 2016; Reiland, 2017).

Similarly, in two longitudinal studies with college student samples event centrality was significantly related to depressive symptoms at later measurement occasions (Boals, 2014: $r = .23$, $N = 312$; Del Palacio-Gonzalez & Berntsen, 2018: $r = .27$, $N = 220$). Furthermore, in the study by Boals (2014), perceived event centrality of a relationship breakup also predicted changes in depressive symptoms over 2 months. However, in two other studies, perceived event centrality did not predict changes in depressive symptoms over time (Boelen, 2017; Newby & Moulds, 2011). For example, in the study by Boelen (2017), perceived event centrality of bereavement explained only 0.5% of variance of depressive symptoms at T2 controlling for T1 depressive symptoms 6 months before. In summary, the longitudinal

relevance of this perceived event characteristic remains once again unclear. Drawing clear-cut conclusions on the relevance of perceived event centrality is impaired by the fact that existing studies differed in the retest interval and the examined major life events.

Growth. Perceived growth was mostly assessed as a composite score of different growth-related dimensions such as perceiving new possibilities or spiritual change in relation to specific negative events such as bereavement (e.g., Eisma et al., 2019). Cross-sectionally, higher perceived growth was associated with lower levels of depressive symptoms. In particular, strong negative associations between perceived growth and depressive symptoms have been found for bereavement (e.g., Eisma et al., 2019: $r = -.28$, $N = 412$ bereaved adults) and severe illnesses (e.g., Hibberd, 2014: $r = -.39$, $N = 139$ with myocardial infarction). For other events such as childbirth (Sawyer et al., 2015), however, less evidence was available and results were more mixed (e.g., results differed across subsamples in the mentioned study).

Finally, only one longitudinal study examining the relationship between perceived growth and depression was available. In this study, perceived bereavement-related growth did not predict changes in depressive symptoms over 6 months (Eisma et al., 2019).

Summary. Compared to hypothetical event studies, autobiographical event studies examined a more diverse set of perceived event characteristics. For many of these perceived event characteristics, cross-sectional associations with depression were found (Table 4.3). In particular, perceived globality, valence, impact, distress, threat, loss, event centrality, and growth were cross-sectionally related to depression in most studies. However, as only few longitudinal studies examining these perceived event characteristics were available, it is less clear whether they can also predict the onset of a depressive disorder or changes in depressive symptoms over time. Furthermore, drawing conclusions on the relevance of certain perceived event characteristics is impaired by the fact that studies differed in several important design characteristics (e.g., the assessment of perceived event characteristics, the retest interval, the included covariates, the considered major life events). Currently, perceived distress, valence, and loss seem to be the most promising candidates for predicting the onset of a depressive disoder or changes in depressive symptoms longitudinally.

Table 4.3: *Summary of Findings*

Perceived event characteristic	Cross-sectionally related to depression	Predicting depression longitudinally
Hypothetical event studies		
Internality	Yes	Maybe
Stability	Yes	Maybe
Globality	Yes	Maybe
Inferred negative consequences	Yes	Maybe
Negative self-implications	Yes	Maybe
Attributional/cognitive style	Yes	Yes
Autobiographical event studies		
Internality	Maybe (rather no)	
Stability	Maybe (rather no)	
Globality	Yes	
Controllability	Maybe	
Valence	Yes	
Impact	Yes	Too few studies available for definite conclusions
Distress	Yes	
Threat	Yes	
Challenge	Maybe (rather no)	
Loss	Yes	
Event centrality	Yes	
Growth	Yes	

Note. In this table, we rated the available evidence for a certain perceived event characteristic to be associated with depression cross-sectionally or to predict depression longitudinally from *no* (i.e., exiting evidence indicates that an effect does not exist), *maybe* (i.e., evidence is mixed) to *yes* (i.e., evidence indicates that an effect exists). For autobiographical event studies, perceived distress, valence, and loss currently can be seen as most promising candidates for predicting depression longitudinally.

4.4   Discussion

In this scoping review, we provided an overview of the existing research and findings regarding the relationship between the perception of major life events and depression. Our first aim was to summarize how the perception of major life events has been studied in depression research. We distinguished between confounded and non-confounded studies (depending on whether the effects of the number of experienced major life events and the perception of these events could be separated) as well as between hypothetical and

autobiographical event studies (depending on whether the perception of an imagined or an experienced event was rated). Non-confounded studies were mostly conducted in the United States, using college student samples. Furthermore, depression was mostly assessed using self-reports. In non-confounded hypothetical event studies, perceived event characteristics were typically assessed with measures that were derived from the Hopelessness Theory of Depression (e.g., *Attributional Style Questionnaire*; Peterson et al., 1982). In non-confounded autobiographical event studies, participants typically rated their perception of a specific experienced major life event by means of non-validated ad-hoc questionnaires.

Our second aim was to provide an initial narrative overview of the existing evidence on the association been the perception of major life events and depression. In hypothetical event studies, perceived internality, stability, globality, inferred negative consequences, and negative self-implications were cross-sectionally associated with depression. Furthermore, composite scores reflecting a depressogenic attributional or cognitive style also predicted changes in depressive symptoms longitudinally. In autobiographical event studies, perceived globality, valence, impact, distress, loss, threat, event centrality, and growth were cross-sectionally associated with depression. Longitudinal studies on the association between perceived event characteristics and depression were scarce, but distress, valence, and loss seem to be promising candidates for predicting the onset of a depressive disorder or changes in depressive symptoms over time.

4.4.1 Directions for Future Research

This scoping review identified several knowledge gaps in research on the association between the perception of major life events and depression, and it thus has several implications for future research. First, regarding the samples, more research needs to be conducted in non-Western cultures. So far, most studies relied on data collected in the United States or in other Western countries, only 8% of studies were conducted in non-Western countries. However, as the normativity of major life events may differ among cultures (e.g., some events are more common in certain cultures; Ngo & Le, 2007), major life events are likely perceived differently in different cultures and thus the association between the perception of major life events and depression may also differ among cultures. Furthermore, most research on the association between the perception of major life events and depression used student samples. However, the normativity of life events also differs

among age groups and other demographic groups (Tekcan et al., 2012). Thus, it is necessary to examine the relationship between depression and perceived event characteristics in more heterogeneous samples.

Second, another aspect related to the included samples that needs to be considered in future research is the sample size. Our narrative integration of existing evidence suggested that one reason for diverging findings may be a lack of power in some studies with a small sample size. There was initial evidence that the effects of perceived event characteristics for predicting changes in depressive symptoms over time are small (e.g., Boelen, 2017; Hummer & Hokanson, 1990). A similar conclusion has also been drawn for the association between the perception of major life events and changes in other constructs, such as personality traits (Haehner et al., 2022) or empathy (Fassbender et al., 2022). Thus, to be adequately powered, future research needs samples that are large enough to detect such small effects (i.e., $r \approx .05$; Funder & Ozer, 2019).

Third, most studies conceptualized depression dimensionally and used self-report measures of depression. While a dimensional conceptualization of depressive symptoms is in line with existing evidence on their latent structure (Hankin et al., 2005), these studies can only partly address the theoretical prediction that a certain way of perceiving major life events leads to *the onset of a depressive disorder*[11]. Furthermore, as self-report measures are subject to certain biases (e.g., men minimizing their symptoms in self-reports; Hunt et al., 2003), future research examining clinician-diagnosed depression is warranted.

Fourth, for many perceived event characteristics (particularly in autobiographical event studies), drawing robust conclusions regarding their relevance for predicting depression longitudinally was not possible. Such conclusions were impaired by the fact that studies focused on many different perceived event characteristics and assessed these characteristics with a range of different (often not validated) questionnaires. However, as shown by findings from hypothetical event studies, integration of knowledge is improved if a consistent set of perceived event characteristics is assessed with similar measures across many studies. Consequently, the measures used to assess the perception of experienced

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[11] This limitation of existing research is also the reason why our theoretical background often comprised terms such as "X leads to the onset of depression", whereas our results section rather comprised terms such as "X predicted an increase in depressive symptoms over time".

major life events need to be unified in future research. Although there is no questionnaire that comprises all the perceived event characteristics that were consistently associated with depression, the *Attribution Questionnaire* (Gong-Guy & Hammen, 1980), the *Event Characteristics Questionnaire* (Luhmann et al., 2021), or the *Stress Appraisal Measure* (Peacock & Wong, 1990) may be good measures for future research as they reliably assess a range of relevant perceived event characteristics. Furthermore, this review may help to facilitate future research on the perception of major life events by providing both a summary and a definition of several perceived event characteristics (based on scale descriptions and example items from different measures; see Table 4.1).

Fifth, studies differed regarding the considered major life events. Several studies addressed the effects of all major life events that participants experienced in a certain time frame, whereas other studies focused on specific major life events (e.g., bereavement, serious illness, or childbirth). However, as for example indicated by findings on perceived growth, the association between the perception of major life events and depression may differ among events. Thus, it is an important avenue for future research to disentangle which perceived event characteristics are important for which event (Haehner, Bleidorn, & Hopwood, 2023; Luhmann et al., 2021).

Sixth, and maybe most importantly, more longitudinal research on the association between the perception of major life events and depression is necessary. For many perceived event characteristics, only few longitudinal studies were available. However, compared to cross-sectional studies, longitudinal research provides a better test of the proposed direction of causality that a certain way of perceiving major life events leads to depression (Abramson et al., 1989; Beck & Bredemeier, 2016; Slavich & Irwin, 2014). Thus, in light of the limitation that experimental research on major life events is difficult or nearly impossible for most events, longitudinal research should be the gold standard for assessing the association between the perception of major life events and depression. Under certain circumstances, longitudinal studies even allow drawing causal inference (Grosz et al., 2020). Assessing both depression and perceived event characteristics at multiple measurement occasions would also help to examine the dynamic interplay between these constructs and identify for example bidirectional effects (Bedi, 1999; Haehner, Pfeifer, et al., 2023). Furthermore, different retest intervals were identified as one possible explanation for diverging findings across studies outlining the relevance of longitudinal

studies with more than just two measurement occasions. Generally, the association between the perception of major life events and depression seemed to be stronger in the first weeks or months after the event occurrence (e.g., Kwon, 1997). Thus, our findings also provide some initial guidelines for choosing the optimal time scale for spacing measurement occasions in future research and for incorporating the role of time in future theoretical accounts (Hopwood et al., 2022).

In summary, future research on the association between the perception of major life events and depression is needed. This research needs to (1) be conducted with more diverse samples, (2) be adequately powered to detected small effects, (3) use additional clinical depression ratings, (4) employ validated questionnaires assessing a unified set of perceived event characteristics, (5) examine perceived event characteristics in the context of different major life events, and (6) be longitudinal (ideally with more than just two measurement occasions). If more studies fulfilling these criteria become available, meaningful systematic integrations (e.g., using meta-analyses) of research on the (longitudinal) relationship between the perception of major life events and depression will be possible.

4.4.2 *Theoretical Implications*

Depression theories differ with respect to which perceived event characteristics they consider to be relevant for explaining the onset of a depression (Abramson et al., 1989; Beck & Bredemeier, 2016; Bedi, 1999; Ingram, 1984; Slavich & Irwin, 2014). The present review allows an initial evaluation of these different theoretical predictions.

A lot of research has been conducted on the perceived event characteristics proposed in Abramson's Hopelessness Theory of Depression: internality, stability, globality, inferred negative consequences, and negative self-implications (Abramson et al., 1989). These characteristics as well as their composite scores assessing a depressogenic attributional or cognitive style were frequently examined in hypothetical event studies. These studies found that the individual perceived event characteristics were cross-sectionally related to depression and that their composite scores interacted with the number of experienced negative life events in predicting increases in depressive symptoms over time (e.g., Haeffel, 2010; Joiner et al., 1995). Thus, findings were in line with the theoretical prediction that a depressogenic attributional or cognitive style serves as diathesis leading to depression when people are faced with negative life events. However, the Hopelessness Theory of

Depression also makes predictions for experienced major life events (which can be evaluated in autobiographical event studies). Perceiving experienced events in a depressogenic way (e.g., as having stable, global, and internal causes) should be the result of the diathesis-stressor interaction and lead to depression (mediated via hopelessness). Results from autobiographical event studies only partly supported this prediction. Only perceived globality of experienced events was cross-sectionally associated with depressive symptoms (e.g., Flett et al., 1991), and longitudinal evidence was too scarce to evaluate this theoretical prediction for autobiographical events.

A similar conclusion can be drawn for the other theoretical predictions summarized in Figure 4.1 derived from theories such as the Social Signal Transduction Theory (Slavich & Irwin, 2014). Future longitudinal research is necessary to evaluate whether the perceived event characteristics that have been proposed in the respective theories can predict the onset of a depression or changes in depressive symptoms over time. Currently, three of the theoretically proposed perceived event characteristics can at least be seen as promising candidates for predicting depression longitudinally: *distress* (as proposed in the Biopsychosocial Distress Adaptation Model), *valence* (as proposed in the Information Processing Model), and *loss* (as proposed in the Unified Model of Depression and the Information Processing Model). However, when more longitudinal research becomes available further relevant perceived event characteristics may be identified.

In summary, empirical evidence supports the diathesis-component of the Hopelessness Theory of Depression. However, future longitudinal research is necessary for conclusions whether the perception of experienced major life events can predict the onset of a depressive disorder. Furthermore, an integration (or refinement) of different theoretical perspectives regarding which perceived event characteristics are relevant for which major life events may be needed. Currently, no depression theory considers all perceived event characteristics that are associated with depression and existing evidence indicates that the relevance of perceived event characteristics may differ among events.

4.4.3   Practical Implications

Depression is a disorder with enormous relevance for public health (World Health Organization, 2017). Thus, it is of critical importance to understand its causes and to develop effective treatments. As most research summarized in this review was cross-

sectional and correlational, we refrain from drawing strong claims regarding the practical relevance of certain perceived event characteristics for the onset of depression. However, this scoping review allows one general conclusion: Considering how people perceive major life events is likely one important piece to understand why some people become depressed after experiencing major life events whereas others do not. This conclusion is of practical relevance for several reasons. First, a similar conclusion has already been drawn for post-traumatic stress disorder and grief implying that the perception of major life events may be of transdiagnostic relevance (Ehlers & Clark, 2000; Gehrt et al., 2018). Second, examining how people perceived a major life event may inform early intervention (e.g., who is particularly at risk for becoming depressed after experiencing a negative life event). Third, information on how people perceive major life events may be used to specify and personalize cognitive interventions (e.g., using techniques in the context of re-appraisal and cognitive restructuring; Woud & Hofmann, 2022).

4.4.4 Limitations

This review has some limitations. First, this scoping review provided an initial narrative integration of the existing evidence on the association between the perception of major life events and depression. However, narrative integrations always have a certain degree of subjectivity (e.g., due to decisions on how much space is attributed to certain studies; Crocetti, 2016). Consequently, when more longitudinal research becomes available, meta-analytical tools should be used for knowledge integration.

Second, as the theories to which we referred focused on explaining the onset of depression in adulthood (e.g., Abramson et al., 1989; Slavich & Irwin, 2014), we only included studies in this review that examined the association between the perception of major life events and depression in adulthood. However, depression is also an important threat to mental health among children and youth, and the perception of major life events is likely also relevant to understand the onset of depression in this age group (Joiner & Wagner, 1995). Furthermore, cognitive models of depression (e.g., Beck & Bredemeier, 2016) focus on childhood as a critical timeframe during which negative schemata (e.g., depressogenic cognitive styles) may be learned. Thus, improving our understanding of depressogenic styles and the perception of major life events in childhood might aid in preventing both depression in childhood and chronic depression in adulthood.

Third, the perception of major life events is only one factor associated with depression. However, the onset of depression depends on a range of social, biological, and psychological factors (e.g., cognitive biases, social support), and these factors are interacting with each other. Thus, to completely understand the onset of depression, it is necessary to examine the complex interplay of these different factors throughout the life span (Zhang et al., 2018).

Finally, we only included self-reported ratings of the subjective perception of major life events in this review. However, self-reports are subject to biases such as response styles, social desirability, and mood-confounding effects (Paulus & Vazire, 2009). Thus, assessing objective characteristics of major life events (e.g., Haehner, Bleidorn, & Hopwood, 2023), informant reports (e.g., Esbensen & Benson, 2006), or clinician ratings (e.g., Brown & Harris, 1989) of major life events may also be important to understand them as triggering factors of depression. Integrating these different perspectives on major life events beyond their subjective perception may be a challenging task for future research.

4.4.5   Conclusion

How people perceive major life events is associated with depression. This review showed that several perceived event characteristics such as valence, impact, or globality were consistently correlated with depression in cross-sectional research. However, evidence on the question whether the perception of major life events may explain the onset of a depressive disorder or changes in depressive symptoms over time was limited. Thus, further longitudinal research considering a unified set of perceived event characteristics, using large, non-Western, non-student samples is needed to better understand the association between the perception of major life events and depression.

4.5 Data Accessibility Statement

Details on the coding procedure, the extracted data, and an R script can be found at https://osf.io/dyr8z/. This study was preregistered on PROSPERO (protocol number: CRD42021266248).

4.6 Author Contribution Statement

The contributions of each author according to the CRediT Classifaction:

Peter Haehner:	Conceptualization (*lead*), Data Curation (*lead*), Investigation (*equal*), Methodology (*lead*), Project Administration (*lead*), Writing – Original Draft Preparation (*lead*), Writing – Review and Editing (*equal*)
Felix Würtz:	Conceptualication (*supporting*), Validation (*equal*), Investigation (*equal*), Writing – Review and Editing (*equal*)
Sarah Kritzler:	Conceptualication (*supporting*), Validation (*equal*), Investigation (*equal*), Writing – Review and Editing (*equal*)
Marius Kunna:	Conceptualication (*supporting*), Validation (*equal*), Investigation (*equal*), Writing – Review and Editing (*equal*)
Maike Luhmann:	Conceptualication (*supporting*), Resources (*equal*), Supervision (*equal*), Writing – Review and Editing (*equal*)
Marcella L. Woud:	Conceptualication (*supporting*), Resources (*equal*), Supervision (*equal*), Writing – Review and Editing (*equal*)

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5

Stability and Change of Perceived Characteristics of Major Life Events

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5. Stability and Change of Perceived Characteristics of Major Life Events

Abstract: The occurrence of major life events is associated with changes in well-being and personality traits. To better understand these effects, it is important to consider how individuals perceive major life events. Although theories such as Appraisal Theory and Affective Adaptation Theory suggest that event perceptions change over time and that these changes are relevant for personality traits and well-being, stability and change of perceived event characteristics have not been systematically examined. This paper aims to fill this gap using data from a longitudinal study ($N = 619$ at T1). In this study, participants rated nine perceived characteristics of the same major life event up to five times within 1 year. We estimated rank-order and mean-level stabilities as well as intraclass correlations of these life event characteristics with continuous time models. Furthermore, we computed continuous time models for the stability of affective well-being and the Big Five personality traits to generate benchmarks for the interpretation of the stability of the life event characteristics. Rank-order stabilities for the perceived event characteristics were lower than for the Big Five, but higher than for affective well-being. Most of the variance in perceived event characteristics was explained by between-person differences. Furthermore, we found a significant mean-level increase for the event characteristic change in world views and a significant decrease for extraordinariness. These mean-level changes are in line with the meaning-making literature and Affective Adaptation Theory, whereas the rather high rank-order stability of the perceived event characteristics challenges the importance of reappraisal processes of major life events.

5.1 Introduction

Major life events are relevant for various psychological outcomes. They have been associated with personality changes (Bleidorn et al., 2018; Lüdtke et al., 2011; Shiner et al., 2017; Specht, 2017), with changes in subjective well-being (Diener et al., 2006; Headey & Wearing, 1989; Lucas, 2007; Luhmann et al., 2012; Mancini et al., 2011), and with the onset of mental disorders (Assari & Lankarani, 2016; Beards et al., 2013; Berenbaum et al., 2008; Kendler et al., 2003; Paykel, 2003). In most studies, the occurrence of major life events was assessed categorically, that is, checklists were used to determine the type and the frequency of life events that the participants had experienced (Assari & Lankarani, 2016; Berenbaum et al., 2008; Headey & Wearing, 1989; Lüdtke et al., 2011; Shiner et al., 2017). This approach has been criticized because very different major life events can fall into the same checklist category and because interindividual differences in the perception of major life events are not taken into account (Dohrenwend, 2006; Luhmann et al., 2021; Redfield & Stone, 1979). An alternative approach is to let participants rate their perception of major life events on different continuous dimensions, henceforward called perceived event characteristics, such as valence, predictability, or challenge (Ferguson et al., 1999; Kendler et al., 2003; Luhmann et al., 2021). These perceived event characteristics can be used as predictors of event-related changes in subjective-well-being, mental health, and other outcomes (e.g., Fassbender et al., 2022; Luhmann et al., 2021).

In the present paper, we focus on how perceived event characteristics change over time. Examining stability and change of event characteristics is important for several reasons. First, studies that have investigated perceived event characteristics so far have asked the participants for their ratings at different time points after the major life event. In some studies, participants were asked to rate perceived event characteristics some weeks after the event (Mitchell et al., 1997), in other studies months (Hasan & Power, 2004; Nakai et al., 2014; Sheets et al., 1996) or even years after the event (Servaty-Seib, 2014). Currently, it is unclear how such temporal differences between studies affected the measured event characteristics and their associations with psychological outcomes. Second, findings on the stability and change of perceived event characteristics can help to further explore their nature (for a similar argument see Chung et al., 2014). A low stability could indicate that people's perception of life events is strongly determined by situational influences (Hammen, 2005; Schmidt et al., 1990), whereas a high stability could suggest that people

have a stable mental presentation of a major life event which might be more strongly influenced by stable personality traits or enduring cognitive styles (Rakhshani et al., 2022). Third, if perceived event characteristics change over time, it should be investigated whether these changes are correlated with changes in psychological outcomes. For example, does life satisfaction change after a major life event because someone perceives the event positively or because their perception becomes *more* positive over time (Brose et al., 2021)?

To date, stability and change of perceived event characteristics have not yet been systematically investigated. The present paper therefore focuses on the following research questions: How rank-order stable are the perceived event characteristics over time? Are there mean-level changes in the perceived event characteristics? Are these changes more prominent in certain event characteristics? We addressed these questions using longitudinal data containing repeated ratings of perceived characteristics of the same major life event using the Event Characteristics Questionnaire (ECQ; Luhmann et al., 2021). We used continuous time models (CTMs) to estimate rank-order and mean-level stabilities as well as intraclass correlations of the perceived event characteristics (Driver et al., 2017; Voelkle et al., 2012). These models treat time continuously and allow identifying the generating process of change (Voelkle et al., 2012). Since CTMs are not yet widely used in psychology, we also applied these models to analyze the stability of personality and affective well-being. Their stability has been well examined (e.g., Borghuis et al., 2017; Lüdtke et al., 2011; Roberts & DelVecchio, 2000; Watson & Walker, 1996; Yap et al., 2014) so that these results can provide benchmarks for the interpretation of the stability of the perceived event characteristics.

5.1.1 *Major Life Events and Perceived Event Characteristics*

Major life events are defined as "events that are clearly timed, disrupt one's everyday routine, and are perceived as personally significant and memorable by those who experienced them" (Luhmann et al., 2021, p. 634). In most studies, major life events are assessed with checklists that list numerous event categories and ask participants to indicate whether they have experienced them or not (Dohrenwend, 2006). One example is the *List of Threatening Experiences* (Brugha et al., 1985) which includes 12 event categories such as "serious illness, injury or assault to self", or "major financial crisis". Other checklists are more fine-grained (e.g., *PERI Life Events Scale*: 102 event categories, Dohrenwend et al., 1978; *Social Readjustment Rating Questionnaire*: 43 event categories, Holmes & Rahe, 1967).

In most cases, either the experience of a single event or a sum score of experienced events is then used as predictor for outcomes such as life satisfaction, mental health, or personality change (Assari & Lankarani, 2016; Berenbaum et al., 2008; Headey & Wearing, 1989; Lüdtke et al., 2011; Shiner et al., 2017).

This approach has several disadvantages (see Luhmann et al., 2021, for a more detailed discussion). First, the variability within a category is neglected. For example, a major depressive disorder and an almost deadly virus infection are quite different life events falling into the same category "serious illness, injury or assault to self" (Dohrenwend, 2006; Hammen, 2005). Second, differences between categories are not explained. For example, in the *List of Threatening Experiences* (Brugha et al., 1985), "separation due to marital difficulties" and "broke off a steady relationship" are distinguished without justifying why and how these categories differ. Third, the same life event can be perceived differently by different people (Redfield & Stone, 1979). For example, if a couple breaks up, one person might perceive this separation as a sudden, unforeseen, very negative event and for the other person it might be a relief that was long in coming.

To address these disadvantages, Luhmann et al. (2021) developed the *Event Characteristics Questionnaire (ECQ)*. The ECQ is a dimensional taxonomy to assess nine perceived characteristics of major life events: *valence* (positivity or negativity of the event), *impact* (extent to which the event changed one's life), *predictability* (extent to how predictably the event had occurred), *challenge* (amount of stress and anxiety caused by the event), *emotional significance* (extent to which the event elicited strong feelings), *change in world views* (extent to which the event changed one's views), *social status change* (extent of negative changes in one's social status), *external control* (extent to which the event was controlled or caused by others), and *extraordinariness* (extent of how extraordinary the event was). The ECQ showed satisfactory reliability, convergent validity, and predictive validity (Luhmann et al., 2021).

5.1.2   *Stability and Change of Perceived Event Characteristics*

Various theories suggest that the perception of major life events can change over time. For example, Appraisal Theory (Lazarus & Folkman, 1984) distinguishes between primary appraisal and reappraisal of an event. The term reappraisal explicitly describes a change in the primary appraisal (i.e., a change in the perception of an event). This change can be triggered by new information or it can be a form of cognitive coping, in which the past is

reinterpreted in a more positive way. In a similar manner, reappraisal of events is seen as important strategy of emotion regulation (Ford & Troy, 2019; Gross, 2002; Uusberg et al., 2019). Theories of post-traumatic growth also assume that the perceptions of stressful life events can change over time and that these changes are related to personality development (Jayawickreme & Blackie, 2014; Park, 2010). Finally, Affective Adaptation Theory (Wilson & Gilbert, 2008) states that adaptation of affective well-being occurs (at least partly) because perceptions of an event change over time. More precisely, the authors propose that the affective response after a major life event decreases over time as people try to explain the event to themselves. Thus, the event is in hindsight interpreted as more predictable and ordinary. Although these theories suggest that the perceptions of major life events change over time and that these changes are important for personality development and well-being, empirically, little is known about the occurrence and time frame of these changes.

Stability and change of a construct can be examined in different ways. In the present paper, we investigated rank-order stability and mean-level stability as indicators of stability at an aggregated level. Both are conceptually and statistically independent of each other and suitable to investigate different questions (Borghuis et al., 2017; Roberts et al., 2006; Roberts & DelVecchio, 2000). Rank-order stability indicates how much people change in their relative position within a sample over time (Bleidorn & Hopwood, 2019; Roberts & DelVecchio, 2000). Mean-level stability measures the direction and extent of absolute changes in a given construct averaged over all participants (Bleidorn & Hopwood, 2019; Roberts et al., 2006). Another indicator related to the stability and change of constructs that we also examined in the present study is the ratio of between-person and within-person variance (Merz & Roesch, 2011). This ratio indicates the relative importance of between-person differences and within-person changes.

Rank-Order Stability of Perceived Event Characteristics

Rank-order stability can be examined using test-retest correlations (e.g., the correlation between extraversion at time point one and extraversion at time point two) or autoregressive coefficients (e.g., the predictive effect of extraversion at time point one for extraversion at time point two). Test-retest correlations and autoregressive coefficients differ in their value range: test-retest correlations, like every correlation, have a fixed value range whereas autoregressive coefficients do not. However, for both measures, values between zero and one are usually expected in psychological research (Hamaker & Grasman, 2014; Ryan et

al., 2018). Another difference is the underlying causal assumption: Only autoregressive coefficients are based on a causal model and they indicate the carryover or predictive effect over time whereas test-retest correlations capture not only this direct carryover effect but may also be affected by other variables. Therefore, autoregressive coefficients are usually lower than test-retest correlations, and some authors argue that autoregressive coefficients are the preferable stability indicator (Dormann & Griffin, 2015).

There are already some findings regarding test-retest correlations of perceived event characteristics (Ferguson et al., 1999; Frazier et al., 2011; Lewinsohn et al., 1985; Sarason et al., 1978). However, these correlations were used to estimate test-retest reliability rather than rank-order stability, so the retest intervals were rather short (between 3 weeks and 3 months; see Table 5.1). Furthermore, a test-retest correlation based on manifest variables does not account for measurement error and therefore confounds measurement error and actual change. For this reason, rank-order stability is typically determined using structural equation modeling (see below for details; Chung et al., 2014). Despite these limitations, the previously published test-retest correlations can give an impression of rank-order stabilities over short intervals. If estimates of reliability are additionally available (e.g., Cronbach's alpha), a rank-order stability estimate adjusted for measurement error can be calculated (Röseler et al., 2020; Equation 2). Table 5.1 summarizes these existing findings on test-retest correlations of different perceived event characteristics and, whenever possible, also gives a rank-order stability estimate adjusted for measurement error.

Overall, these findings show that there is a moderate to high rank-order stability of perceived event characteristics at least over short periods of time. However, research on other constructs has shown that rank-order stability decreases when the length of the retest interval increases (e.g., personality traits: Damian et al. 2019, Fraley and Roberts 2005, Caspi et al. 2005; intelligence: Gow et al. 2011; self-esteem: Trzesniewski et al. 2003, Anusic and Schimmack 2016; attitudes: Arsenian 1970). In this study, we therefore moved beyond these short retest intervals by investigating rank-order stabilities of perceived event characteristics over a period of approximately 1 year. We expected to observe a similar decrease of rank-order stabilities of perceived event characteristics with increasing length of the retest interval (Hypothesis 1).

Table 5.1: *Test-Retest Correlations and Estimated Rank-Order Stability Coefficients of Perceived Event Characteristics Assessed With Questionnaires Other Than the ECQ*

Reference	Retest interval	Event characteristics	α	r_{12}	Estimated stability
Ferguson et al. (1999)	1 month	Threat	.82[a]	.90	1.00
		Challenge	.87[a]	.86	.99
		Loss	.75[a]	.77	1.00
	3 months	Threat	.82[a]	.49	.60
		Challenge	.87[a]	.48	.55
		Loss	.75[a]	.59	.79
Frazier et al. (2011)	3 weeks	Past control	.88 / .89	.80	.90
		Present control	.79 / .86	.59	.72
		Future control	.88 / .90	.79	.89
	4 to 6 weeks	Past control	.82 – .86	.76	.88 – .93[b]
		Present control	.77 – .82	.48	.59 – .62[b]
		Future control	.80 – .84	.67	.79 – .84[b]
Lewinsohn et al. (1985)	1 month	Aversiveness	.76 – .93	.60 – .80	
Sarason et al. (1978)	5 to 6 weeks	Positive change		.53	
		Negative change		.88	

Note. Stability was estimated according to Röseler et al. (2020), Equation 2.

[a] Information on internal consistency was derived from a different sample than the test-retest correlation, so the calculated stability may be inaccurate.

[b] Since only a range was specified for internal consistency in this study, only a range could be calculated for the stability estimator.

Mean-Level Stability of Perceived Event Characteristics

To the best of our knowledge, the mean-level stability of perceived event characteristics has not yet been empirically investigated. Therefore, this study provides first results on whether there are mean-level changes in the trajectories of perceived event characteristics (i.e., an increase or decrease over time). Based on theoretical considerations and empirical findings

from other fields of research, we had some expectations on how the perceived event characteristics extraordinariness, predictability, and valence might change over time.

As described above, Affective Adaptation Theory (Wilson & Gilbert, 2008) states that an event triggers a weaker emotional response over time because it is "explained away". By this, the authors refer to some higher order iterative mental process of finding explanations for an event so that it is perceived as more predictable and less exceptional. Accordingly, we assumed that perceived extraordinariness of major life events decreases, and that perceived predictability increases over time (Hypotheses 2 and 3). Findings on hindsight bias, which show that an event is retrospectively judged as more predictable, also fit this assumption (Fessel et al., 2009; Fischhoff & Beyth, 1975; Hawkins & Hastie, 1990). However, it should be noted that hindsight bias is usually tested by comparing participants' ratings of the likelihood of an event *before* and *after* the event occurred. In this study, perceived event characteristics were only assessed at different time points *after* the event. Nonetheless, there is research suggesting that hindsight bias needs some time to develop and that the perceived predictability of an event increases with increasing temporal distance from this event (Blank et al., 2008; Bryant & Brockway, 1997; Bryant & DeHoek, 2006; Bryant & Guilbault, 2002).

Another memory bias that could explain how the perception of an event characteristic changes over time is the positive memory bias or "rosy view" (Adler & Pansky, 2020). According to the positive memory bias, healthy individuals remember autobiographical events more positively in retrospect and forget negative emotions more quickly than positive ones (Adler & Pansky, 2020; Mitchell et al., 1997; Olson & Zanna, 2013; Sedikides & Skowronski, 2020; Walker & Skowronski, 2009). Based on findings on positive memory bias, we expected the perceived valence of an event to become more positive over time (Hypothesis 4).

Ratio of Between-Person and Within-Person Variance
Between-person variance refers to the variability that can be attributed to differences between individuals. Within-person variance quantifies changes of a construct within individuals over time. Test-retest correlations as indictors of rank-order stability have been criticized since they mix these two types of variance (Cicchetti, 1994; Wagner et al., 2019). This criticism applies also to our estimation of rank-order stability using autoregressive

coefficients. For this reason, we additionally computed intraclass correlations that estimate how much of a construct's total variance can be attributed to between-person differences. Higher intraclass correlations are an indicator of a higher stability since between-person differences are then more important than within-person fluctuations (Andreassen, 2016). In principle, similar results can be expected for intraclass correlations and rank-order stability: If there is no within-person variance (i.e., individuals do not change over time), there should be no changes in rank orders (maximum rank-order stability). However, if every participant changes equally over time, say, all participants become one scale point more extraverted, rank-order stability will still be at its maximum although there are within-person fluctuations. Thus, intraclass correlation and rank-order stability provide different information about stability and change of a construct.

5.1.3   *Statistical Methods for Estimating Stability and Change*

The statistical methods for estimating stability and change of constructs have evolved over the last decades. Older studies were based on the investigation of manifest variables using test-retest correlations and repeated measures ANOVA (e.g., Arsenian, 1970; Costa et al., 2000; Crawford et al., 1986; Gustavsson et al., 1997; Watson & Walker, 1996). As mentioned above, these results can be distorted by measurement error (Borghuis et al., 2017; Watson, 2004). Modern approaches therefore use statistical methods for latent variables such as structural equation modeling.

Structural equation modeling allows separating the true (common) variance of a construct and the error variance (Little, 2013a; Ullman & Bentler, 2006). Latent growth curve models are frequently applied to evaluate mean-level stability within the context of structural equation modeling (Bleidorn et al., 2009; Borghuis et al., 2017; Chung et al., 2014; van Scheppingen et al., 2018). In latent growth curve models, a latent intercept and a latent slope are modeled to describe the average change of a construct over time. Latent growth curve models allow modeling both linear and non-linear changes (Little, 2013a) and time can be explicitly included in these models. In contrast to mean-level stability, rank-order stability is often estimated by using first-order autoregressive models in which the autoregressive coefficient serves as stability estimate (Borghuis et al., 2017; Chung et al., 2014). In these models, time is usually only considered implicitly by the order of measurement occasions which makes it difficult to account for unequally spaced time intervals (Voelkle et al., 2012).

In the present study (as in many panel studies), the time intervals between the measurement occasions varied between and within participants. If not adequately accounted for, these unequal temporal distances lead to a distorted estimation of autoregressive parameters since those parameters are time-interval dependent (Kuiper & Ryan, 2018; Voelkle & Oud, 2013). One way to deal with unequally spaced time intervals between the measurement occasions is the use of continuous time models (CTMs)[12]. As used here, CTMs are estimated in context of structural equation modeling. These models treat time continuously and thus describe the change of a construct over time accurately even if the time intervals differ within a study (Voelkle et al., 2012; Voelkle & Oud, 2013; Voelkle & Wagner, 2017). Traditional models for longitudinal data analysis (e.g., cross-lagged panel models or latent change score models) provide estimates of a change process for specific time intervals (e.g., the autoregressive effect of extraversion for an interval of 3 months). In contrast, CTMs can be used to investigate the generating process of change, that is, that they use the available information to identify the underlying function of the parameter of interest (e.g., the function of the autoregressive effect of extraversion). With this function, it is possible to compute the autoregressive effect for any time interval of interest. Overall, CTM is a useful and flexible method to investigate the stability and change of a construct over time.

By using CTMs, unequally spaced measurement occasions turn into a strength of the study as they deliver information about the change of a construct at many *different* time points, and this information can help identify the generating process of change (Voelkle & Oud, 2013). In this study, their use was especially important because besides the unequally spaced measurement occasions due to our sampling procedure (see below), CTMs also account for unequal temporal intervals between the event occurrence and the first measurement occasion. Furthermore, it can be assumed that most psychological constructs (including perceived event characteristics) undergo continuous changes for which it is reasonable to model change continuously (Deboeck, 2013; Hecht & Voelkle, 2021; Ryan et al., 2018).

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[12] Some helpful references to understand CTMs in more detail are: Voelkle et al. (2012) for a comprehensive introduction of CTMs in context of psychology; Voelkle and Oud (2015) for a comparison of latent change score models and CTMs; de Moor et al. (2021), Mueller et al. (2018), and Wagner et al. (2018) as applied examples of the use of CTMs in context of personality psychology.

Since CTMs are not yet widely used in psychology (Deboeck, 2013; Voelkle et al., 2012; Wagner et al., 2019), we explain them in detail in the Data Analysis section below. To facilitate the interpretation of the findings of stability and change of perceived event characteristics, we also computed CTMs for measures of personality and affective well-being as their stability has been well examined (Lüdtke et al., 2011; Roberts & DelVecchio, 2000; Vaidya et al., 2008; Watson & Walker, 1996). According to the meta-analysis by Anusic and Schimmack (2016), these two constructs are quite representative of the range of rank-order stabilities of psychological constructs, with personality being among the most stable constructs and affective well-being being relatively volatile.

5.1.4 *The Present Study*

In this longitudinal study, a sample of young adults rated the perceived characteristics of a major life event they had recently experienced with the ECQ up to five times within 1 year. This design allowed us to examine how their perceptions of the characteristics of the same major life event changed over time. We examined stability and change in these perceived event characteristics in different ways to answer three research questions. (1) How stable are individual differences in the perceived event characteristics (rank-order stability)? In particular, we were interested in whether perceived event characteristics differed in their rank-order stability and in how stable the rank orders of event characteristics were compared to the rank orders of affective well-being and personality traits. We expected rank-order stabilities of the perceived event characteristics to decrease with increasing length of the retest interval (Hypothesis 1). (2) Does the average perception of certain perceived event characteristics change over time (mean-level stability)? We expected perceived predictability and valence to increase, and perceived extraordinariness to decrease over time (Hypotheses 2 to 4). (3) What percentage of the total variance of perceived event characteristics can be explained by between-person differences (intraclass correlation)? Is this amount of variance similar to the ones of affective well-being or personality traits? We had no directed hypothesis for this research question.

5.2 **Methods**

The data for this paper came from the *What's NEXT? Study*, a five-wave longitudinal panel study conducted in 2018 and 2019. Data from the *What's NEXT? Study* were already used by Fassbender et al. (2022), Kritzler et al. (2022), and Luhmann et al. (2021), but these publications did not investigate stability or change of perceived event characteristics. Data

collection was approved by the local ethics committee of Ruhr-University Bochum. The preregistration of the study design is provided at https://osf.io/pm5xn. The preregistration for the analyses presented in this paper can be retrieved from https://osf.io/cjtk6. Deviations from this preregistration are summarized in the supplemental material (Table S5.1).

5.2.1   Research Design

The *What's NEXT? Study* primarily addressed young adults who had graduated from high school or university in Summer 2018. This target group was selected because major life events are particularly likely to occur after life transitions such as a graduation (Lüdtke et al., 2011). Participants first registered for the study, provided an email address, informed consent, and they verified their age (minimum age 18 years). After this registration, they were invited to complete an online survey five times (henceforward referred to as T1 to T5) within 1 year (i.e., 0, 12, 24, 36, and 48 weeks after registration). Participants were invited to all online surveys, regardless of whether they had participated at the previous measurement occasion, unless they unsubscribed from the study. Thus, there were participants with missing data on some assessments (including T1). We asked participants to complete the surveys within 2 weeks after receiving the email invitations, but there was no limit on the time in which they were able to respond to an invitation. Consequently, some participants followed our invitation immediately and others after several weeks, so that the time intervals between the measurement occasions were not equal for all participants (Table 5.2).

At T1, participants freely named the most important major life event that had occurred in the last 3 months and rated it with the ECQ. At T2, participants were shown the event they had named at T1 and were asked to rate it again with the ECQ. At T3 and T4, only a randomly selected subsample of participants rated the T1 event with the ECQ again[13]. This design resulted in planned missing values for the ECQ at T3 and T4 which can easily be handled with CTMs, since these missing values "may simply be conceptualized as instances of unequal time intervals" (Mueller et al., 2018, p. 1132). At T5, all participants were asked to re-rate the T1 event with the ECQ. In addition to the ECQ, other

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[13] The other participants rated events that had occurred between the other measurement occasions which we did not analyze here.

questionnaires including the ones assessing personality or well-being were also administered at each measurement occasion (see the study-design preregistration for a complete list of all questionnaires).

Table 5.2: *Information on Demographic Characteristics and Temporal Distances Between the Measurement Occasions*

Measurement occasion	Demographic characteristics		Temporal distance to the next measurement occasion (in weeks)			
	% female	% high school graduation	*M*	*SD*	*Min*	*Max*
T1	72.54	92.57	12.94	1.19	4.06	19.60
T2	76.00	92.24	12.08	1.20	6.29	21.06
T3	76.52	92.82	12.09	0.98	8.66	18.34
T4	75.61	92.99	12.16	1.02	7.22	18.18
T5	76.10	93.08				

Note. The average temporal distance between the major life event named by the participants and T1 was 6.78 weeks ($SD = 3.85$, Range = 0–15).

5.2.2 Participants

Participants were recruited via social media platforms as well as at introductory events at universities. As compensation for participation and to reduce dropout, vouchers with increasing values were raffled after each measurement occasion.

A total of 857 people registered to take part in this panel study. To ensure data quality, we excluded all participants with incorrect or missing answers on two instructed response items (see below) and participants who completed the online questionnaires in less than 10 minutes (40% of expected duration). Furthermore, only participants who named and rated an event at T1 that had occurred in the last 15 weeks (i.e., within the requested time frame) were included in our analyses. Overall, this procedure resulted in the following sample sizes: $N_{T1} = 619$, $N_{T2} = 430$, $N_{T3} = 364$, $N_{T4} = 331$, and $N_{T5} = 321$. Participants' mean age at T1 was 21.48 years ($SD = 4.05$). More details on the demographic characteristics of the sample are displayed in Table 5.2.

5.2.3   Measures

Items of the scales were presented in randomized order. Mean scores were calculated for descriptive purposes.

Naming a Major Life Event and Timing of the Event

At T1, participants could freely name a major life event that had occurred in the last 3 months before T1. The instruction included information on the definition of major life events (personally relevant, clearly timed). To provide more information on the named events, we created a word cloud of the free-text answers and coded the events into event categories (see the supplemental material for details). In addition, participants were asked to indicate how many weeks ago the event occurred.

Big Five Personality Traits

The Big Five personality traits (agreeableness, conscientiousness, extraversion, neuroticism, openness) were measured with the German 15-item version of the BFI-2-XS (Rammstedt et al., 2018; Soto & John, 2017). Items were rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Responses were reversed if appropriate.

Affective Well-Being

Affective well-being was assessed with the German 6-item version of the Scale of Positive and Negative Experiences (SPANE; Diener et al., 2010; Rahm et al., 2017). Participants were asked to rate how often they felt a certain way (e.g., "happy") within the last month. Items were rated on a 5-point scale ranging from 1 (*very rarely or never*) to 5 (*very often or always*). Responses were reversed if appropriate so that all items indicate higher affective well-being.

Event Characteristics Questionnaire

The ECQ (Luhmann et al., 2021) was used to assess perceived characteristics of the major life event (items as in Study 5 in Luhmann et al., 2021). Items were rated on a 5-point scale ranging from 1 (*not true at all*) to 5 (*absolutely true*). The ECQ measures nine perceived event characteristics: valence (6 items, e.g., "The event was joyful"), challenge (4 items, e.g., "The event was stressful"), extraordinariness (3 items, e.g., "Few people like me experience such an event in their lives"), predictability (4 items, e.g., "The event was predictable"), external control (4 items, e.g., "The event was in other people's hands"), emotional significance (4 items, e.g., "The event elicited strong feelings"), change in world views (4 items, e.g.,

"The event changed my views"), impact (4 items, e.g., "The event had a strong impact on my life"), and social status change (4 items, e.g., "The event threatened my social status"). Responses were reversed if appropriate.

Instructed Response Items

Each survey included two instructed response items (Meade & Craig, 2012) such as "In order to secure the data quality, please select the response option *often*". Participants with false or no answer on these items were excluded.

5.2.4 Data Analysis

All analyses were conducted in R (version 4.0.2). The R scripts for our analyses can be retrieved from https://osf.io/urqdw. We used CTMs to answer our research questions and to test our hypotheses. These analyses were conducted with R packages *ctsem* and *ctsemOMX* (Driver et al., 2017). We used a level of significance of $\alpha = .05$.

General Information on Continuous Time Models

We applied CTMs via structural equation modeling. As in classical structural equation modeling, a latent factor is modeled which is free of measurement error. This latent factor is also referred to as latent process since its level and relation to other constructs is continuously monitored over time (Voelkle et al., 2012; Voelkle et al., 2018).

To understand CTMs, one has to distinguish continuous and discrete time parameters[14]. Other methods to model longitudinal data (e.g., latent change score models or cross-lagged panel models) usually provide discrete time parameters which describe the relationship between two variables at a certain point in time (e.g., the autoregressive effect of valence for an interval of 3 months). In contrast, continuous time parameters determine the underlying function of the discrete time parameters. In CTMs, these continuous time parameters are calculated based on stochastic differential equations (Voelkle et al., 2012). The interpretation of continuous time parameters can be difficult without a deeper understanding of these differential equations. However, continuous time parameters offer the advantage that they can be used to determine the discrete time parameters for any time interval.

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[14] To distinguish discrete time and continuous time parameters in equations and results, we label discrete-time parameters with an asterisk (*).

With CTMs, the following continuous time parameters are calculated: the drift matrix, the diffusion matrix, and continuous time intercept(s). For this study, the drift matrix is the most important part of CTMs as it includes the parameters that describe the temporal dynamics of latent processes (Driver & Voelkle, 2018a). In our case, since we used CTMs with only one latent process, the drift matrix has only one element: an auto-effect. This auto-effect can be used to determine discrete time autoregressive effects for any time interval (Driver & Voelkle, 2018a; Voelkle et al., 2012). For example, the continuous time auto-effect for extraversion can be used to compute the autoregressive effect for extraversion for an interval of 3, 5, or 12 months (see Voelkle et al., 2012 for equations).

Using Continuous Time Models to Answer the Research Questions and Test the Hypotheses

In our analyses, we applied CTMs based on first-order stochastic differential equations with only one latent process (i.e., one model for each perceived event characteristic). To obtain benchmarks for interpretation, we also computed the same models for the Big Five personality traits and affective well-being. First-order CTMs assume that there is a single generating process of change (Ryan et al., 2018; Voelkle et al., 2012). In this kind of model, a negative continuous time auto-effect indicates that the latent process is reverting to an equilibrium position (asymptotically stable process; Voelkle & Oud, 2013). For example, if the major life event caused an immediate increase in affective well-being, a first-order CTM with a negative continuous time auto-effect implies that affective well-being will revert to a stable long-term mean level (i.e., equilibrium position) over time. We chose this kind of modeling because it seemed reasonable to assume that the perceived event characteristics, personality traits, and affective well-being change in such a manner after a major life event. This assumption is also supported by existing equilibrium theories for well-being and personality traits (for an overview see Luhmann & Intelisano, 2018, and Ormel et al., 2017). However, other dynamics can also be modeled with the employed first-order stochastic differential equations. For example, a positive continuous time auto-effect would indicate an explosive process that is not reverting to an equilibrium position but is repelled from it (Ryan et al., 2018).

To answer our first research question regarding the rank-order stabilities of the perceived event characteristics, we examined the continuous time auto-effect a. As outlined above, we expected this coefficient to be negative. In this case, values closer to zero indicate a higher rank-order stability of a construct (Driver & Voelkle, 2018a; Ryan et al., 2018). Furthermore,

values closer to zero indicate a smaller decline in discrete time autoregressive coefficients with increasing length of the retest interval. A value of exactly zero means that the discrete time autoregressive coefficient equals one for any time interval (i.e., no decline of rank-order stability). Thus, results would be consistent with Hypothesis 1 (decline of rank-order stability with increasing length of the retest interval) if the confidence interval of the continuous time auto-effect included only negative values. Furthermore, we computed and plotted the more interpretable discrete time autoregressive coefficients for time intervals of up to 15 months (which approximately equals the temporal distance between the event occurrence and the last measurement occasion) to address Research Question 1.

Regarding the mean-level stability of the perceived event characteristics (Research Question 2 and Hypotheses 2 to 4), we examined the mean level of the latent process. We computed and plotted this mean level over an interval of 15 months. Additionally, we calculated an effect size for mean-level change over 15 months (ES_{15}) for all nine perceived event characteristics, the Big Five personality traits, and affective well-being:

$$ES_{15} = \frac{\mu_{\eta 15}^{*} - \mu_{\eta 0}^{*}}{\sqrt{q_0^{*}}} \tag{1}$$

$\mu_{\eta 0}^{*}$ (*ToMean*) and q_0^{*} (*ToVar*) indicate the mean level and the variance of a latent process at time point zero and can be seen as starting values of the latent process (Driver & Voelkle, 2018). We also tested the statistical significance of mean-level changes for a certain life event characteristic by comparing the model fit of two nested CTMs (Driver et al., 2017). In the first (restricted) model, it was assumed that the latent process is already in its equilibrium position ($\mu_{\eta 0}^{*}$ is restricted to stationarity). Thus, in this restricted model, no mean-level changes are allowed. In the second (unrestricted) model, the parameter $\mu_{\eta 0}^{*}$ was freely estimated and may thus deviate from the equilibrium position, so that there may be mean-level changes in the latent process. The two nested models were compared with a likelihood ratio test (Δ–2LL) and by examining the change in Akaike's information criteria (ΔAIC). Mean-level changes were interpreted as significant if ΔAIC > 4 *and* if the likelihood ratio test was significant (de Moor et al., 2021). Using this procedure, we could examine whether there were overall mean-level changes in the process with the passing of time. However, it should be noted that not all forms of mean-level changes can be identified using this procedure (e.g., a big oscillation; Driver & Voelkle, 2018b).

Regarding Research Question 3 (ratio of between-person and within-person variance), we computed intraclass correlations for the perceived event characteristics, affective well-being, and the Big Five personality traits. The intraclass correlations indicate how much of the total long-range process variance is explained by between-person differences (Hecht & Voelkle, 2021):

$$\text{ICC} = \frac{\sigma_{b\infty}^2}{\sigma_{b\infty}^2 + q_{\infty}^*} \tag{2}$$

To calculate such an intraclass correlation, we estimated CTMs with random intercepts (see next section for more details). $\sigma_{b\infty}^2$ is the long-range variance of the continuous time intercept and thereby a measure of between-person differences in the long range (i.e., between-person variance when the time interval approaches infinity). q_{∞}^* is the asymptotic diffusion variance and indicates the within-person variance in the long range (i.e., within-person variance when the time interval approaches infinity)[15].

Details on Model Specification

The specification of our model is illustrated in Figure 5.1, and the model equations are provided in the supplemental material ([Figure S5.2]). CTMs were applied in the same way to all nine perceived event characteristics, the Big Five, and affective well-being. The latent process was scaled using the indicator-variable method, that is, the factor loading of the first indicator was fixed to one and its mean to zero. All other means of the manifest indicators and factor loadings were freely estimated. We used single items as indicators, except for valence and affective well-being. These two constructs were measured with six items, allowing us to create three item parcels with two items each as recommended by Little (2013b). All continuous time parameters (drift matrix, diffusion matrix, continuous time intercept) were freely estimated. In addition, we freely estimated the initial variance (q_0^*; *ToVAR*) and the initial mean ($\mu_{\eta 0}^*$; *ToMEAN*) of the latent process—with the exception that the initial mean was restricted to stationarity in model comparisons to test significance

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[15] Note that the estimates of the intraclass correlations of CTMs might not be directly comparable to the ones computed using mixed models. With CTMs, we were estimating how much of the "long-range variance" is attributable to between-person differences. These long-range estimates can be interpreted as "expectations about the estimated process, independent of any measurements" (Hecht et al., 2019; p. 536). In contrast, intraclass correlations computed with mixed models are not independent of the measurements but are calculated based on observed scores.

of mean-level changes. Regarding the coding of time, we set the time point at which the event occurred to zero and computed the individual distances (in weeks) between this starting point and the measurement occasions for every participant.

In the models addressing Research Question 3, random intercepts were included to distinguish between-person and within-person variability[16] (Voelkle et al., 2018; Wagner et al., 2019). In the models addressing Research Questions 1 and 2, in contrast, the intercept was fixed for two reasons. First, with a fixed intercept, the autoregressive drift coefficient reflects both within-person and between-person changes (which allows the desired rank-order stability interpretation). Second, models with fixed intercepts are more parsimonious and may lead to more consistent results than models with random intercepts (de Moor et al., 2021).

Figure 5.1: *Illustration of Model Specification in Our Case*
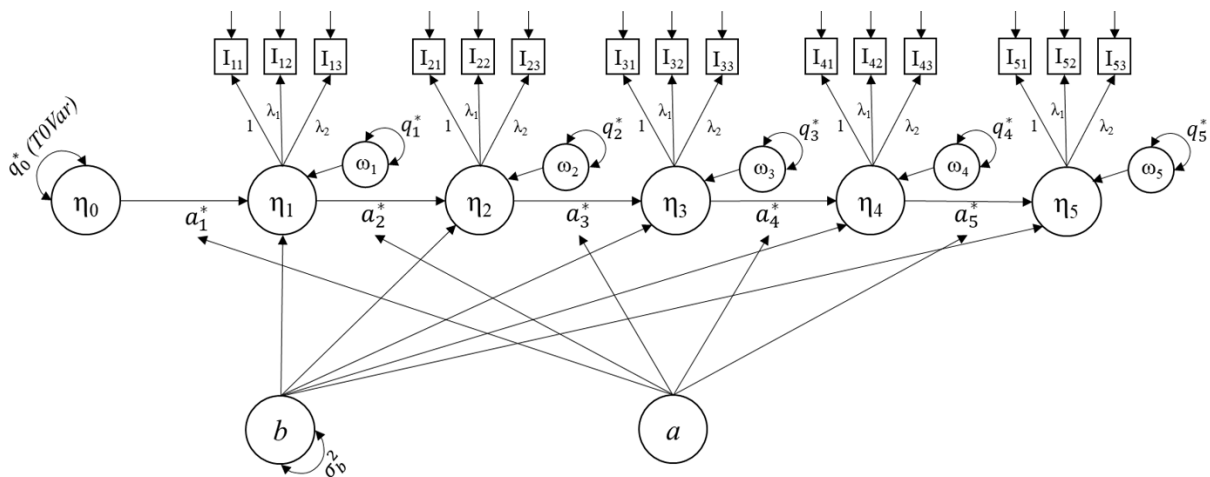
Note. To keep the figure parsimonious, we did not include illustrations of means. σ_b^2 was only estimated in the random-intercept model to answer Research Question 3; in the other models, this variance was fixed to zero. a represents the continuous time auto-effect and b the continuous time intercept. Asterisks (*) indicate discrete time parameters. Some elements of this illustration are adapted from Hecht and Zitzmann (2020) and Wagner et al. (2018).

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[16] In contrast to the fixed-intercept models, we computed the random-intercept models using the *ctStanFit*-function (Driver & Voelkle, 2018a) which allows random effects for all intercept-related parameters (*ToMean*, b, and manifest means).

Measurement Invariance and Required Sample Sizes for Continuous Time Models

Although the assumption of measurement invariance can be relaxed for CTMs (Driver, 2020), we applied CTMs in a way that requires measurement-invariant items over time. We tested this assumption using the R packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2020). More details on the model specification and the results are reported in the supplemental material (Table S5.7). All scales except the subscale agreeableness of the Big Five and the ECQ subscale impact showed strong measurement invariance. For these two subscales, the covariance matrix of the latent factors was not positive definite. Since stability and change of agreeableness were not the main focus of the present paper, we did not consider it in the CTMs. For the ECQ subscale impact, we were able to achieve strict measurement invariance by dropping the item with the largest modification index.

Regarding the required sample size for CTMs, a simulation study by Hecht and Zitzmann (2020) indicated that for a design like ours with five measurement occasions, 250 to 500 people might be sufficient for good model performance. We thus assumed that our sample size was sufficient to compute univariate CTMs. However, a word of caution is needed since these simulations are based on many other assumptions (e.g., the range of true parameter values) and it is difficult to generalize their findings beyond the investigated conditions (Hecht & Zitzmann, 2020).

Problems with Estimation of Continuous Time Models

Not all CTMs converged right away. Therefore, we followed our preregistered statistical analysis back-up plan to improve model estimations. First, we changed the coding of time. Although CTMs in general allow computing discrete time parameters for any arbitrary time interval, the coding of time is relevant for model estimation. Model estimation is improved if a time scale is chosen "that roughly matches the expected dynamics" (Driver et al., 2017, p. 27). With time coded in months, all models for the perceived event characteristics except impact and the model for affective well-being converged. For the Big Five and the perceived event characteristic impact, which seemed to be more stable, we had to code time in units of 6 months. However, estimates can easily be converted between the different time scales so that the presented results and the created graphs can be directly compared across all constructs.

Second, we had some estimation problems with the random-intercept models for the Big Five personality traits. Initially, we had planned to include a random effect for the continuous time intercept only. However, the random-intercept models for the Big Five only converged when including random effects for all intercept-related parameters (*ToMean*, *b*, and manifest means). To obtain comparable results, we computed all random-intercept models in this way. In general, the results for the different Big Five personality traits were then very similar to each other so that, in the following, we only report findings on openness. Results for the other Big Five traits are presented in the supplemental material (Tables S5.8 and S5.9).

5.3   Results

5.3.1   *Descriptive Statistics*

Descriptive statistics and internal consistencies for all scales are reported in the supplemental material (Tables S5.2 to S5.5). Figure 5.2 depicts individual growth trajectories for the perceived life event characteristics for 75 randomly selected participants. Two aspects about this figure should be noted: First, there are pronounced between-person differences in the perceived event characteristics; second, at least for some individuals, there are considerable changes in event perceptions over time.

Regarding the events that the participants named at T1, it can be summarized that these events were mostly positive and that they can be seen as typical for a sample of young university students. The event categories that the participants named most frequently were *vacation* ($N = 52$), *starting college* ($N = 48$), *relocation* ($N = 47$), and *Abitur* (German high school diploma; $N = 46$). More details on the event categories and the free-text answers of the participants are presented in the supplemental material (Table S5.6 and Figure S5.1).

Figure 5.2: *Individual Growth Trajectories of 75 Randomly Selected Participants*
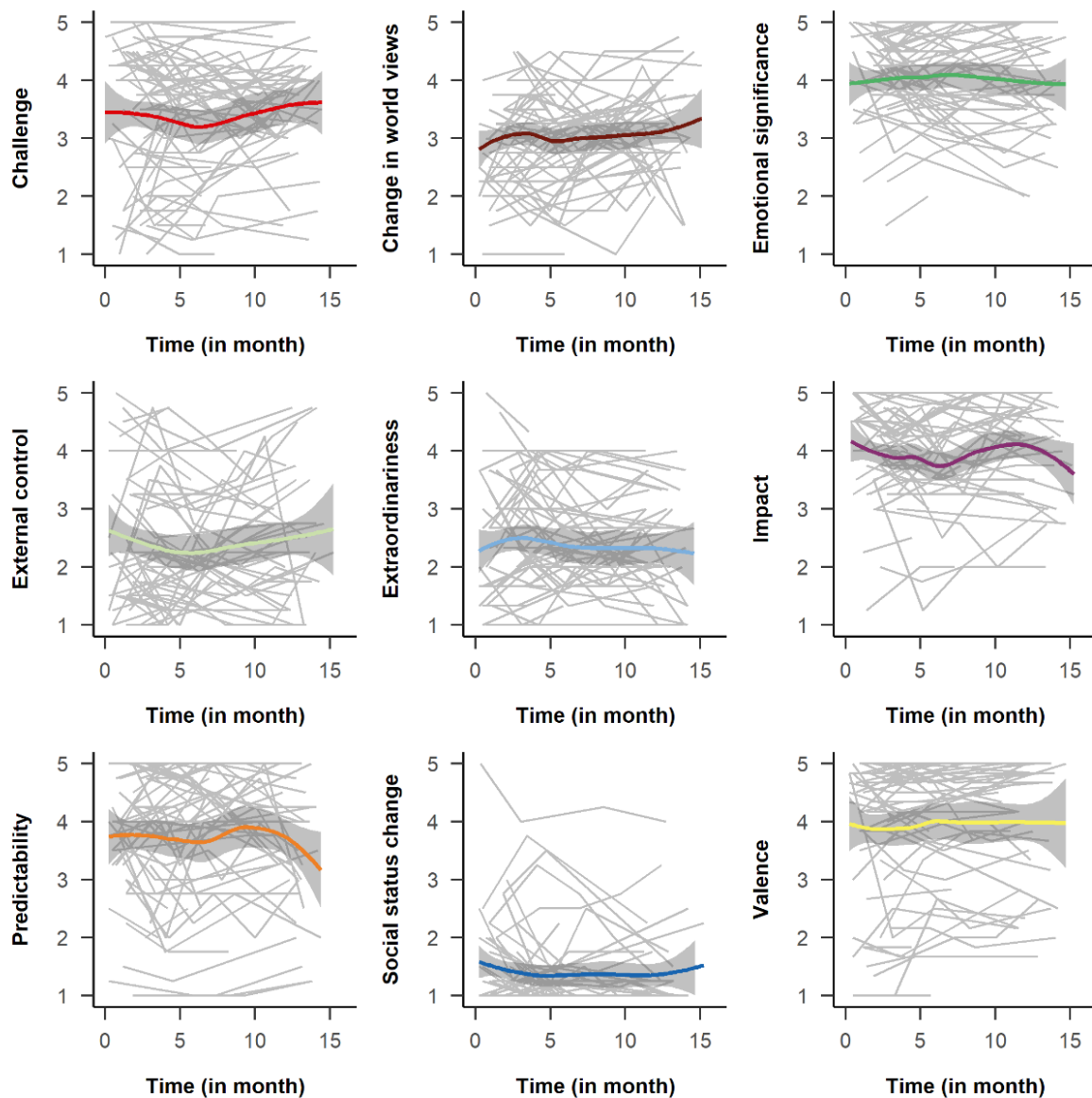
Note. Growth trajectories for the nine perceived event characteristics of 75 randomly selected participants including LOESS curve with confidence interval.

5.3.2   Rank-Order Stability

Rank-order stability indicates how much people change in their relative position within a sample over time. Our first research question was whether the perceived event characteristics differed in their rank-order stability and how stable the rank orders of the event characteristics were compared to the rank orders of affective well-being and personality traits. Furthermore, we hypothesized that the rank-order stabilities of the perceived event characteristics decreased with increasing retest interval (Hypothesis 1). To

evaluate Hypothesis 1 and Research Question 1, Table 5.3 shows the continuous time auto-effect (a) as well as the 1-month (a_1^*) and 12-months (a_{12}^*) discrete time autoregressive parameters for all perceived event characteristics, openness, and affective well-being. The change of discrete time autoregressive coefficients over time is also depicted in Figure 5.3. In the following, the main findings of these analyses are summarized.

Table 5.3: *Model Fit, Continuous Time Auto-effects, and Discrete Time Autoregressive Parameters for the Perceived Event Characteristics, Openness, and Affective Well-being*

Variable	Continuous time auto-effects		Discrete time autoregressive effects		Model fit (−2LL)
	a	95% CI	a_1^*	a_{12}^*	
Challenge	−0.030	[−0.041, −0.027]	0.971	0.698	17071.57
Change in world views	−0.038	[−0.054, −0.023]	0.963	0.634	17217.37
Emotional significance	−0.020	[−0.032, −0.018]	0.980	0.783	15387.05
External control	−0.022	[−0.036, −0.010]	0.978	0.763	18574.44
Extraordinariness	−0.019	[−0.032, −0.008]	0.981	0.793	12769.53
Impact [a]	0.010	[0.002, 0.017]	1.010	1.124	13905.75
Predictability	−0.028	[−0.038, −0.026]	0.972	0.711	16224.65
Social status change	−0.040	[−0.054, −0.026]	0.961	0.622	12328.93
Valence	−0.023	[−0.030, −0.022]	0.977	0.755	9072.07
Openness [a]	−0.002	[−0.010, 0.005]	0.998	0.977	15646.28
Affective well-being	−0.141	[−0.165, −0.118]	0.869	0.185	10502.89

Note. a = continuous time auto-effect; CI = confidence interval; a_1^* = 1-month discrete time autoregressive parameter; a_{12}^* = 12-months discrete time autoregressive parameter; −2LL = −2 Log-Likelihood.

[a] Estimates for openness and impact were computed using a coding of time in units of 6 months to improve model estimation but were then converted so that the results are now directly comparable to the results of the other scales.

Figure 5.3: *Discrete Time Autoregressive Coefficients for Different Lengths of the Retest Interval*
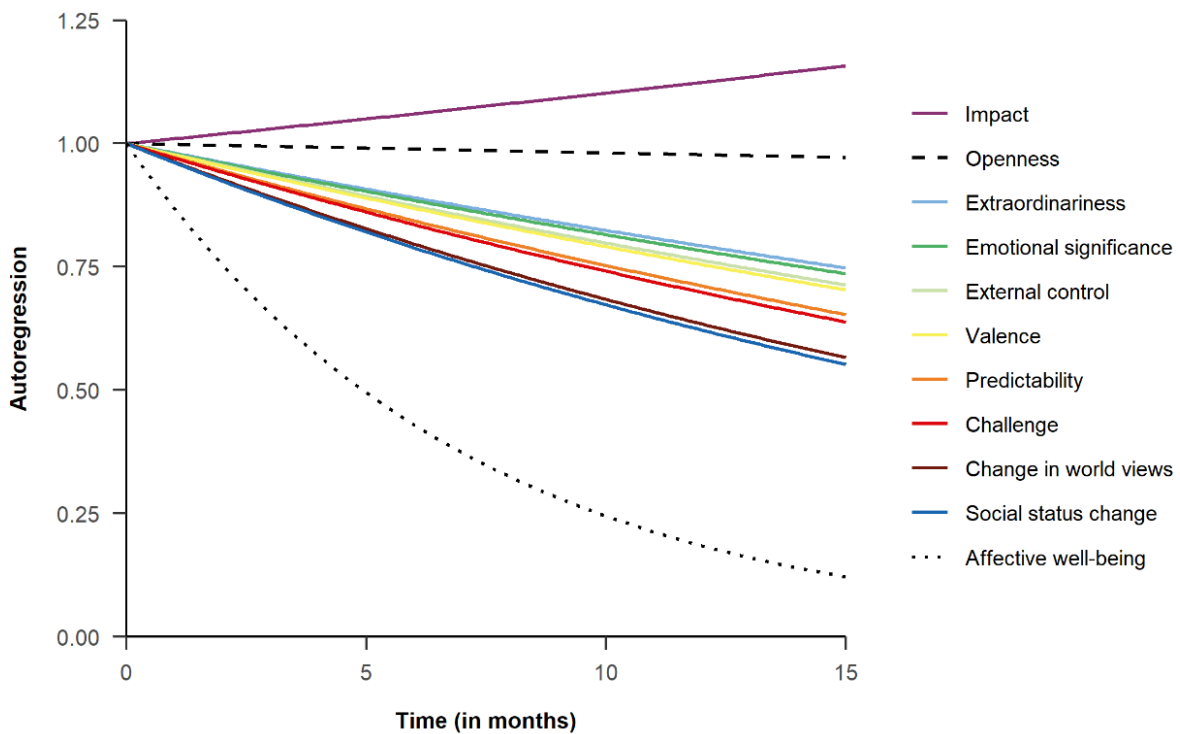
Note. Discrete time autoregressive coefficients for different lengths of the retest interval are depicted. The order of the constructs in the legend corresponds to their order in the graph (from high to low autoregressive coefficients). In the supplemental material, there is a depiction of autoregressive coefficients separately for each perceived event characteristic with openness and affective well-being as benchmarks for interpretation (Figure S5.3).

First, for the interpretation of the continuous time auto-effects, it is important to recall that they were expected to be negative with values closer to zero indicating a higher rank-order stability (Driver & Voelkle, 2018a; Ryan et al., 2018). All perceived event characteristics except impact had negative continuous time auto-effects and their confidence intervals did not include zero. This means that the discrete time autoregressive coefficients significantly decreased with increasing length of the retest interval. Thus, results for all life event characteristics (except impact) were consistent with Hypothesis 1. In contrast to the perceived event characteristics, openness, neuroticism, and extraversion did not reveal a statistically significant decrease within the time frame of the study, which means that they were highly stable over 1 year.

Second, perceived event characteristics descriptively differed in their rank-order stability with extraordinariness having (beside impact, see below) the highest rank-order stability ($a = -0.019$, 95% CI = [-0.032, -0.008]) and social status change having the lowest rank-order stability ($a = -0.040$, 95% CI = [-0.054, -0.026]). However, the confidence intervals of the auto-effects overlapped for the different perceived event characteristics.

Third, autoregressive effects of the perceived event characteristics (except impact) were in between the autoregressive effects of openness and affective well-being. For a retest interval of 1 year, affective well-being had a discrete time autoregressive coefficient of $a_{12}^* = 0.185$, autoregressive coefficients for the perceived event characteristics ranged from $a_{12}^* = 0.622$ to $a_{12}^* = 0.793$, and openness had an autoregressive coefficient of $a_{12}^* = 0.977$. Thus, rank-order stabilities of the perceived event characteristics were in between the ones of affective well-being and the Big Five personality traits—but being closer to the Big Five.

Fourth, there was an unexpected finding for the ECQ subscale impact. For impact, we found a small positive auto-effect ($a = 0.010$, 95% CI = [0.002, 0.017]) which indicates an "explosive process" that moves further and further away from an equilibrium position as the time interval increases (Driver & Voelkle, 2018a). While an explosive process is unrealistic as a generating process over longer time frames, it can be an adequate characterization of the dynamics for the observed time frame (Driver & Voelkle, 2018b). Within 1 year, the small positive auto-effect for impact might indicate a positive self-feedback (e.g., high impact ratings get somewhat higher over time, low ratings get somewhat lower). However, when using the four-item version for the subscale impact, the confidence interval of the auto-effect included zero ($a = 0.006$, 95% CI = [-0.002, 0.015]). A confidence interval including zero means that there is no significant change in discrete time autoregressive coefficients with increasing lengths of the retest interval, which in turn can be interpreted as high stability of the subscale impact.

5.3.3 Mean-Level Stability

Mean-level stability measures the direction and extent of absolute changes in a given construct averaged over all participants. Our second research question was whether there are mean-level changes for the different perceived event characteristics. We hypothesized that extraordinariness decreased over time (Hypothesis 2) and that predictability (Hypothesis 3) and valence (Hypothesis 4) increased over time. To evaluate Research

Question 2 and Hypothesis 2 to 4, we computed effect sizes for mean-level change over an interval of 15 months (ES_{15}), which can be interpreted in *SD* units. We further compared two nested models: a restricted model not allowing any mean-level changes and an unrestricted model allowing mean-level changes. Consequently, if a model comparison is statistically significant, the results indicate a significant mean-level change for the respective construct. Table 5.4 summarizes the results of this computations. Mean-level changes of the latent processes over time are also depicted in Figure 5.4. In the following, the main findings of these analyses are summarized.

Table 5.4: *Effect Sizes for Mean-level Changes, Results of Model Comparisons for Models With and Without Stationary Means, and Intraclass Correlations*

Variable	ES_{15}	Model comparison			ICC
		Δ–2LL(1)	p	ΔAIC	
Challenge	0.06	1.10	.294	−0.90	.80
Change in world views	0.41	28.19	< .001	26.19	.63
Emotional significance	−0.15	5.10	.024	3.10	.83
External control	0.17	5.37	.021	3.37	.78
Extraordinariness	−0.19	8.08	.004	6.08	.76
Impact	−0.14	4.53	.033	2.53	.94
Predictability	−0.08	2.19	.139	0.19	.85
Social status change	−0.11	2.51	.142	0.15	.68
Valence	0.10	5.64	.018	3.64	.87
Openness	< 0.01	< 0.01	.955	−2.00	.98
Affective well-being	0.07	0.64	.423	−1.36	.53

Note. ES_{15} = effect size for mean-level changes over 15 months; Δ–2LL = change in −2 Log-Likelihood; ΔAIC = change in Akaike's information criteria; ICC = intraclass correlation.

Figure 5.4: *Mean-level Changes Over Time*
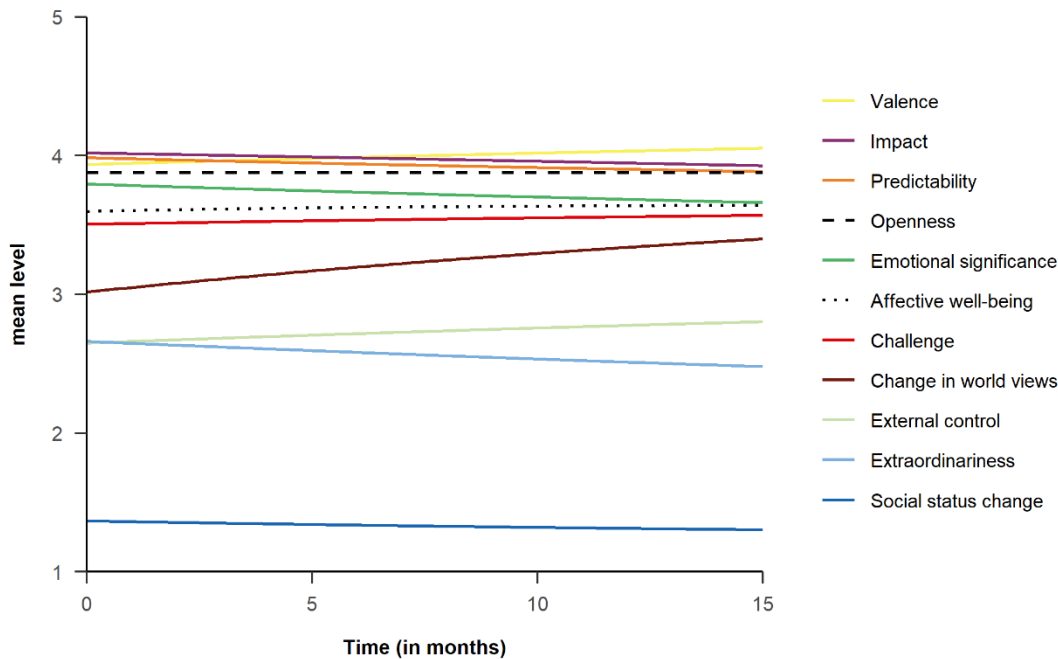
Note. Mean-level changes for all perceived event characteristics, affective well-being, and openness are depicted. The order of the constructs in the legend corresponds to their order in the graph (from high to low mean level at 15 months). Higher values indicate a higher level of the respective construct. In the supplemental material, there is a depiction of mean-level changes for each perceived event characteristic separately with openness and affective well-being as benchmarks for interpretation (Figure S5.4).

Effect sizes for mean-level changes for the perceived event characteristics ranged from 0.06 (challenge) to 0.41 (change in world views). Contrary to Hypothesis 3 (predictability increased over time) and Hypothesis 4 (valence increased over time), neither predictability ($ES_{15} = -0.08$) nor valence ($ES_{15} = 0.10$) significantly changed. Similarly, challenge ($ES_{15} = 0.06$) and social status change ($ES_{15} = -0.11$) showed only weak and non-significant mean-level changes (all $ps > .05$ and $\Delta AIC < 4$). Impact ($ES_{15} = -0.14$), emotional significance ($ES_{15} = -0.15$), and external control ($ES_{15} = 0.17$) showed slightly stronger but still non-significant mean-level changes ($\Delta AIC < 4$).

In contrast, there were significant mean-level changes for extraordinariness and change in world views. Consistent with Hypothesis 2, perceived extraordinariness of major life events decreased over time ($ES_{15} = -0.19$, $\Delta-2LL(1) = 8.08$, $p = .004$, $\Delta AIC = 6.08$), meaning that participants perceived their life event as less extraordinary with increasing time since the event. Change in world views ($ES_{15} = 0.41$, $\Delta-2LL(1) = 28.19$, $p < .001$, $\Delta AIC = 26.19$)

increased over time, indicating that participants perceived major life events as more world-view changing with increasing retest interval.

5.3.4 *Ratio of Between-Person and Within-Person Variance*

To evaluate Research Question 3 concerning the ratio of between-person and within-person variance, we computed intraclass correlations. The results are presented in Table 5.4. In general, intraclass correlations showed rather high values for all perceived event characteristics, openness, and affective well-being, indicating that most of the long-range variance can be attributed to between-person differences (e.g., 63% to 94% of the long-range variance of the perceived event characteristics can be attributed to between-person differences). In principle, we found a result pattern comparable to the one of the rank-order stabilities: The intraclass correlations for the perceived event characteristics were in between the ones of affective well-being (ICC = .53) and openness (ICC = .98)—but being on average somewhat closer to openness and the other Big Five. At the same time, the results for intraclass correlations and rank-order stability were not identical. For example, extraordinariness was the perceived event characteristic with the highest rank-order stability but had a relatively low intraclass correlation (ICC = .76) indicating that there were within-person fluctuations that did not result in changes in rank-orders for this subscale. To sum up, between-person differences seemed to be most important for the perceived event characteristics impact (ICC = .94), valence (ICC = .87), and emotional significance (ICC = .83); within-person variability was most important for the event characteristics change in world views (ICC = .63) and social status change (ICC = .68).

5.4 Discussion

This longitudinal study used continuous time models (CTMs) to investigate how perceived event characteristics change over time. With multiple measurement occasions spread over 1 year, this study examined the stability and change of perceived event characteristics more comprehensively than previous studies (Ferguson et al., 1999; Frazier et al., 2011; Scherer & Drumheller, 1992). We addressed three different research questions regarding their stability and change: First, we found the different perceived event characteristics to have a similar rank-order stability which decreased with increasing length of the retest interval. Moreover, perceived event characteristics were more rank-order stable than affective well-being but less rank-order stable than personality traits. Second, we found significant mean-level changes for the perceived event characteristics extraordinariness and change in world

views: Over time, major life events were perceived as less extraordinary but as more world-view changing. Third, most of the (long-range) variance in perceived event characteristics was explained by between-person differences. In the following, we discuss explanations for and theoretical implications of these findings.

5.4.1 Rank-Order Stability of Perceived Event Characteristics

Compared to other psychological constructs, perceived event characteristics were moderately rank-order stable: Their rank-order stabilities were in between the ones of the Big Five personality traits and affective well-being, being somewhat closer to personality traits. This result seems theoretically reasonable: Personality traits are among the most stable constructs in psychology and affective well-being has a considerably lower stability (Anusic & Schimmack, 2016). Compared the results by de Moor et al. (2021) who used CTMs to examine the rank-order stability and interplay of self-esteem and relationship satisfaction, the perceived event characteristics were approximately as stable as self-esteem but less stable than relationship satisfaction. Thus, our findings contradict the criticism that perceived event characteristics are strongly biased by the current emotional state of a person (Hammen, 2005). If this criticism had been true, the rank-order stabilities of the life event characteristics would have been significantly lower. Nonetheless it is true that participants *did* change in their relative position within the sample, and that rank-order stabilities of almost all event characteristics decreased with increasing length of the retest interval.

Surprisingly, we did not find the expected mean-reverting process and decrease of rank-order stability with increasing length of the retest interval for the perceived event characteristic impact. For this subscale, a positive continuous time auto-effect was found. This finding might indicate a kind of positive self-feedback within 1 year (e.g., those who rate impact low initially rate it even lower over time). However, this feedback effect was rather small, and in our robustness check, the continuous time auto-effect did not significantly deviate from zero. Thus, this finding might indicate a very high rank-order stability of this event characteristic over longer retest intervals which should be investigated in future research. If this interpretation holds, one will have to explain why impact is more rank-order stable than the other life event characteristics. It might be the case that impact is a central property of major life events that therefore shows little change in rank orders.

5.4.2 *Mean-Level Stability of Perceived Event Characteristics*

The perceived event characteristics differed in their mean-level stability. For most perceived event characteristics, no significant mean-level changes over time were found. However, for extraordinariness and change in world views, there were significant mean-level changes such that perceived extraordinariness decreased and that perceived change in world-views increased over time. This finding is in line with the results by Kritzler et al. (2022) who found that perceived event characteristics were correlated with the temporal distance between the occurrence and the rating of a major life event. Consequently, for future research, the time lag between the occurrence and rating of a major life event should be considered in the interpretation of findings.

Regarding the effect sizes of the mean-level changes, Funder and Ozer (2019) proposed new guidelines for the interpretation of effect sizes in psychological research that move beyond the ones by Cohen (1988). Their guidelines are based on the average effect size in the published literature and other effect sizes that are relevant in daily experiences. According to Funder and Ozer (2019), the effect sizes for the mean-level changes of extraordinariness and change in world views are small (to medium at most). However, as they also suggest that effect sizes should be evaluated within context, it should be noted that the effect sizes for the mean-level changes of the perceived event characteristics were two to four times larger than the effect sizes found for the Big Five personality traits and affective well-being.

For extraordinariness, we found the hypothesized mean-level decrease over time. This finding is consistent with Affective Adaptation Theory (Wilson & Gilbert, 2008) which states that an event is perceived as less extraordinary over time because explanations for the occurrence of the major life event are found. However, this finding might also be due to a kind of selection effect. The *What's Next? Study* was primarily addressed to young adults who had just finished school. As a result of the transition to university, new peer relations are established and peer groups are more homogenous than peer groups at high school (good grades, accepted at university, similar interests because they study the same career). Thus, their new peer group may also have experienced similar major life events, so that one's own major life event seems less extraordinary.

We did not find the hypothesized mean-level changes for predictability and valence. These hypotheses had been based on literature on hindsight bias and positive memory bias. As noted above, these biases are usually assessed by comparing pre- and post-event ratings and only few studies focused on their unfolding over time (Blank et al., 2008; Bryant & Brockway, 1997; Bryant & Guilbault, 2002). In their study on hindsight bias, Blank et al. (2008) identified different components of the phenomenon and hypothesized that the sense of predictability increases over time. However, in their stuy, post-event measurements were only taken in the first month after the event. It could be that the increase in the feeling of predictability is limited to the early post-event period. Thus, we might not have found any mean-level changes because this process had already been completed at our first measurement occasion (T1 took place on average 7 weeks after the major life event occurred).

The strongest mean-level change was found for change in world views. The finding that major life events are perceived as more world-view changing over time might indicate that the relevance of a major life event for one's own world view is only becoming clear over time (Jayawickreme & Blackie, 2014; Park, 2010). However, it should be noted that we had no a priori hypotheses about mean-level changes in changes in world views. Thus, this result is exploratory and should be replicated in future research.

5.4.3   Ratio of Between-Person and Within-Person Variance

We found that most of the long-range variance of the perceived event characteristics can be attributed to between-person differences. However, these interindividual differences are based on two sources. On the one hand, the participants experienced and rated *different* major life events, which obviously contributes to interindividual differences. On the other hand, trait-like individual differences in the *perception* of major life events might also exist (e.g., stable tendencies of people to perceive major life events as positive, predictable, or extraordinary). For example, Power and Hill (2010) found consistent individual differences in the ratings of hypothetical minor life events, which were correlated with different personality traits (see also Rakhshani et al., 2022). Future research should attempt to separate these two sources of between-person variance in context of perceptions of major life events as well.

5.4.4 *Theoretical Implications*

Our results have implications for existing appraisal theories as well as claims about episodic memory of major life events. First, our results at least partly challenge the importance of reappraisal processes. In the Appraisal Theory by Lazarus and Folkman (1984), reappraisal is described as one way of cognitive coping with stressful situations and it is also conceptualized as an important emotion-regulation strategy (Ford & Troy, 2019; Gross, 2002; Uusberg et al., 2019). In our study, however, most event characteristics had high rank-order and mean-level stabilities. These stabilities were particularly high for perceived valence and emotional significance, the two event characteristics that are conceptually most similar to the emotional processes associated with reappraisal. Consequently, reappraisal as way of coping and emotion regulation may have occurred only to a small extent in our sample.

Second, our results for the perceived event characteristic change in world views are in line with the meaning-making literature. The Meaning-Making Model by Park (2010) assumes that successful meaning making processes of major life events may change one's global meaning (i.e., individuals' general orienting systems beliefs, goals, and feelings). The ECQ subscale change in world views (e.g., viewing things from a different perspective, changing attitudes due to the event) is conceptually similar to this change in the global meaning. Consequently, our finding that life events are perceived as increasingly world-view changing over time is consitent with the notion that the process of meaning making includes changes of the global meaning. Furthermore, our results add some insight into the time course of the meaning-making process. Park (2010) noted that "meaning making is typically described as occurring over time [...], but the time frame has not been clearly specified" (p. 290). The mean-level increase of change in world views found in our study indicates that the process of meaning making occurs over a time frame of at least 1 year. For future research, it would be interesting to investigate whether this mean-level increase in change in world views continues over even longer time frames and whether it is associated with a better long-term adjustment to the event (e.g., reduced distress) as predicted by Park's (2010) Meaning-Making Model.

Third, our results allow to draw some conclusions regarding episodic memory and memory biases of major life events. As outlined above, our hypotheses regarding hindsight bias and positive memory bias were not supported. Instead, our results suggest that these biases are

limited in time and that they might act on a short time scale (Bryant & DeHoek, 2006). Regarding the memory of emotions, it should be noted that the subscale emotional significance was among the ones with the highest rank-order stabilities and intraclass correlations and that it did not show a significant mean-level change. These results speak against strong distortions of memory of emotions due to post-event knowledge or personality (Levine, 1997; Safer et al., 2016). On a more general level, the high stability of the perceived event characteristics might imply that episodic memory of major life events is in general quite accurate over time. Our results thus add to recent findings that real-life events are stored in episodic memory more accurately than initially expected (Diamond et al., 2020).

Fourth, our results also provide insights into the "nature" of the event perceptions themselves. In general, event perceptions were quite stable over 1 year, so they might be useful predictors of changes after major life events even if they were assessed only once (Luhmann et al., 2021). At the same time, it is also true that there were changes in the perceived event characteristics. One reason for such changes might be that the consequences of major life events actually change over time (e.g., Sheldon & Lyubomirsky, 2012). For example, two people who have just started a new job may both consider the social status change caused by this job to be relatively high. After some time, one person quits the job and therefore estimates the social status change of the job lower than initially. The other person gets promoted on this job and thus rates the social status change higher than initially. Additionally, the fact that the change-related event characteristics, social status change and change in world views, had the lowest intraclass correlations further supports the argument that changes in real-life consequences of major life events may cause changes in the perceived event characteristics. Another reason for changes in event perceptions might be that the evaluation standard for rating major life events might change over time. For example, new positive life events could cause an increase in person's aspiration level, causing the previous life event to be perceived as less positive (Sheldon et al., 2013).

We can only speculate about the reasons for such changes here, so future research should explicitly investigate possible factors contributing to changes in perceptions of major life events (e.g., by using experimental designs). Moreover, it would be interesting to have a closer look at those individuals who show the most pronounced changes in event perceptions. Building on theories of post-traumatic growth (Jayawickreme & Blackie, 2014),

one might suspect that these individuals also exhibit the most extensive changes in subjective well-being or personality traits following major life events. In this context, future research should also investigate the interplay of perceived event characteristics and subjective well-being over time. For this purpose, CTMs (including cross-effects) might again be an adequate analytical method.

5.4.5 Limitations and Future Directions

This study had several limitations. First, we used a non-representative, highly educated, predominantly female sample of young adults for our analyses. This sample might differ from other populations in the occurrence and perception of major life events. Possibly, the results for stability and change of the life event characteristics are also at least partly influenced by these sample characteristics. For example, our young and highly educated participants mainly named positive life events at T1 such as graduating from high school, meeting new people, and starting college. Consequently, the average valence rating at T1 was already very positive, which might be a reason for why no significant increase in valence over time was found.

Second, some results of the present paper should be regarded as preliminary. As noted above, the meaning and robustness of the positive autoregressive drift coefficient of the perceived event characteristic impact should be investigated in future research. The same applies to the finding on the significant mean-level change for change in world views. Moreover, our modeling approach to detect mean-level changes was adequate to answer the question whether there are overall mean-level changes in the data, but it was not adequate to detect every possible kind of mean-level change (e.g., oscillations; Driver & Voelkle, 2018b).

Third, this paper focused on describing changes in event perceptions, but we did not explain them. Furthermore, this study did not directly address the question whether changes in the perceptions of major life events are correlated with changes in psychological outcomes such as mental health, subjective well-being, or personality. As outlined above, future research should continue here and investigate factors contributing to the stability and change of event perceptions as well as the interplay of changes in event perceptions with changes in mental health, subjective well-being, or personality.

5.4.6 Conclusion

This study systematically examined changes in the perceived characteristics of major life events. We found that the rank orders of these perceptions were relatively stable, that there were significant mean-level changes in two perceived event characteristics, and that most of the variance in life event characteristics was explained by between-person differences. The contribution of this study is threefold: First, the consideration of perceived event characteristics is an important line of research to disambiguate diverging findings on the effects of major life events on different psychological outcomes (Luhmann et al., 2021). Investigating the stability of these perceptions over time is an important cornerstone to better understand the construct of perceived event characteristics, and it shows the relevance of considering the temporal dimension when studying (perceptions of) major life events. Second, our findings have implications for theories on appraisal and meaning making. The mean-level increase of change in world views and the mean-level decrease of extraordinariness are consistent with the Meaning-Making Model (Park, 2010) and Affective Adaptation Theory (Wilson & Gilbert, 2008). However, the rather high stabilities of the perceived event characteristics valence and emotional significance challenge the importance of reappraisal processes of major life events in our sample. Third, CTMs are a promising methodological tool to investigate the dynamics of psychological processes (Voelkle et al., 2018). This study demonstrated their use to examine stability and change of psychological constructs.

5.5   Data Accessibility Statement

The study materials, data, and analysis scripts used for this article can be accessed at https://osf.io/urqdw. The preregistration for this study can be found at https://osf.io/cjtk6.

5.6   Author Contribution Statement

The contributions of each author according to the CRediT Classifaction:

Peter Haehner: Conceptualization (*lead*), Data Curation (*lead*), Formal Analysis (*lead*), Investigation (*supporting*), Methodology (*lead*), Project Administration (*lead*), Software (*lead*), Writing – Original Draft Preparation (*lead*), Writing – Review and Editing (*equal*)

Sarah Kritzler: Conceptualization (*supporting*), Formal Analysis (*supporting*), Visualization (*lead*), Writing – Review and Editing (*equal*)

Ina Fassbender: Conceptualization (*supporting*), Investigation (*lead*), Writing – Review and Editing (*equal*)

Maike Luhmann: Conceptualization (*supporting*), Funding Acquisition (*lead*), Investigation (*supporting*), Methodology (*supporting*), Resources (*lead*), Supervision (*lead*)

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6

Are Changes in the Perception of Major Life Events Associated With Changes in Subjective Well-Being?

6. Are Changes in the Perception of Major Life Events Associated With Changes in Subjective Well-Being?

Abstract: How people perceive major life events changes over time. We examined the longitudinal interplay between perceived event characteristics and subjective well-being (SWB) using two short-term longitudinal studies ($N_{Study1} = 619$; $N_{Study2} = 691$). In both studies, perceived event characteristics and SWB were assessed at two measurement occasions 3 months apart. Perceiving events as increasingly externally controlled and as increasingly social status threatening over time was consistently associated with a decrease in life satisfaction. Furthermore, perceiving events as increasingly challenging over time was associated with a decrease in positive affect and an increase in negative affect. Our results indicate that the development of SWB and perceived event characteristics is intertwined.

6.1   Introduction

Major life events are "events that are clearly timed, disrupt one's everyday routine, and are perceived as personally significant and memorable by those who experienced them" (Luhmann et al., 2021, p. 634). Major life events such as a job loss can lead to lasting changes in subjective well-being (SWB; Lucas, 2007; Specht et al., 2011). However, not all people react in the same way to a major life event (Luhmann et al., 2021; Yap et al., 2014).

Previous studies suggested that some of these individual differences in event-related changes in SWB can be explained by differences in how people perceive a major life event, for example, the extent to which an event was perceived as negative, impactful, or controllable (Luhmann et al., 2021; Prizmić-Larsen et al., 2020). However, in these studies, perceived event characteristics were assessed only once, implying that the perception of an event is stable over time. But recent research has shown that this assumption is probably not tenable: the perception of major life events changes over time (Haehner, Kritzler et al., 2022). This novel observation raises the question of whether changes in the perception of major life events are related to changes in SWB. For example, how does SWB change if a negatively perceived event is perceived as increasingly positive (or increasingly negative) over time?

In this article, we addressed this question using two short-term longitudinal studies in which we assessed changes in SWB and changes in the perception of major life events over a period of 3 months. As we elaborate in more detail below, examining the dynamic interplay of these constructs is relevant for theoretical and empirical reasons. First, this type of association is proposed in several theories but rarely tested directly (e.g., Lazarus & Folkman, 1984; Wilson & Gilbert, 2008). Second, the results may shed light on the nature of the relationship between perceived event characteristics and SWB: correlated changes between perceived event characteristics and SWB might be an indication of feedback loops between these constructs (see Olaru & Allemand, 2021). Finally, correlated changes between these constructs would have implications for the measurement of major life events (e.g., assessing perceived event characteristics at multiple measurement occasions).

6.1.1   Major Life Events and Changes in SWB

SWB describes how people experience and evaluate their lives (Diener, 1984). SWB is often conceptualized as comprising three related components: life satisfaction, positive affect,

and negative affect. Life satisfaction describes the cognitive evaluation of life. Positive and negative affect (also referred to as affective well-being) encompass positive and negative feelings and mood (Busseri, 2018; Diener et al., 1999). As these components of SWB differ in their correlates and their stability over time, they should be analyzed separately when investigating the effects of major life events (e.g., Kettlewell et al., 2020; Luhmann et al., 2012).

Longitudinal studies indicate that major life events can lead to lasting changes in SWB—at least for some people (Kettlewell et al., 2020; Luhmann et al., 2012). However, important questions remain: For example, why do these effects differ among events and among people (Luhmann et al., 2021; Yap et al., 2014)? One way to approach this question is to change the assessment of major life events. Most longitudinal studies examined whether or not a major life event occurred (e.g., by inferring the occurrence of major life events based on changes in demographical variables; Denissen et al., 2019; Kettlewell et al., 2020). This rather simple assessment of major life events neglects that the supposedly same major life event can be perceived differently by different individuals and thus have different implications for people's SWB (Luhmann et al., 2021). For example, for one person, a job loss may be a very negative and impactful experience, whereas another person may perceive this event as rather neutral.

6.1.2 Perceived Event Characteristics and Changes in SWB

To assess how people perceive major life events, we focus on perceived event characteristics. Perceived event characteristics are ratings of people's subjective experience of an event on different continuous dimensions. For example, the Event Characteristics Questionnaire (Luhmann et al., 2021) assesses nine perceived event characteristics: challenge (extent to which an event is perceived as distressing, challenging, and exhausting), change in world views (extent to which an event is perceived as changing attitudes and world views), external control (extent to which an event is perceived as controlled by others), extraordinariness (extent to which an event is perceived as extraordinary, uncommon, and exceptional), emotional significance (extent to which an event is perceived as significant, eliciting strong feelings, and moving), predictability (extent to which an event is perceived as predictable and expected), impact (extent to which an event is perceived as life changing, important, and role changing), social status change

(extent to which an event is perceived as threatening one's social status and reputation), and valence (extent to which an event is perceived as positive, joyful, and beneficial).

Several theories suggest that changes in SWB may be associated with perceived event characteristics. For example, the concept of hedonic adaptation (Frederick & Loewenstein, 1999) implies a direct relationship between the perceived valence of an event and the hedonic response (i.e., changes in SWB). Furthermore, Affective Adaptation Theory (Wilson & Gilbert, 2008) assumes that the emotional response to an event depends on the extent to which the event is perceived as unexplained, unexpected, and self-relevant. Relatedly, several depression theories predict that the onset of depression after negative life events depends on their perceived controllability (Abramson et al., 1978), their self-relevance (Beck & Bredemeier, 2016), and their implications on the social status (Slavich & Sacher, 2019).

Empirically, there is emerging evidence that individual differences in the perception of major life events can explain the onset of depression (for a review, see Haehner et al., 2023). For SWB, the perceived importance of negative events longitudinally predicted higher levels of negative affect (Prizmić-Larsen et al., 2020). Similarly, perceiving negative events as more impactful was associated with a more pronounced adaptation in people's affective well-being after the event (Luhmann et al., 2021). In addition, the perceived event characteristics challenge, extraordinariness, and social status changes were associated with changes in SWB in this study.

6.1.3 Changes in the Perceived Event Characteristics and Changes in SWB

The perception of major life events differs not only among people, it also changes over time (Haehner, Kritzler et al., 2022), which leads to the question: Are changes in the perception of major life events related to changes in SWB? Examining the dynamic interplay of the perception of major life events and SWB is theoretically relevant as several theories assume the existence of feedback loops and coupled changes among these constructs. First, the concept of reappraisal as introduced in the Appraisal Theory (Lazarus & Folkman, 1984) or in the emotion regulation literature (e.g., Gross, 2002) implies that changes in the perception of major life events (i.e., a reappraisal) lead to changes in SWB. Second, Affective Adaptation Theory states that affective adaptation to an event "involves higher order mental processes that alter the meaning of those events" (Wilson & Gilbert, 2008,

p. 370). In particular, perceiving events as more explainable, as less extraordinary, or as less self-relevant should be related to changes in SWB. While these theories suggest that changes in the perception of major life events *lead to* changes in SWB, there are also theoretical propositions that support the opposite direction of causality. For example, the mood-congruent memory effect suggests that changes in people's SWB influences how they remember past experiences (Mayer et al., 1995). Thus, if people's SWB increases, this might cause a more positive memory and evaluation of past events.

Empirically, we know only little about possible associations between changes in the perception of major life events and changes in SWB. For the related domain of mental health, Brose et al. (2021) examined associations between the perception of the Covid-19 pandemic and changes in mental health. They found that not the perception of the Covid-19 pandemic as such but *changes* in this perception (e.g., perceiving the pandemic as increasingly threatening and challenging over time) predicted decreases in mental health. Similarly, in a study by Shigemoto (2020), perceiving more event-related growth over time was associated with less post-traumatic stress symptoms. However, for SWB, empirical evidence on correlated changes between perceived event characteristics and SWB is currently lacking.

6.1.4 *The Present Article*

In this article, we examined whether changes in perceived event characteristics are associated with changes in SWB. We conducted two short-term longitudinal studies in which we assessed participants' SWB and their perception of a recently experienced major life event at two measurement occasions 3 months apart. In Study 1, we explored the associations between changes in the perceived event characteristics and changes in SWB. Based on these results, we preregistered our analyses and hypotheses for Study 2 and evaluated whether the associations found in Study 1 could be replicated in this second study.

6.2   Study 1: Exploratory Analyses

Study 1 was based on data from the *What's NEXT? Study*, a longitudinal online study with five measurement occasions spread over 1 year. Data from the *What's NEXT? Study* have already been used in previous publications on perceived event characteristics (Fassbender et al., 2022; Haehner, Kritzler et al., 2022; Haehner, Rakhshani et al., 2022; Kritzler et al.,

2022; Luhmann et al., 2021). However, none of these studies examined the relationship between changes in the perception of major life events and changes in SWB (see Table S6.1 for details).

6.2.1 Methods

Procedure

The *What's NEXT? Study* was conducted in 2018 and 2019. The study was addressed to young adults which first had to register for it. Registration comprised age verification (minimum age 18 years), providing informed consent, and providing an email address. Afterwards, participants were invited via email to the five measurement occasions of the study (i.e., 0, 12, 24, 36, 48 weeks after registration).

For the present article, we only used data from the first and second measurement occasion (T1 and T2) of the *What's NEXT? Study* because participants rated their perception of the same major life event at these measurement occasions. At T1, participants freely named the most important major life event they had experienced in the last 3 months and rated their perception of this event with the Event Characteristics Questionnaire. At T2, participants were shown the event they had named at T1 and rated this event again. SWB was assessed at both measurement occasions (see the study-design preregistration below for a list of all measures).

Participants

German-speaking young adults were recruited via social media and at introductory events at universities. In total, 857 people registered to take part in the study. To ensure data quality, we excluded participants with missing or incorrect answers on two instructed response items (e.g., "In order to secure the data quality, please select the option *often*") and participants who completed a measurement occasion in less than 10 minutes (i.e., 40% of the expected duration). Furthermore, we excluded participants who did not participate at T1 or who named a major life event at T1 that occurred more than 3 months ago (i.e., outside the requested time frame). Applying these criteria, our final sample size was $N = 619$ at T1 and $N = 433$ at T2. Participants' mean age at T1 was 21.48 years ($SD = 4.05$) and 73% of the sample was female. About 93% of the sample had a high school graduation and around 10% of the sample indicated that their mother tongue was not German (i.e., an indirect measure of migration background).

Measures

For all measures, we reversed responses if appropriate and calculated mean scores for descriptive purposes.

Naming a Major Life Event and Timing of the Event (T1). Participants freely named a major life event they had experienced in the previous 3 months. Two independent coders coded these free-text answers into event categories (interrater agreement κ = .87; see Table S6.2 for details). Furthermore, participants were asked to indicate how many weeks ago the event occurred (variable *weeks.ago*).

Event Characteristics (T1 and T2). Participants rated their perception of the named event using the Event Characteristics Questionnaire (Luhmann et al., 2021; 37-item version as in Study 5). This questionnaire assesses nine perceived event characteristics: *valence* (6 items, e.g., "The event was joyful"), *impact* (4 items, e.g., "The event had long-term consequences"), *challenge* (4 items, e.g., "The event was straining"), *change in world views* (4 items, e.g., "The event helped me to gain new perspectives"), *emotional significance* (4 items, e.g., "The event moved me a lot"), *external control* (4 items, e.g., "Others were able to control the event"), *extraordinariness* (3 items, e.g., "The event was extraordinary"), *predictability* (4 items, e.g., "The event was surprising"), and *social status change* (4 items, e.g., "The event threatened my social status"). Items were rated on a scale ranging from 1 (*not true at all*) to 5 (*absolutely true*).

Positive and Negative Affect (T1 and T2). Positive and negative affect were assessed with three items, respectively, using the German 6-item version of the Scale of Positive and Negative Experiences (Diener et al., 2010; German version by Rahm et al., 2017). Participants rated how often they had felt a certain way in the last month (e.g., "sad") on a scale ranging from 1 (*very rarely or never*) to 5 (*very often or always*).

Life Satisfaction (T1 and T2). Life satisfaction was assessed with the German 3-item version of the Satisfaction with Life Scale (Diener et al., 1985; German version by Glaesmer et al., 2011). Items (e.g., "I am satisfied with my life") were rated on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Transparency and Openness

Data collection of the *What's NEXT? Study* was approved by local ethics committee of Ruhr-University Bochum. The study design was preregistered at https://osf.io/pm5xn. Analyses were conducted in R (Version 4.1.1). All data, analysis code, and a codebook are available at https://osf.io/e23bc. As Study 1 was exploratory, the analyses were not preregistered.

Data Analysis

Our analyses comprised four steps: checking for longitudinal measurement invariance; attrition analysis, estimating univariate latent change score models, and estimating bivariate latent change score models.

Longitudinal Measurement Invariance. Using the R packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2020), we checked for longitudinal measurement invariance of our measures (see Table S6.3 for details). All constructs showed scalar measurement invariance, except for life satisfaction and predictability. For life satisfaction, restricting the intercepts to be equal across the two measurement occasions significantly reduced model fit. However, by freeing the intercept of the item "I am satisfied with my life", we were able to establish partial scalar invariance. All subsequent analyses for life satisfaction were thus based on this partially invariant measurement model. For predictability, the fit of the configural model was not acceptable. We decided to drop the item "I knew in advance that the event would be happening" from the analyses of Study 1 because it was involved in the largest modification indices[17].

Attrition Analysis. Using two-sample *t*-tests and χ^2-tests, we examined whether participants who completed both measurement occasions and participants who dropped out of the study differed in their demographic characteristics, their SWB, or the perceived event characteristics. No statistically significant differences were found (Table S6.4).
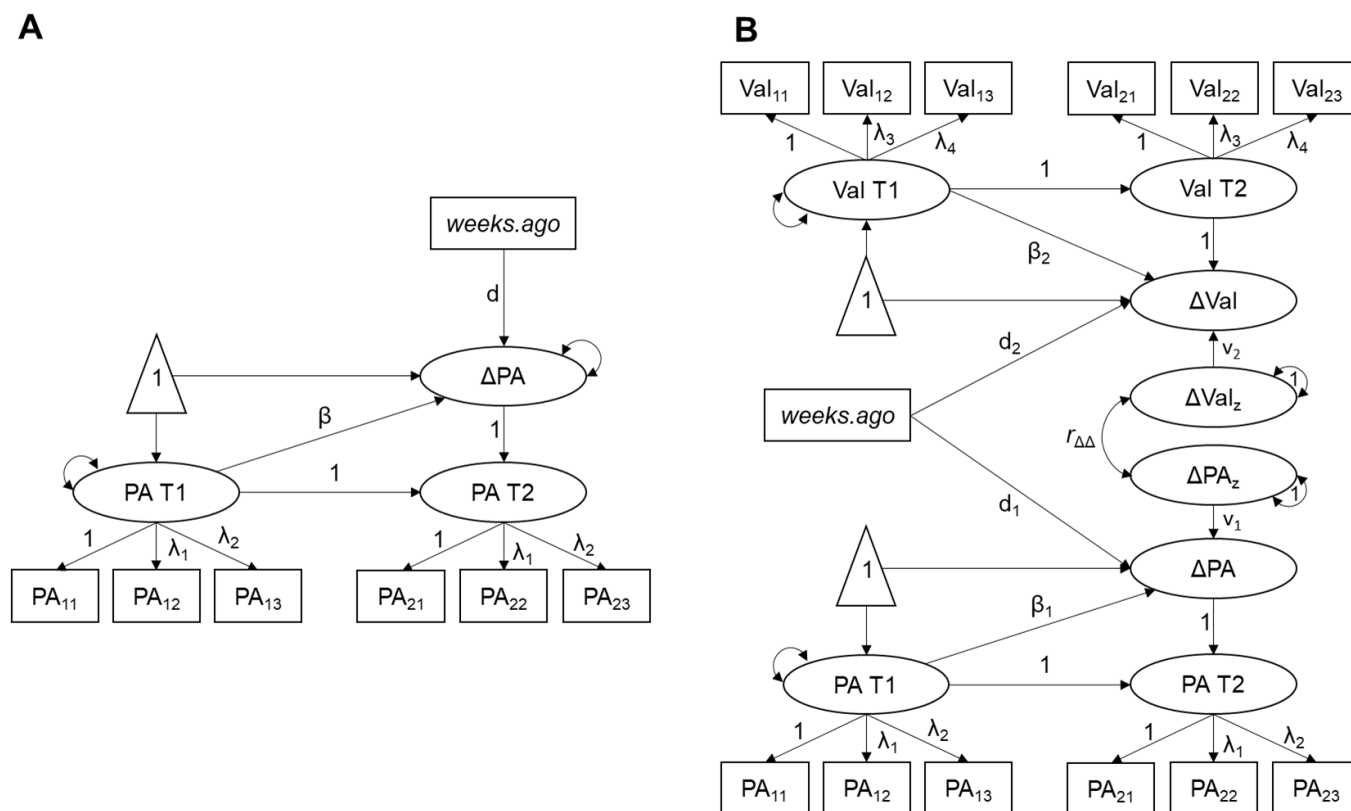
Univariate Latent Change Score Models. Latent change score models allow estimating within-person changes without accumulating measurement errors in the calculation of difference scores (McArdle, 2009). We computed univariate latent change score models for each construct to evaluate whether they acceptably fitted the data (acceptable: RMSEA < .08, CFI > .95, TLI > .95; Schermelleh-Engel et al., 2003). Our univariate latent change score

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[17] As robustness check, we estimated the latent change score models with all four items of *predictability*. The pattern of significant findings obtained with the bivariate latent change score models remained unchanged.

models comprised one latent factor for each measurement occasion as well as a latent change score that estimates within-person changes between T1 and T2. Mean and variance of the T1 factor and the latent change score factor were freely estimated; mean and variance of the T2 factor were fixed to zero. Additionally, we included the temporal distance between the event occurrence and T1 (variable *weeks.ago*) as predictor of the latent change score factor to control for possible effects of unequal temporal distances. We estimated the latent changes score models using the indicator variable method (i.e., fixing the factor loading of the first indicator to one and its mean to zero). Means and intercepts for the other indicators were freely estimated but constrained to be equal across the two measurement occasions (except for life satisfaction). We allowed correlated residuals for the same repeatedly measured indicators. To deal with missing values, we used full information maximum likelihood estimation. An example for a univariate latent change score model is depicted in Figure 6.1.

Bivariate Latent Change Score Models. To examine whether changes in the perceived event characteristics are associated with changes in SWB, we computed 27 bivariate latent change score models—each comprising one SWB component and one perceived event characteristic. Bivariate latent change score models allow estimating correlated changes among constructs independent of measurement error (McArdle, 2009). In general, these bivariate latent change score models were estimated in the same way as their univariate counterparts. However, we additionally included two phantom variables (see Figure 6.1). These phantom variables were based on the latent change score factors but had a variance fixed to one. Thus, they estimate the correlation (instead of the covariance) of the latent change score factors (Little, 2013). To answer our research question, we estimated the statistical significance of this correlation ($r_{\Delta\Delta}$). To reduce Type I error inflation, we used a level of significance of $\alpha = .01$ in Study 1.

Figure 6.1: *Illustration of the Univariate and Bivariate Latent Change Score Models*

Note. Panel A: Illustration of the univariate latent change score models for positive affect. Positive affect at T1 (PA T1), positive affect at T2 (PA T2), and a latent change score (ΔPA) are the estimated latent variables in this model. The latent change score is controlled for the temporal distance since the event occurrence (*weeks.ago*). Intercepts of indicators, residual variances, and residual covariances are not depicted. Panel B: Illustration of the bivariate latent change score models for positive affect and valence. In addition to the latent change scores (ΔPA, ΔVal), this model includes two phantom variables (ΔPA$_z$, ΔVal$_z$) with a variance fixed to one. These phantom variables allow estimating the correlation between the latent change scores ($r_{\Delta\Delta}$) instead of their covariance. Intercepts of indicators, residual variances, and residual covariances are not depicted. PA = positive affect; Val = valence.

6.2.2 Results

Descriptive Statistics and Univariate Latent Change Score Models

Participants most frequently reported the events vacation ($n = 52$), beginning college ($n = 48$), relocation ($n = 47$), and graduation from high school ($n = 46$; Table S6.2). Intraclass correlations of the perceived event characteristics varied between $ICC = .66$ and $ICC = .90$ indicating that all perceived event characteristics showed a certain degree of within-person variability. Intraclass correlations of SWB components were slightly lower ($ICC = [.53, .77]$; see Table S6.5). Descriptive statistics of our study variables as well as the latent change score variables estimated with the univariate latent change score models are summarized in Table S6.5 and S6.6. As indicated by the standardized means of the latent change score variables, changes over time were most pronounced for life satisfaction (increased), change in world views (increased), impact (increased), and emotional significance (decreased). The univariate latent change score models showed acceptable model fit for all constructs (all CFI $\geq .98$, TLI $\geq .97$, and RMSEA $\leq .05$; Table S6.7). The variable *weeks.ago* was only significantly associated with the latent change scores for the perceived event characteristic challenge ($b = -0.03$, $SE = 0.01$, $z = -2.98$, $p = .003$).

Bivariate Latent Change Score Models

All bivariate latent change score models showed at least acceptable fit (all CFI $\geq .95$, TLI $\geq .95$, and RMSEA $\leq .05$; Tables S6.8-S6.10). The correlations among the latent change score factors, which are decisive for our research question, are summarized in Table 6.1.

Life Satisfaction. Perceiving events as less externally controlled ($r_{\triangle\triangle} = -.25$, $p = .001$), as less social status threatening ($r_{\triangle\triangle} = -.28$, $p < .001$), and as more positive ($r_{\triangle\triangle} = .34$, $p < .001$) over time was related to an increase in life satisfaction. Changes in the other perceived event characteristic were not related to changes in life satisfaction.

Positive Affect. Perceiving events as less challenging ($r_{\triangle\triangle} = -.26$, $p < .001$), as less externally controlled ($r_{\triangle\triangle} = -.19$, $p = .009$), and as more positive ($r_{\triangle\triangle} = .19$, $p = .003$) over time was related to an increase in positive affect. Changes in the other perceived event characteristic were not related to changes in positive affect.

Negative Affect. Perceiving events as more challenging ($r_{\triangle\triangle} = .31$, $p < .001$) and as less positive ($r_{\triangle\triangle} = -.23$, $p < .001$) over time was related to an increase in negative affect. Changes in the other event characteristic were not related to changes in negative affect.

Table 6.1: *Correlations Between Latent Change Score Factors in Study 1*

Perceived event characteristics	Life satisfaction				Positive affect				Negative affect			
	$r_{\Delta\Delta}$	z	p	99% CI ($r_{\Delta\Delta}$)	$r_{\Delta\Delta}$	z	p	99% CI ($r_{\Delta\Delta}$)	$r_{\Delta\Delta}$	z	p	99% CI ($r_{\Delta\Delta}$)
Challenge	−.14	−1.78	.075	[−.34, .06]	−.26	−3.78	< .001	[−.44, −.08]	.31	4.26	< .001	[.12, .49]
Change in world views	.16	1.9	.058	[−.06, .38]	.01	0.17	.865	[−.19, .21]	.06	0.73	.466	[−.15, .27]
Emotional significance	−.02	−0.23	.821	[−.23, .19]	−.16	−2.26	.024	[−.35, .02]	.06	0.76	.449	[−.14, .26]
External control	**−.25**	**−3.34**	**.001**	**[−.45, −.06]**	−.19	−2.63	.009	[−.37, −.00]	.09	1.22	.222	[−.10, .29]
Extraordinariness	−.11	−1.48	.140	[−.31, .08]	.00	0.00	.996	[−.18, .18]	−.05	−0.69	.493	[−.24, .14]
Impact	.12	1.22	.223	[−.13, .37]	−.09	−1.01	.315	[−.32, .14]	−.04	−0.42	.673	[−.28, .20]
Predictability	.08	0.97	.334	[−.13, .28]	−.13	−1.77	.077	[−.31, .06]	.07	0.83	.404	[−.14, .27]
Social status change	**−.28**	**−4.01**	**< .001**	**[−.47, −.10]**	−.11	−1.58	.115	[−.28, .07]	.08	1.18	.236	[−.10, .27]
Valence	**.34**	**5.08**	**< .001**	**[.17, .51]**	**.19**	**3.01**	**.003**	**[.03, .35]**	**−.23**	**−3.50**	**< .001**	**[−.40, −.06]**

Note. Significant effects (α = .01) in bold print.

6.2.3   Summary and Discussion

We found several significant associations between changes in the perceived event characteristics and changes in SWB. First, changes in perceived event valence were consistently associated with changes in the three SWB components. This result is in line with previous findings that valence is an important event characteristic for predicting changes in SWB (e.g., Luhmann et al., 2021) and other constructs like personality traits (e.g., Vries et al., 2021).

Second, perceiving events as increasingly externally controlled over time was related to decreasing life satisfaction and positive affect. Furthermore, perceiving events as increasingly social status threatening was related to decreasing life satisfaction. These findings are in line with Helplessness Theory of Depression and with Social Signal Transduction Theory (Abramson et al., 1978; Slavich & Sacher, 2019). We elaborate more on these findings in the General Discussion.

Third, perceiving events as increasingly challenging over time was related to decreasing positive affect and increasing negative affect. As the perceived event characteristic challenge was measured with items that focus on people's feelings (e.g., "The event scared me"), it seems reasonable that changes in this perceived event characteristic were related to changes in the affective components of SWB (instead of life satisfaction as cognitive component). In general, our findings underline the importance of analyzing the three SWB components separately to better understand event-related changes in SWB (Kettlewell et al., 2020; Luhmann et al., 2012).

The effect sizes for the statistically significant correlated changes between the perceived event characteristics and SWB were at least of medium size ($.19 \leq r_{\Delta\Delta} \leq .34$; Funder & Ozer, 2019). Compared to results on correlated changes from other domains, the associations were about as strong as correlated changes among certain personality trait domains (Allemand & Martin, 2016; Klimstra et al., 2013) as well as correlated changes between positive affect and symptoms of anxiety (Hou et al., 2015). Taken together, Study 1 suggests that there are significant correlated changes between perceived event characteristics and SWB. However, as Study 1 was exploratory, we tried to replicate the results in a second, independent sample.

6.3   Study 2: Confirmatory Analyses

The aim of Study 2 was to test the associations between changes in perceived event characteristics and changes in SWB in a second sample. We hypothesized that correlations between changes in the perceived event characteristics and changes in SWB that were statistically significant in Study 1 would replicate in Study 2. As Study 2 was based on an existing dataset that was not specifically collected for the purpose of this study, the design of Study 2 differed in some respects from the one of Study 1. These differences are summarized in Table 6.2.

Study 2 is based on data from the *One Year of Corona Pandemic Study*. This study was conducted in 2021 and comprised three measurement occasions (T1 to T3). We only used data from T1 and T3 because participants only rated their perception of a recently experienced event at these two measurement occasions. T1 and T3 were 3 months apart (i.e., same temporal distance as in Study 1).

6.3.1   Methods

Procedure

To take part in the *One Year of Corona Pandemic Study*, participants first had to register for it by providing informed consent, verifying their age (minimum age 18 years), and providing an email address. Thereafter, participants were invited via email to the three measurement occasions of the study (i.e., 0, 1, 12 weeks after registration).

At T1, participants received a checklist of life events and indicated which of these events they had experienced in the past year. For all experienced events, participants reported how many months ago the event occurred. Furthermore, they indicated the event that was most significant to them. This most significant event was then rated using the Event Characteristics Questionnaire. At T3, participants were shown the event they had rated at T1 and were asked to re-rate this event. SWB was assessed at both measurement occasions (see the study-design preregistration below for a list of all measures).

Table 6.2: *Differences in the Study Design Between Study 1 and Study 2*

Design aspect	Study 1	Study 2
Sample	Addressed to young adults: M_{age} = 21.48 years (SD = 4.05)	Addressed to the general public: M_{age} = 34.18 years (SD = 12.02)
Life event assessment	Open answer field	Life event checklist
Time frame of life events	Rated life events of the last 3 months	Rated life events of the last 12 months
Event Characteristics Questionnaire [a]	37-item version (as in Study 5 of Luhmann et al., 2021)	38-item version (final version proposed by Luhmann et al., 2021)
Scale of Positive and Negative Experiences	6-item version (3 items per construct)	12-item version (6 items per construct)
Satisfaction With Life Scale	3-item version	5-item version
Data collection period	2018 to 2019 (before the Covid-19 pandemic)	2021 (during the Covid-19 pandemic)

Note. This table only summarizes the differences between Study 1 and Study 2 that are relevant for the purpose of the present article. The two studies, for example, also differed in other constructs that were not used in the present article.

[a] For more details on the overlapping and non-overlapping items of the two versions of the Event Characteristics Questionnaire see Table S6.11.

Participants

German-speaking participants of any age were recruited for Study 2. Based on the results of Study 1, we conducted a power analysis using the shiny app *pwrSEM* (Wang & Rhemtulla, 2021). Assuming a level of significance of α = .05, we were able to detect correlated changes of $r_{\Delta\Delta}$ = .20 with 600 individuals and a power of 84%. In total, 1075 people registered to take part in the study. We applied the same exclusion criteria as in Study 1: We excluded participants with no or incorrect answers on the instructed response items and participants who completed the online survey for a measurement occasion in less 40% of the expected duration. Additionally, we excluded participants who had not experienced a major life event in the last 12 months or who had indicated that the most significant experienced event occurred more than 12 months ago (i.e., event outside the requested time frame). Applying these criteria, our final sample size was N = 691 at T1 and N = 438 at T2. Participants' mean age at T1 was 34.18 years (SD = 12.02) and 71% of the sample were female. About 70% of the sample had a high school graduation and around 6% of the sample indicated that they were not born in Germany.

Measures

For all measures, we reversed responses if appropriate and calculated mean scores for descriptive purposes.

Life Event Checklist and Timing of the Event (T1). Participants received a life event checklist and marked all the events they had experienced in the past year (see Table S6.12 for similarities and differences between our life event assessment in Study 1 and Study 2). This life event checklist comprised 32 events which had been taken from common life event inventories (Holmes & Rahe, 1967; Sarason et al., 1978). In addition, participants had the opportunity to name an additional major life event that was not mentioned. Participants then indicated which of the experienced events was most significant to them (i.e., the event that was subsequently rated with the Event Characteristics Questionnaire). Furthermore, participants provided information on how many months ago the event occurred (variable *months.ago*). For the analyses, we transformed this variable *months.ago* into a variable *weeks.ago* by multiplying it with 4.34 so that its interpretation matches the one of the temporal-distance variable in Study 1.

Event Characteristics (T1 and T3). Perceived event characteristics were assessed with the Event Characteristics Questionnaire (Luhmann et al., 2021). The items differed slightly between Study 1 and Study 2 (see Table S6.11 for details). Items were rated on a scale ranging from 1 (*not true at all*) to 5 (*absolutely true*).

Life Satisfaction (T1 and T3). Life satisfaction was assessed with the German 5-item version of the Satisfaction with Life Scale (Diener et al., 1985; German version by Glaesmer et al., 2011). Items were rated on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Positive and Negative Affect (T1 and T3). Positive and negative affect were assessed with the German 12-item version of the Scale of Positive and Negative Experiences (Diener et al., 2010; German version by Rahm et al., 2017). Items were rated on a scale ranging from 1 (*very rarely or never*) to 5 (*very often or always*).

Transparency and Openness

Data collection of the *One Year of Corona Pandemic Study* was approved by local ethics committee of Ruhr-University Bochum. The study design was preregistered at https://osf.io/x52bq. Hypotheses and analyses for Study 2 were preregistered at https://osf.io/3yw2a. Deviations from this preregistration are summarized in Table S6.14. All data, analysis code, and a codebook are available at https://osf.io/b392y.

Data Analysis

The analyses comprised the same four-step procedure as in Study 1. However, since the employed items slightly differed between the two studies, there were a few differences in the analyses, which we describe in the following sections.

Longitudinal Measurement Invariance. We evaluated longitudinal measurement invariance independently from the results from Study 1 (Table S6.15). All constructs showed scalar measurement invariance, except for emotional significance and valence. For these two perceived event characteristics, we were able to establish partial scalar invariance by allowing one intercept for each construct to differ between the two measurement occasions. All subsequent analyses of these two variables were based on these partially invariant measurement models.

Attrition Analysis. As in Study 1, participants who completed both measurement occasions and participants who completed only T1 did not differ significantly in their demographic characteristics, their SWB, or the perceived event characteristics (Table S6.16).

Univariate Latent Change Score Models. As in Study 1, we computed univariate latent change score models to test whether their model fit was acceptable (acceptable: *RMSEA* < .08, *CFI* > .95, *TLI* > .95; Schermelleh-Engel et al., 2003). Due to differences in longitudinal measurement invariance and differences in the employed items, the measurement models of the univariate latent change score models slightly differed between the two studies. All other aspects of the latent change score models were retained as in Study 1.

Bivariate Latent Change Score Models. We used bivariate latent change score models to test our hypotheses regarding the associations between changes in perceived event characteristics and changes in SWB. Again, the correlation between the latent change score variables ($r_{\Delta\Delta}$) was crucial for these hypotheses. For those correlations that we expected to be significant based on the results of Study 1, we preregistered using a level of significance of α = .05. For those correlations that were not significant in Study, we used a more conservative level of significance of α = .01 to reduce the risk of false positive findings.

6.3.2 Results

Descriptive Statistics and Univariate Latent Change Score Models

The most frequently reported major life events were changes in the work situation ($n = 61$), death of a loved one ($n = 57$), start of a new job ($n = 55$), relocation ($n = 49$), and own serious illness or injury ($n = 43$; Table S6.13). Intraclass correlations of the perceived event characteristics varied between $ICC = .64$ and $ICC = .91$ indicating that all perceived event characteristics showed a certain degree of within-person variability. Intraclass correlations of SWB components were higher in Study 2 compared to Study 1 and in a similar range as intraclass correlations of perceived event characteristics ($ICC = [.69, .86]$; see Table S6.17 for details). Descriptive statistics of our variables as well as the latent change score variables estimated with the univariate latent change score models are summarized in the supplemental material (Table S6.17 and S6.18). As indicated by the standardized means of the latent change score variables, the most pronounced changes between T1 and T3 were found for negative affect, emotional significance, and impact (all decreased across the 3 months). The variable *weeks.ago* was not associated with the latent change scores in any of

the models. The univariate latent change score models showed acceptable model fit for all constructs (all CFI ≥ .99, TLI ≥ .98, and RMSEA ≤ .05; Table S6.19).

Bivariate Latent Change Score Models

All bivariate latent change score models showed at least acceptable fit (all CFI ≥ .96, TLI ≥ .96, and RMSEA ≤ .06; Tables S6.20-S6.22). Table 6.3 summarizes the results on the correlations of the latent change scores.

Life Satisfaction. As expected, based on our results from Study 1, perceiving events as less externally controlled ($r_{\Delta\Delta} = -.18$, $p = .008$) and as less social status threatening ($r_{\Delta\Delta} = -.17$, $p = .014$) over time was related to an increase in life satisfaction. However, contrary to our hypotheses, changes in valence were not significantly related to changes in life satisfaction ($r_{\Delta\Delta} = .04$, $p = .592$). Changes in the other perceived event characteristics were also not significantly related to changes in life satisfaction.

Positive Affect. As expected, we found a significant correlation between changes in positive affect and changes in challenge: Perceiving events as less challenging over time was related to an increase in positive affect ($r_{\Delta\Delta} = -.19$, $p = .003$). However, contrary to our hypotheses, changes in external control ($r_{\Delta\Delta} = -.02$, $p = .697$) and changes in valence ($r_{\Delta\Delta} = .10$, $p = .074$) were not significantly related to changes in positive affect in this study. Changes in the other perceived event characteristics were also not significantly related to changes in positive affect.

Negative Affect. As hypothesized, perceiving events as more challenging over time was significantly related to an increase in negative affect ($r_{\Delta\Delta} = .19$, $p = .006$). Furthermore, there was a significant correlation for social status change that was not found in Study 1: Perceiving events as more social status threatening over time was related to an increase in negative affect ($r_{\Delta\Delta} = .17$, $p = .009$). However, the association between changes in valence and changes in negative affect did not replicate in Study 2 ($r_{\Delta\Delta} = -.06$ $p = .301$). Finally, changes in the other perceived event characteristics were not significantly related to changes in negative affect.

Table 6.3: *Correlations Between Latent Change Scores Factors in Study 2*

Perceived event characteristics	Life satisfaction				Positive affect				Negative affect			
	$r_{\Delta\Delta}$	z	p	95% CI ($r_{\Delta\Delta}$)	$r_{\Delta\Delta}$	z	p	95% CI ($r_{\Delta\Delta}$)	$r_{\Delta\Delta}$	z	p	95% CI ($r_{\Delta\Delta}$)
Challenge	−.11	−1.49	.136	[−.25, .03]	**−.19**	**−2.98**	**.003**	**[−.31, −.06]**	**.19**	**2.72**	**.006**	**[.05, .32]**
Change in world views	.03	0.43	.668	[−.10, .16]	−.03	−0.44	.659	[−.14, .09]	.05	0.84	.400	[−.07, .18]
Emotional significance	.00	0.02	.981	[−.14, .14]	−.09	−1.43	.154	[−.22, .03]	.05	0.73	.467	[−.08, .18]
External control	**−.18**	**−2.64**	**.008**	**[−.32, −.05]**	−.02	−0.39	.697	[−.14, .10]	.03	0.41	.682	[−.10, .16]
Extraordinariness	.05	0.62	.536	[−.10, .20]	.03	0.42	.672	[−.10, .16]	−.09	−1.20	.232	[−.23, .06]
Impact	−.02	−0.19	.845	[−.17, .14]	−.15	−2.24	.025	[−.28, −.02]	.08	1.16	.246	[−.06, .23]
Predictability	−.01	−0.18	.854	[−.15, .12]	−.03	−0.53	.598	[−.15, .09]	−.02	−0.29	.772	[−.15, .11]
Social status change	**−.17**	**−2.47**	**.014**	**[−.31, −.04]**	−.14	−2.22	.026	[−.26, −.02]	.17	2.60	.009	*[.04, .30]*
Valence	.04	0.54	.592	[−.09, .17]	.10	1.79	.074	[−.01, .22]	−.06	−1.03	.301	[−.19, .06]

Note. Associations that were expected based on the results of Study 1 and that replicated in Study 2 are depicted in bold (α = .05). Shaded in grey are all associations that were expected based on the results of Study 1 but that did not replicate in Study 2. Written in italics are associations that were not significant in Study 1 but that were significant in Study 2 based on a more conservative level of significance of α = .01.

Robustness Checks

As outlined in Table 6.2, Study 1 and Study 2 differed in several aspects. To test the robustness of our findings and to evaluate possible reasons for diverging results, we conducted five robustness checks. Each robustness check addressed one aspect that differed between the two studies: differences in the employed items, potential relevance of stress due to the Covid-19 pandemic, differences in age composition of the samples, differences in the examined event categories, and different time frames of the included events (for details on the methods and results, see Table 6.4). In general, the pattern of significant associations was highly consistent across the different robustness checks, with three exceptions. First, using only those items that had been assessed in both studies led to larger standard errors and somewhat lower effect sizes for the correlated changes, possibly due to reduced reliability of the shorter scales. Second, restricting the analyses of Study 2 to those event categories that overlapped between the two studies led to higher effect sizes for the correlated changes and made the results of Study 2 more similar to the ones of Study 1. Third, restricting the analyses of Study 2 to events that occurred in the last 3 months (i.e., the time frame in Study 1) also led to stronger correlated changes between the perceived event characteristics and changes in SWB (in particular, for positive and negative affect).

Exploratory Analyses (not Preregistered)

To gain first insights into the direction of causality between changes in perceived event characteristics and changes in SWB, we estimated bivariate latent change score models that additionally included time-ordered paths. Building on the bivariate latent change score model depicted in Figure 6.1, we additionally included a path from the T1 score of SWB to the latent change score of the perceived event characteristics (*Path A*) as well as a path from the T1 score of the perceived event characteristics to the latent change score of SWB (*Path B*). The results of these exploratory analyses can be found in the supplemental material (Table S6.28 and S6.29). In summary, *Path A* and *Path B* were not significant in most bivariate latent change score models (i.e., 102 out of 108 associations were not significant using a level of significance of $\alpha = .01$). Thus, we refrain from drawing any conclusions about the direction of causality for the observed correlated changes based on our exploratory analyses.

Table 6.4: *Overview of the Results of the Robustness Checks*

Factor that was tested	How it was tested	Results
Different items used in the two studies	Estimated the bivariate latent change score models only using the items which were employed in both studies	- Pattern of results remained similar (e.g., similar effect sizes; Table S6.23) - However, some correlations that were significant in the main analyses fell below our level of significance; mainly because standard errors were larger when only using overlapping items
Potential relevance of stress due to the Covid-19 pandemic	Included Covid-19 related stress at T1 as predictor of the latent change scores to control for its effects	- Associations between latent change scores were almost identical compared to the main analyses (Table S6.24) - Covid-19 related stress was negatively related to changes in valence ($p = .009$) and positively related to changes in change in world views ($p = .003$)
Different target age groups of the two studies	Included age as predictors of the latent change scores to control for its effects	- Associations between latent change scores were almost identical compared to the main analyses (Table S6.25) - Age was not associated with changes in the perceived event characteristics and changes in the SWB components (all $ps > .010$)
Different event categories examined in the two studies	Estimated the bivariate latent change score models only using events that were examined in both studies ($N = 533$)	- Compared to the main analyses, associations were stronger using only the overlapping events (Table S6.26) - Changes in valence were significantly associated with changes in positive affect - As in Study 1, changes in social status change were not significantly associated with changes in negative affect - In general, results of Study 2 became more similar to the results of Study 1
Different time frames of the included events in the two studies	Estimated the bivariate latent change score models only using events that occurred in the last 3 months ($N = 136$)	- Compared to the main analyses, associations were stronger when only including events that occurred in the last 3 months before T1 (Table S6.27) - However, due to the smaller sample size, most associations were not significant - Additional exploratory analyses indicated that associations between changes in the perceived event characteristics and changes in positive and negative affect become weaker when less recent are considered (Figure S6.1)

6.3.3   Summary and Discussion

In Study 2, we examined whether the correlations between changes in perceived event characteristics and changes in SWB found in Study 1 replicated in another sample under slightly modified conditions. Perceiving events as increasingly externally controlled and as increasingly social status threatening over time was related to a decrease in life satisfaction in both studies. Furthermore, perceiving events as increasingly challenging over time was related to a decrease in positive affect and to an increase in negative affect in both studies. With some minor deviations, this pattern of results was also found in the robustness checks.

Surprisingly, changes in perceived valence, which were consistently related to changes in SWB in Study 1, were not related to changes in any SWB component in Study 2. As indicated by the robustness checks, these differences can at least partly be explained by differences in the employed time frame of the considered events (i.e., 3 months in Study 1 versus 12 months in Study 2) as well as the sampled event categories.

6.4   General Discussion

In this study, we examined whether changes in perceived event characteristics were related to changes in SWB. Drawing on two short-term longitudinal studies, the following associations consistently emerged: Perceiving events as increasingly challenging over time was related to a decrease in positive affect and an increase in negative affect. Furthermore, perceiving events as increasingly externally controlled and as increasingly social status threatening over time was related to a decrease in life satisfaction. In addition, there were correlations that only emerged in one of the two studies and that might require future research. In particular, the fact that changes in valence were consistently related to changes in all three components of SWB in Study 1 but unrelated to changes in SWB in Study 2 was surprising.

6.4.1   Changes in the Perceived Event Characteristics and Changes in SWB

The results of our study are consistent with theories that propose the existence of correlated changes between the perception of major life events and changes in SWB (Lazarus & Folkman, 1984; Wilson & Gilbert, 2008). In particular, the negative association between changes in perceived challenge and changes in affective well-being are in line with Appraisal Theory as the challenge appraisal is assumed to be of central relevance for the

resulting affective reaction to a stressor (Lazarus & Folkman, 1984). Furthermore, this finding that perceiving events as increasingly challenging over time was associated with a decrease in affective well-being is also in line with previous findings. Brose et al. (2021) found that perceiving the Covid-19 pandemic as increasingly threatening and challenging over time predicted decreases in mental health.

The associations between changes in life satisfaction and changes in external control and social status change can best be explained by theories on the onset of depression. According to Helplessness Theory (Abramson et al., 1978) and Social Signal Transduction Theory (Slavich & Sacher, 2019), perceiving events as externally controlled and as social status threatening should contribute to the onset of depression. Thus, it seems reasonable that perceiving events as more externally controlled and as more social status threatening over time was associated with a decrease in life satisfaction.

Differences in the item content of the perceived event characteristics might explain why their correlated changes differed among the three SWB components. For example, items for external control require a cognitive evaluation of the causes of the event (e.g., "Others were responsible for the event") explaining why changes in external control were most strongly related to changes in life satisfaction as cognitive component of SWB. In contrast, items for challenge refer to the feelings that were elicited by the event (e.g., "The event scared me") explaining why changes in this characteristic were most strongly related to changes in positive and negative affect.

Regarding the perceived event characteristic valence, our two studies led to inconsistent results. In Study 1, valence was consistently associated with changes in all three components of SWB and the effect sizes were quite large. In Study 2, no statistically significant correlated changes between valence and SWB were found. Our robustness checks examined whether these different results can be explained by differences in the design of the two studies. In particular, the temporal distance between the event occurrence and T1 and the sampled event categories seemed to be at least partly responsible for the diverging findings indicating that changes in perceived valence are only correlated with changes in SWB under specific conditions.

6.4.2   Possible Causes for Correlated Changes

As we found correlated changes between the perception of major life events and SWB, we must address the question *why* these associations emerged. Our study was based on theories assuming feedback loops and coupled changes among these constructs (e.g., Lazarus & Folkman, 1984; Wilson & Gilbert, 2008). Additional other possible causes for correlated changes discussed in the literature are response biases and external factors inducing similar changes in both constructs (Olaru & Allemand, 2021). For example, public events (e.g., terrorist attacks) or seasonal changes might induce changes in people's SWB and in the perceived event characteristics and thus be responsible for the observed correlated changes. Nonetheless, we argue that feedback loops and coupled changes between the perception of major life events and SWB are the most likely explanations for our results. First, there was no indication that the number of reversed-keyed items used in the assessment of the perceived event characteristics (varying from zero to three per subscale) was associated with strength of the associations which speaks against a pronounced influence of response biases such as acquiescence. Second, by examining the associations in two independent samples, we were able to exclude at least some external factors such as age-related developments (as the two samples differed in their age composition) or seasonality (Study 1 was conducted in Winter 2018, Study 2 in Summer 2021).

Assuming that our correlated changes were (mainly) caused by feedback loops between these constructs, future research should uncover *how* these feedback loops might work. We reviewed theories that assume that changes in the perception of major life events lead to changes in SWB as well as theories that assume the opposite direction of causality. In our exploratory analyses, we tried to gain first insights into the temporal order of the correlated changes. However, these analyses did not allow a definite conclusion. Thus, it remains a task for future research to examine whether changes in the perception of major life events lead to changes in SWB or vice versa. For example, longitudinal studies comprising multiple measurement occasions might be useful to better understand possible feedback mechanisms and the temporal order of the associations between the perception of major life events and SWB.

6.4.3 Implications for Future Research on Major Life Events

Although questions regarding the causality of the coupled changes between SWB and perceived event characteristics still need to be addressed, our findings nonetheless have practical implications for research on major life events. First, our study provides further evidence that examining how people perceive major life events may be useful to better understand their consequences (Luhmann et al., 2021). Second, to examine event-related changes, longitudinal study designs are necessary not only to address changes in the outcome of interest (Luhmann et al., 2014) but also to gain a more complete understanding of the perception of major life events and its changes over time. Third, as indicated by our robustness checks, the timing of the measurement occasions and the time passed since the event occurrence are relevant for the associations that can be found. For positive and negative affect, the first months after event occurrence seem to be particularly crucial.

6.4.4 Limitations and Future Directions

The two studies have several limitations. First, both studies relied on samples which were predominantly female and recruited in a Western democratic country. Thus, future research should examine whether our findings generalize to other cultural backgrounds. As the frequency of certain major life events differs among cultures, different associations between changes in SWB and changes in the perceived event characteristics might emerge in these populations (Ngo & Le, 2007). Relatedly, in our studies, we only assessed the perceived event characteristics of the most important major life event the participants had experienced in the given time frame. Consequently, it remains a question whether other associations emerge when focusing on specific and maybe also less important events.

Second, as indicated above, assessing correlated changes between the perception of major life events and SWB is only a first step to learn more about their interplay. We found that changes in these constructs are related to each other. To amplify these findings, longitudinal studies with multiple measurement occasions and experimental studies (e.g., by manipulating people's SWB through interventions) should be conducted to learn more about the mechanisms causing the observed pattern of correlated changes.

Third, some associations between the perceived event characteristics and SWB emerged only in one of the two studies. In our robustness checks, we tried to examine whether differences in the designs of the two studies were responsible for differences in the results.

However, these robustness checks can only be seen as an approximation to this question as not all possible reasons for differences could be examined. For example, we tried to estimate the influence of the Covid-19 pandemic in Study 2 by including a measure of Covid-related stress to the bivariate latent change score models, but the pandemic has consequences that reach far beyond people's self-rated stress (e.g., health problems, occurrence of different major life events).

Fourth, in this article, we could not analyze which factors may have caused changes in the perception of major life events as we observed naturally occurring changes in the perceived event characteristics. However, for applied contexts like interventions, future research should uncover under which conditions the perception of major life event changes. For example, changes in the consequences of an event and changes in one's evaluation standard for major life events may be possible candidates that elicit changes in the perception of major life events.

6.4.5 Conclusion

The present article further empathizes that considering the perception of major life events enhances our understanding of event-related changes in SWB (Haehner, Kritzler et al., 2022; Luhmann et al., 2021). In particular, not only the initial perception of major life events, but also their changes over time are related to changes in SWB. Based on these findings, future research should uncover the mechanisms causing this pattern of correlated changes.

6.5 Data Accessibility Statement

The study materials, data, and analysis scripts for both studies can be accessed at https://osf.io/cp7d6. The preregistration for the analyses of Study 2 can be found at https://osf.io/3yw2a.

6.6 Author Contribution Statement

The contributions of each author according to the CRediT Classifaction:

Peter Haehner: Conceptualization (*lead*), Data Curation (*lead*), Formal Analysis (*lead*), Investigation (*equal*), Methodology (*lead*), Project Administration (*lead*), Software (*lead*), Visualization (*lead*), Writing – Original Draft Preparation (*lead*), Writing – Review and Editing (*equal*)

Lena S. Pfeifer: Conceptualization (*supporting*), Funding Acquisition (*supporting*), Investigation (*equal*), Writing – Review and Editing (*equal*)

Ina Fassbender: Conceptualization (*supporting*), Investigation (*equal*), Writing – Review and Editing (*equal*)

Maike Luhmann: Conceptualization (*supporting*), Funding Acquisition (*lead*), Investigation (*supporting*), Methodology (*supporting*), Resources (*lead*), Supervision (*lead*)

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7

General Discussion

7. General Discussion

Research over the last decades has demonstrated that major life events can lead to changes in personality traits, depressive symptoms, and subjective well-being (e.g., Bleidorn et al., 2018; Kraaij et al., 2002; Luhmann et al., 2012). More recently, however, research interest turned to the question of individual differences, that is, why people change differently in context of major life events (Blackie & Jayawickreme, 2022; Bleidorn et al., 2020). Existing studies were often limited regarding their ability to address these individual differences due to their simplistic assessment of major life events which focused on whether an event occurred or not (e.g., by employing life event checklists). As people differ in how they perceive major life events (Kritzler et al., 2022), assessing these event perceptions was suggested as an important advancement to better understand the effects of major life events (Bleidorn et al., 2020; Jayawickreme et al., 2021; Luhmann et al., 2021). In the present dissertation, a recently developed taxonomy of perceived event characteristics (Luhmann et al., 2021) was employed to address two broad research questions:

3) Can perceived event characteristics explain individual differences in personality trait changes and depression following major life events?

4) Does the perception of major life events change over time? If so, are such changes in the event perception related to changes in subjective well-being?

7.1   Summary of the Studies Included in This Dissertation

The present dissertation comprised four empirical studies and one scoping review. The findings and conclusions of these studies are summarized in Table 7.1 and described in more detail in the following sections.

7.1.1   *Perception of Major Life Events and Personality Trait Changes*

Studies on event-related personality trait change often found only small effects of major life events on personality traits and results were at least partly inconsistent across studies (Bleidorn et al., 2020; Denissen et al., 2019). Considering how people perceive major life events may thus be an important step to better understand event-related personality trait changes (Bleidorn et al., 2020; Luhmann et al., 2021).

Table 7.1: *Summary of Findings and Conclusions of the Studies Included in This Dissertation*

Chapter	Research questions	Main findings	Conclusion
2	(3) Are perceived event characteristics associated with (the amount of) personality trait changes? (4) Do these associations differ among event types?	Perceived valence was associated with changes in agreeableness and neuroticism, but direction, strength, and significance of these associations depended on the time interval between pre-event and post-event personality assessment as well as on the event type. Furthermore, there were some small associations between other perceived event characteristics and the amount of personality trait change.	Although the associations between perceived event characteristics and personality trait changes seem to be small, they may help to further clarify the nuanced effects of major life events on personality trait changes.
3	(3) Which personal, environmental, and event-related variables can explain individual differences in personality trait changes after negative life events? (4) Do results differ among differently specified statistical models?	Using the preregistered multilevel lasso estimation, none of the examined personal, environmental, and event-related moderators was significantly associated with personality trait changes. In exploratory analyses (i.e., differently specified multilevel models), a few associations consistently emerged that should be considered in future research. However, in general, all moderators together explained less than 2% of variance in personality traits.	Better understanding individual differences in personality trait changes seems to be a challenging task. Future research on this topic should rely on large samples, use different analytical methods, and consider an even more diverse set of personal, environmental, and event-related moderators.
4	(3) How has the perception of major life events been examined in depression research? (4) What is known about the association between the perception of major life events and depression?	The association between the perception of major life events and depression has often been assessed in cross-sectional studies using student samples and non-validated ad-hoc questionnaires. In these studies, several perceived event characteristics were cross-sectionally related to depression (e.g., globality, valence, distress). Furthermore, in hypothetical event studies (i.e., studies in which participants rate their expected perception of an imagined event), depressogenic cognitive or attributional styles also predicted changes in depressive symptoms over time.	Perceived event characteristics are associated with depression. However, to clarify whether perceived event characteristics can predict the onset of depression longitudinally, further longitudinal research examining a standardized set of perceived event characteristics in more diverse samples is necessary.

Table 7.1 (continued)

Chapter		Research questions	Main findings	Conclusion
5	(4)	How stable are individual differences in perceived event characteristics?	Rank-order stabilities of the perceived event characteristics were in between the ones of affective well-being and the Big Five personality traits, indicating moderate stability of perceived event characteristics. Furthermore, two significant mean-level changes were found: Major life events were perceived as less extraordinary and as more world view changing over time. Finally, most of the variance in perceived event characteristics was explained by between-person differences.	The perception of major life events can vary between and within individuals. Considering the temporal distance between the occurrence of a major life event and the subsequent assessment of their perception is relevant for future research on major life events.
	(5)	Does the mean level of perceived event characteristics change over time?		
	(6)	What percentage of the total variance of perceived event characteristics can be explained by between-person differences?		
6	(3)	Are changes in the perception of major life events associated with changes in subjective well-being?	Across two datasets, four correlated changes between perceived event characteristics and subjective well-being consistently emerged. For example, perceiving events as increasingly challenging over time was associated with a decrease in positive affect and an increase in negative affect. The sampled event types and the temporal distance between the event occurrence and the first measurement occasion at least partly explained the differences in results from the two datasets.	The development of perceived event characteristics and subjective well-being is intertwined. Assessing perceived event characteristics repeatedly to examine whether the perception of a major life events changes over time may be beneficial for future research on event-related changes in subjective well-being (and other constructs).
	(4)	Can differences in the designs of the two studies explain differences in the results?		

Drawing on a sample of young adults, the study presented in Chapter 2 examined whether perceived event characteristics are related to personality trait changes over 1 year. Some associations between perceived event characteristics and personality trait changes were found. However, these associations were small and depended on the time interval between pre-event and post-event personality assessment. For example, perceived valence was only associated with changes in agreeableness over a 3-months and a 12-months interval (but not over a 6-months or 9-months interval), and the direction of the association between valence and changes in neuroticism changed over time (from negative to positive). Furthermore, exploratory analyses indicated that associations between perceived event characteristics and personality trait changes differed among event types. For example, the association between perceived valence and changes in neuroticism was significantly stronger for occupational events than for educational events. However, contrary to our expectations, neither perceived impact nor its interaction with perceived valence were associated with personality trait changes.

In summary, perceived event characteristics may help to further clarify a complex puzzle of inconsistent and small associations between major life events and personality trait changes. However, the associations between perceived event characteristics and personality trait changes seem to be small as well, and future research on their relationship is required.

7.1.2   *Individual Differences in Personality Trait Changes*
Building on these findings on the association between the perception of major life events and personality trait changes, the study presented in Chapter 3 examined additional factors possibly explaining individual differences in personality trait changes. Beyond perceived event characteristics, other event-related variables (event type and objective-descriptive event characteristics), personal variables (level of personality functioning), and environmental variables (environmental changes) were included in the analyses. The study relied on a sample of participants who had recently experienced a negative major life event (e.g., death of a loved one, a relationship breakup, or a friendship dissolution). Thus, while having no pre-event assessment, this study allowed a closer look at individual differences in personality trait changes after specific negative events.

Using the preregistered multilevel lasso estimation, none of the examined moderators was significantly associated with individual differences in personality trait changes (neither in

the event-specific analyses nor in the combined event analysis). Exploratory analyses employing classic multilevel modeling generally confirmed this finding. The different moderators together explained only a minor proportion of variance in personality trait changes (on average less than 2%). However, these exploratory analyses also identified some effects that might be worth considering in future research. For example, across the different exploratory analyses, perceiving a relationship breakup as more social status threatening was consistently associated with less favorable agreeableness trajectories (e.g., a decrease in agreeableness).

Taken together, this study represents an initial attempt to better understand individual differences in personality trait changes. Although our main analyses did not find any significant moderators of these individual differences, it has important implications for future research. For example, future research on individual differences in personality trait changes should use large samples, routinely include robustness checks, and consider an even more diverse set of personal, environmental, and event-related moderators.

7.1.3   *Perception of Major Life Events and Depression*

As different depression theories converge on the idea that the perception of major life events is relevant to understand the onset of depression (e.g., Abramson et al., 1989; Ingram, 1984), several studies have already examined the association between these constructs. The scoping review presented in Chapter 4 summarized and integrated this existing evidence. Using a systematic literature search on *PsycINFO* and *Medline*, 276 studies (N_{total} = 89,600) examining the relationship between the perception of major life events and depression were identified. The review provided findings on two research questions: (1) How has the perception of major life events been examined in depression research? (2) What is known about the association between different perceived event characteristics and depression?

Regarding the first research question, the review showed that research on the association between the perception of major life events and depression was mostly conducted in the United States using student samples. Furthermore, research frequently used ad-hoc measures to assess the perception of major life events. Finally, there were two common approaches to examine the association between the perception of major life events and depression: hypothetical event studies (i.e., studies requiring imaging the occurrence of

major life events) and autobiographical event studies (i.e., studies in which the perception of already experienced major life events was rated).

Regarding the second research question, the review showed that many perceived event characteristics were cross-sectionally associated with depression. For example, perceiving events more negatively and more distressing was associated with higher levels of depressive symptoms. Furthermore, in hypothetical event studies, a depressogenic attributional style and a depressogenic cognitive style were longitudinally related to depression (in particular, in interaction with negative life events). For autobiographical event studies, definite conclusions on the longitudinal relevance of certain perceived event characteristics are not possible as only few studies addressed these effects. However, perceived distress, valence, and loss may be seen as promising candidates for predicting an increase in depressive symptoms or the onset of depression longitudinally.

In summary, the scoping review presented in Chapter 4 outlined the potential relevance of perceived event characteristics for understanding the onset of depression. Furthermore, it identified several directions for future research such as using more diverse samples, examining a unified set of perceived event characteristics with validated measures, and employing longitudinal study designs with multiple measurement occasions.

7.1.4 Stability and Change of Perceived Event Characteristics

Instead of assessing perceived event characteristics only once, the study presented in Chapter 5 used multiple assessments of perceived event characteristics. Thus, this study allowed examining stability and change of perceived event characteristics over time. In particular, rank-order stability, mean-level stability, and intraclass correlations of perceived event characteristics were examined.

Perceived event characteristics were moderately rank-order stable: Their rank-order stabilities were in between the ones of affective well-being and the Big Five personality traits. However, there was one unexpected finding for impact that requires future research (i.e., an autoregression greater than one). Regarding mean-level stability, there were significant mean-level changes for two perceived event characteristics: Life events were perceived as more world view changing and as less extraordinary over time. Finally, intraclass correlations showed that most of the variance in perceived event characteristics was attributable to between-person differences.

Taken together, the study presented in Chapter 5 showed that the perception of a major life event can change over time. Thus, future research should take such changes into account and examine why the perception of an event is changing over time and whether changes in perceived event characteristics are related to changes in other outcomes.

7.1.5 *Correlated Changes of Perceived Event Characteristics and Subjective Well-Being*

Building on the findings of Chapter 5, the study presented in Chapter 6 examined whether changes in perceived event characteristics are associated with changes in subjective well-being.

Across two datasets, four correlated changes between perceived event characteristics and subjective well-being were consistently found. Perceiving events as increasingly challenging over time was related to a decrease in positive affect and an increase in negative affect. Furthermore, perceiving events as increasingly externally controlled and as increasingly social status threatening over time was related to a decrease in life satisfaction. However, some results differed between the two datasets. Perhaps most striking, changes in perceived valence were related to changes in all three components of subjective well-being in Study 1 but unrelated to changes in subjective well-being in Study 2. Exploratory analyses showed that differences in the results of the two studies were at least partly explainable by the sampled event types and by the temporal distance between the event occurrence and the first measurement occasion.

In summary, the study presented in Chapter 6 illustrated that the development of perceived event characteristics and subjective well-being is intertwined. Future research should uncover the mechanisms responsible for the observed correlated changes.

7.2 Theoretical Implications

Beyond the theoretical implications of each individual study presented in the Chapters 2 to 6, some general theoretical conclusions can be derived from their combination. First, by applying the dimensional taxonomy of perceived event characteristics by Luhmann et al. (2021), this dissertation allows insights into the properties and relevance of perceived event characteristics. Second, by employing longitudinal datasets with varying time frames, the studies of this dissertation provide information on the role of time in research on (the perception of) major life events.

7.2.1 The Properties and the Relevance of Perceived Event Characteristics

In this section, findings from this dissertation on the properties and relevance of perceived event characteristics will be integrated with recent research on perceived event characteristics by other authors (e.g., studies employing the Event Characteristics Questionnaire that were published while the studies in Chapters 2 to 6 were conducted).

Understanding the Properties of Perceived Event Characteristics

One aim of the present dissertation was to contribute to the knowledge on the construct of perceived event characteristics. One way to better understand a construct (e.g., its properties, meaning, and validity) is to look at its nomological network (i.e., its associations with other variables; Cronbach & Meehl, 1955). Based on current effect size conventions (Funder & Ozer, 2019), perceived event characteristics seem to show only weak cross-sectional correlations with several personality variables. For example, perceived event characteristics were on average weakly related to the Big Five personality traits (average $r = .07$ to $r = .11$; Rakhshani et al., 2022; similar results presented in Chapters 2 and 3), depression (average $r = .08$; Ratner et al., 2022), and subjective well-being (average $r = .12$; Luhmann et al., 2021; similar results presented in Chapter 6). Thus, it can be concluded that perceived event characteristics are not mere proxies of personality variables (Rakhshani et al., 2022), although there were some consistent and meaningful correlations such as neuroticism being associated with perceived challenge. Furthermore, there is initial evidence that event-related variables such as the event type (Kritzler et al., 2022) and objective characteristics of major life events (Haehner et al., 2023) are associated with perceived event characteristics. Thus, although these findings were correlational, a possible conclusion of these studies may be that how major life events are perceived depends on both the person and the environment (i.e., the event). A similar assumption has been made in research on the perception of situations: According to Rauthmann et al. (2014), the perception of a situation depends on objective situation characteristics (called *situation cues* such as involved persons, activities, or places) and personal characteristics (e.g., traits, social roles).

Another way to grasp the properties of a construct is to examine its temporal stability (e.g., Anusic & Schimmack, 2016; Bleidorn et al., 2021). Chapter 5 demonstrated that perceived event characteristics are moderately stable over time. This finding implies that perceived event characteristics are not mere proxies of people's current mood (as affective well-being

was less stable; cf. Hammen, 2005), but that people have a relatively stable perception of a major life event. Thus, one could speculate that enduring cognitive styles and enduring information on the event are shaping people's event perception.

Taken together, the studies present in this dissertation along with other recent studies show (1) that perceived event characteristics are associated with personal and environmental variables, and (2) that they are moderately stable over time.

Using Perceived Event Characteristics to Understand the Effects of Major Life Events

Recent research on major life events turned to the question of why people differ in their reaction to major life events (Blackie & Jayawickreme, 2022; Bleidorn et al., 2020; Schwaba et al., 2023). The dimensional taxonomy of perceived event characteristics was proposed to allow a better understanding of these individual differences by providing a closer look at people's subjective event experience (Luhmann et al., 2021). The results presented in this dissertation show that considering how people perceive major life events can indeed advance our understanding of individual differences in the reaction to major life events.

The studies in Chapters 2 and 3 examined the relationship between perceived event characteristics and individual differences in personality trait changes. At first glance, the findings from the two studies may seem contradictory. In Chapter 2, some associations between perceived event characteristics and personality trait changes were found (e.g., perceived valence was related to changes in agreeableness), whereas the main analyses of Chapter 3 did not reveal any significant effects. However, considering the effect sizes found in Chapter 2 and the exploratory analyses of Chapter 3, both studies seem to support the following conclusion: Perceived event characteristics are associated with personality trait changes, but the effect sizes of these associations are (very) small (for details on effect sizes see Section 7.3.2). This conclusion is also in line with studies by other authors on the association between perceived event characteristics and personality trait changes (Schwaba et al., 2023; Vries et al., 2021). Furthermore, this conclusion aligns with studies on the relationship between perceived event characteristics and changes in other traits beyond the Big Five (e.g., empathy, humility, and open-mindedness; Blackie & McLean, 2022; Dorfman et al., 2022; Fassbender et al., 2022). These studies mostly found small (and partly not statistically significant) associations between the perception of major life events and changes in these other traits.

Currently, theorical accounts explaining event-related personality trait changes do not consider the perception of major life events in their predictions (Ormel et al., 2017; Roberts, 2018; Roberts & Nickel, 2017). For example, the Experience-Dependent Set-Point Model (Ormel et al., 2017) predicts that personality traits remain within a narrow range around a set point but that strong environmental influences can lead to permanent shifts in these set points. Research on the perception of major life events could help to clarify what is meant by *strong environmental influences* (e.g., major life events that are perceived in a certain way). However, based on the current state of research, it is too early to say that a revision of these theories is needed to include the perception of major life events. Future research first needs to replicate the proposed small associations between perceived event characteristics and personality trait changes. Furthermore, to obtain falsifiable and adequately specific theories, concrete predictions on which perceived event characteristics are related to changes in which personality traits are required. For example, currently, evidence seems to be most convincing that perceived valence is related to changes in neuroticism (Chapters 2 and 3; but also, Schwaba et al., 2023; Vries et al., 2021).

Compared to theories and empirical evidence on personality trait changes, the perception of major life events plays a more prominent role in research on depression. Chapter 4 summarized the existing empirical evidence on the association between the perception of major life events and depression. Generally, this scoping review provided initial support for the relevance of perceived event characteristics for understanding individual differences in the onset of depression. However, more longitudinal research is required as only longitudinal studies can address the question whether a certain way of perceiving major life events predicts the onset of a depression or whether being depressed predicts a certain way of perceiving major life events. Furthermore, the results of Chapter 4 suggest that an integration of different theoretical accounts may be needed. Currently, depression theories differ regarding which perceived event characteristics they propose to be relevant (e.g., Beck & Bredemeier, 2016; Ingram, 1984), but no theory comprises all perceived event characteristics that can be seen as likely candidates for predicting the onset of depression longitudinally (distress, valence, and loss).

Finally, regarding subjective well-being, the studies presented in Chapter 6 indicate that the development of perceived event characteristics and subjective well-being are intertwined as several correlated changes between these constructs were found. Similarly,

Luhmann et al. (2021) and Prizmić-Larsen et al. (2020) showed that perceived event characteristics (e.g., perceived valence) are related to individual differences in changes in subjective well-being. Thus, the conclusion can be drawn that how people perceive major life events is relevant to understand event-related changes in subjective well-being. This conclusion and the findings on changes in people's event perception (Chapters 5 and 6) are in line with Affective Adaptation Theory (Wilson & Gilbert, 2008). This theory suggests that how people initially perceive an event and how their event perception changes should both be relevant for changes in their subjective well-being over time. However, there are some inconsistencies regarding the specific perceived event characteristics that are relevant for explaining individual differences in event-related changes in subjective well-being. In the theory of Wilson and Gilbert (2008), novelty (akin to extraordinariness) and surprise (akin to predictability) are suggested as important predictors of changes in subjective well-being. Empirical evidence (Luhmann et al., 2021; Prizmić-Larsen et al., 2020), so far, rather supports the relevance of the perceived event characteristics valence, challenge, and impact. Thus, similar to research on personality trait changes, future research is needed to clarify the relevance of certain perceived event characteristics for individual differences in changes in subjective well-being.

In summary, the studies presented in this dissertation, theoretical accounts, and empirical evidence by other authors support the idea that perceived event characteristics are relevant to understand individual differences in psychological outcomes such as personality traits, depression, and subjective well-being.

Integration of Findings and Questions for Future Research

Figure 7.1 integrates evidence and assumptions on perceived event characteristics as described in the preceding sections. Based on existing correlational evidence and the literature on situation perception, it can be assumed that personal variables (e.g., personality traits, cognitive styles) and environmental variables (e.g., objective event characteristics) are relevant for the perception of a major life event (Rakhshani et al., 2022; Rauthmann et al., 2014). Furthermore, perceived event characteristics but also other personal and environmental variables can explain changes in different outcome variables. However, several important questions regarding these propositions need to be addressed in future research.

Figure 7.1: *Overview of Evidence and Assumptions on Perceived Event Characteristics Including Questions for Future Research*
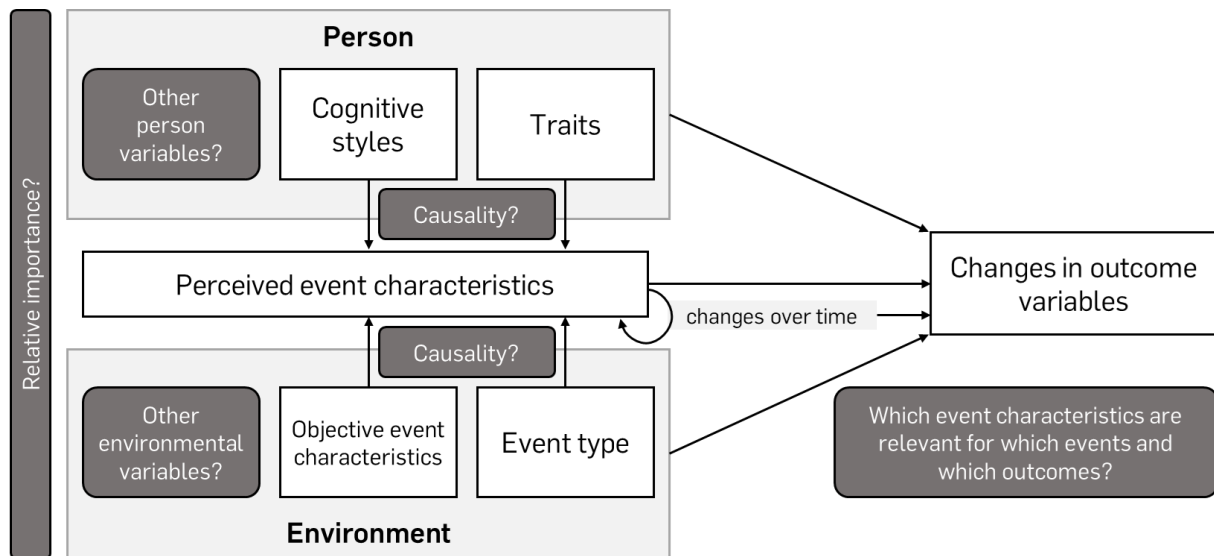
Note. This figure proposes how environmental variables, personal variables, and perceived event characteristics are related to changes in outcomes such as mental health or subjective well-being. The round arrow that goes from perceived event characteristics to perceived event characteristics illustrates that the perception of a major life event changes over time. Questions that need to be addressed in future research are shaded in dark grey.

A first line of research should address the question of what determines people's perception of a major life event. First, the causal relevance of the examined personal and environmental variables for the perception of a major life event has to be examined. Therefore, experimental studies that manipulate the proposed personal or environmental variables could be conducted. For example, cognitive bias modification training may be used to test whether cognitive styles influence people's perception of a major life event (Woud & Hofmann, 2022). Indeed, there is initial evidence from the related field of trauma appraisals showing that modifying people's cognitive styles by means of a bias modification training leads to changes in dysfunctional trauma appraisals and thereby to a reduction of post-traumatic stress symptoms (Woud et al., 2021). Second, a broader evaluation of the nomological network of perceived event characteristics is needed to address the question whether there are further personal or environmental variables that drive the perception of a major life event (Rauthmann, 2022). Third, the relative importance of the different variables for the perception of a major life event should be addressed. Currently, research

suggests that personality traits and other personal characteristics are only weakly correlated with the perception of a major life event (e.g., Rakhshani et al., 2022). However, it is an open question whether this finding implies that the perception of a major life event is mainly driven by event-related variables. To disentangle the effects of the event and the person on the perception of major life events, approaches similar to the variance decomposition in situation perception could be used (i.e., multiple individuals rate multiple events on multiple characteristics; Rauthmann, 2012; Rauthmann & Sherman, 2019). Fourth, regarding changes in the perception of major life events, the question arises whether the initial perception of an event and changes in this event perception are determined by the same variables. So far, the studies presented in this dissertation only examined naturally occurring changes in the perception of a major life event but did not address why the perception of a major life event changes. Addressing these questions regarding the origins of the perception of major life events is of practical relevance as they could inform, for example, psychotherapeutic interventions how to best modify dysfunctional event perceptions (see Section 7.4.2).

A second line of research should address the question how perceived event characteristics are related to changes in different outcome variables. The studies presented in this dissertation already targeted this research question for some outcomes and some events (Chapters 2, 3, 4, and 6). However, more research is needed due to an important difficulty in research on major life events. As illustrated for example in Chapter 3, the associations between perceived event characteristics and personality trait changes differ among events. Furthermore, as shown for example in Chapter 2, the associations between perceived event characteristics and personality trait changes differ depending on the particular outcome (i.e., which personality trait was considered). This complexity that the effects of major life events (and the perception of major life events) can differ among events and among outcomes still puzzles contemporary research on major life events. Currently, there are outcome-specific models describing how a certain outcome variable changes after different major life events (e.g., depression: Abramson et al., 1989; subjective well-being: Headey, 2007; personality traits: Roberts & Nickel, 2017; self-esteem: Reitz, 2022). However, there are also event-specific models describing how different outcome variables change after a certain major life event (e.g., death of a loved one: Stroebe et al., 2006; friendship dissolution: Vieth et al., 2022; job loss: Waters, 2000). None of these perspectives is

inherently wrong but the fact that major life events can be examined from these two angles may complicate integration of knowledge. Furthermore, both outcome- and event-specific models ignore an additional source of variance: There may also be interactions between events and outcomes. That is, the relevance of certain moderators and mediators may depend on the specific event-outcome combination (see also Luhmann et al., 2014). For example, perceived social status changes may be relevant to explain changes in mental health after a job loss but irrelevant to explain changes in other event-outcome combinations. Thus, future research needs to address the question which perceived event characteristics are relevant for which events and which outcomes. In the best case, comprehensive datasets are collected that comprise information on changes in various outcomes in context of various major life events. Then, it is possible to examine similarities and differences among specific event-outcome combinations and to create more specific models based on Figure 7.1 that describe for specific event-outcome combinations which personal characteristics, environmental characteristics, and perceived event characteristics are relevant to explain changes in the respective outcome.

7.2.2 *The Role of Time to Understand the Effects of (the Perception of) Major Life Events*

Another complexity in research on major life events, which is theoretically and methodologically relevant, arises from the consideration of time. Existing research and theories on the effects major life events often neglected the role of time (Bleidorn et al., 2020; Hopwood et al., 2022; Luhmann et al., 2014). For example, contemporary theories on event-related changes in personality traits do not make concrete predictions when and how fast personality changes occur (Hopwood et al., 2022). But time matters: When examining changes in the context of major life events, the observed effects differ based on the number and spacing of measurement occasions (Bleidorn et al., 2020; Hopwood et al., 2022; Luhmann et al., 2014).

The studies presented in this dissertation illustrate the relevance of time in research on the perception of major life events. First, the fact that the perception of a major life event changes over time (Chapter 5) implies that the timing of assessing people's event perception is relevant for the obtained results (see Section 7.3.1). Second, in Chapter 2, the associations between perceived event characteristics and personality trait changes varied across different time intervals between pre-event and post-event personality assessments suggesting that the dynamics between these constructs can change over time. Third, in a

similar way, the scoping review in Chapter 4 indicated that the associations between the perception of major life events and depression depended on the time interval between measurement occasions (e.g., Kwon, 1997). Thus, time has to be considered in theory and research on the perception of major life events.

Based on the studies presented in this dissertation, two implications regarding the time scale of change processes in research on (the perception of) major life events may be drawn. First, the initial period after the occurrence of a major life event (e.g., the first months) seems to be particularly relevant. For example, the exploratory analyses of Chapter 6 demonstrated that correlated changes between perceived event characteristics and subjective well-being were stronger within the first months after the occurrence of a major life event. Similarly, existing research on major life events has shown stronger associations between subjective well-being and more recent major life events (e.g., Suh et al., 1996) and a higher rate of change shortly after the event occurrence (e.g., Luhmann et al., 2012). Second, the studies presented in this dissertation show that event-related changes in different outcomes can occur quickly. For example, Chapters 2 and 3 illustrated that even stable constructs such as personality traits can change over relatively short time frames (i.e., a few months; see also Roberts et al., 2017).

Together, these findings show the relevance of frequent assessments within the first months after the occurrence of a major life event. In doing so, they point to an important disadvantage of large-scale, nationally-representative panel studies such as the *German Socio-Economic Panel* that are commonly used in research of major life events (e.g., Asselmann & Specht, 2021; Buecker et al., 2021; Mancini et al., 2011). These panel studies often rely on annual or bi-annual assessments of the outcomes of interest so that they allow only limited insights into change processes over shorter time frames and within the initial period after the occurrence of a major life event (Luhmann et al., 2014). The studies presented in this dissertation (with time lags of 1 to 3 months between assessments) thus complement research using nationally-representative panel studies. Thereby, they can help to advance theoretical accounts by allowing to generate assumptions on the time course of event-related changes over shorter time frames (see also Blackie & McLean, 2022; Infurna et al., 2022; Jayawickreme et al., 2022).

However, based on the current state of research on major life events, incorporating clear-cut hypotheses on the time scale of event-related changes into theoretical accounts is still a difficult task. As existing research mainly chose the number and spacing of assessments based on practical reasons and as most studies relied on few measurement occasions, knowledge about the shape and rate of event-related changes over different time intervals is surprisingly limited (Hopwood et al., 2022; Luhmann et al., 2014). To deal with this problem, studies that use frequent assessments (i.e., bi-weekly or monthly assessments) over a long time period (i.e., several years) are needed. Such studies would allow insights into the short- and long-term development of a construct and into changes in the dynamics between constructs over time while having an adequate temporal resolution. Furthermore, such frequent assessments would allow to estimate and compare statistical models with differently scaled time variables (including non-linear and discontinuous change), and they could thus provide information on how to best describe a change process (Bleidorn et al., 2020). Future research on the role of time in research on major life events is also required as the time scale of event-related changes likely differs among constructs, events, and people (cf. Section 7.2.2). For example, Chapter 5 illustrated that affective well-being, personality traits, and perceived event characteristics differed in their stability. Generally, such comparative research approaches that describe and compare the change process of different constructs may be useful for future research as they help to contextualize the overserved change rates. Furthermore, as people may differ in how they anticipate, prepare for, and react to events, it could be useful to incorporate *perceived time* (e.g., assessments of the subjective time course) in research on major life events (Hopwood et al., 2022).

In summary, considering the role of time is an important endeavor in research on (the perception of) major life events. The studies presented in this dissertation illustrate the relevance of looking at changes within the first months after the occurrence of a major life event. However, future research on the role of time is needed and these studies should take the following recommendations into account:

    a.   Incorporate concrete predictions on the role of time in theoretical approaches

    b.   Use longitudinal designs with frequent assessments over long time frames

    c.   Explore and compare differently scaled time variables in statistical models

    d.   Use comparative research approaches

    e.   Consider the role of perceived time

7.3   Methodological Implications

The five studies included in this dissertation all examined the perception of major life events. Thus, looking at them together allows drawing methodological recommendations on the assessment of major life events, study designs to examine major life events, and statistical approaches to analyze major life events. Furthermore, some of the theoretical implications discussed above are closely linked to methodological implications.

7.3.1   *Assessment of Major Life Events: The Event Characteristics Questionnaire*

Luhmann et al. (2021) introduced the Event Characteristics Questionnaire (ECQ) as a new measure to dimensionally assess how people perceive major life events. Compared to other approaches assessing major life events (e.g., life event checklists), the ECQ has several advantages such as overcoming the problem of intracategory variability and providing a more detailed understanding of the experienced events (Luhmann et al., 2021).

In general, the studies presented in this dissertation demonstrate the utility of the ECQ to improve the understanding of major life events as perceived event characteristics were associated with event-related changes in different outcome variables (Section 7.2.1). Moreover, the studies in this dissertation provided further evidence regarding the psychometric quality of the ECQ. In different samples, we found good internal consistency of the different subscales (e.g., Chapter 3, Chapter 6; Cortina, 1993), good fit of most subscales in structural equation modeling (e.g., Chapter 2, Chapter 5; Schermelleh-Engel et al., 2003), and evidence for convergent validity (see Section 7.2.1). Thus, the ECQ represents an advancement for research on the perception of major life events, which often relied on non-validated ad-hoc questionnaires (see Chapter 4). Furthermore, the ECQ facilitates aggregating knowledge on perceived event characteristics across outcomes and events as it comprises a broad set of perceived event characteristics applicable to different event types (Luhmann et al., 2021).

The studies presented in this dissertation also have some implications on *how* to employ the ECQ. In existing research, perceived event characteristics have been assessed at very different time points after the event occurrence (i.e., between a few weeks and several years after the event occurrence; Mitchell et al., 1997; Servaty-Seib, 2014). However, as the perception of major life events changes over time (Chapter 5), researchers must consider when they want to measure people's event perception since different time points likely lead

to different findings. Based on the results of this dissertation, two recommendations on the assessment of perceived event characteristics can be given:

1) Researchers should assess perceived event characteristics within the first weeks after the event occurrence as this initial period after an event occurrence seems to be particularly relevant (see Section 7.2.2).

2) Researchers should assess perceived event characteristics at multiple measurement occasions since changes in perceived event characteristics may be relevant to understand changes in important outcome variables such as subjective well-being (Chapter 6) or mental health (Brose et al., 2021).

However, the studies presented in this dissertation also show two potential limitations of the ECQ. First, as described in Chapter 3, some perceived event characteristics did not show strong measurement invariance across different event types. For example, perceived extraordinariness, predictability, and social status change were only weakly invariant across event types (i.e., intercepts of the items differed across events; Putnick & Bornstein, 2016). Furthermore, impact, valence, and external control did not even show configural measurement invariance across event types (i.e., the factor structure differed across events; Putnick & Bornstein, 2016). These findings could indicate that people experiencing different types of major life events differ in their understanding of the ECQ items, although this result has to be tested in other samples. Missing measurement invariance of the ECQ items adds another difficulty to research on the perception of major life events. For example, mean-level comparisons regarding the perception of different event types (e.g., Kritzler et al., 2022) are not valid if strong measurement invariance is not fulfilled (Putnick & Bornstein, 2016). To overcome this issue, a possible solution may be to develop and select items that assess the perception of major life events in a way that is invariant across event types as the robustness checks of Chapter 3 illustrated that not all items were non-invariant.

Second, although the ECQ provides a detailed understanding of people's subjective experience of a major life event (Luhmann et al., 2021), using only the ECQ to measure major life events seems to be not sufficient. For example, as illustrated in Chapter 2, there were significant interactions between perceived event characteristics and event types in predicting personality trait changes. Similarly, in the exploratory analyses of Chapter 3, the event type was significantly associated with personality trait changes controlled for the effects of perceived event characteristics. Together, these findings indicate that the event-

type variable is carrying relevant information on major life events beyond those captured in ECQ. Consequently, completely abandoning a typological approach to measure major life events (cf. Luhmann et al., 2021) cannot be recommended – at least not with the current version of the ECQ. However, it may be possible to modify the ECQ so that the information that is currently captured in the event-type variable becomes included in the ECQ. The event-type variable (e.g., with the values such as *death of a loved one*, *separation*, and *friendship dissolution*) describes what was experienced by the participant (i.e., the content of an event). Currently, characteristics describing the content of a major life event (i.e., what did participants experience) are not included in the ECQ because content dimensions were not discussed in literature on major life events (Luhmann et al., 2021). Not including content characteristics is an important difference between the ECQ and existing situation taxonomies, which include content characteristics such as sociality, adversity, or duty to dimensionally capture the content of a situation (e.g., Rauthmann et al., 2014). Thus, the question arises whether additionally incorporating content characteristics into the ECQ is useful to dimensionally assess the information that is currently captured in the event-type variable.

In summary, the ECQ is an important advancement for research on major life events as it allows to assess the subjective experience of a major life event in a psychometrically sound way (Luhmann et al., 2021). Thus, the ECQ helps to address the question why people differ in their reaction to major life events (Bleidorn et al., 2020; Jayawickreme et al., 2021; Luhmann et al., 2021). Ideally, the ECQ should be applied within the first weeks after the occurrence of a major life event and additionally at further measurement occasions of a study to assess changes in the event perception. However, the ECQ alone is (currently) not sufficient to understand major life events. Future research should strive to develop items that are invariant across event types and examine whether content characteristics should be included in the ECQ to obtain a more complete understanding of major life events.

7.3.2 *Study Design and Sample Requirements to Examine the Perception of Major Life Events*
The section on theoretical implications outlined some complexities in research on major life events (e.g., that effects may differ over time, across events, and across outcomes). Due to these complexities, Bleidorn et al. (2020) recently called for a paradigm shift in research on the associations between personality changes and environmental experiences. They proposed *Longitudinal Experience-Wide Associations Studies* as a framework to examine such

person-environment transactions. This framework builds on the study design requirements for research on major life event outlined in Section 1.2. Among other things (e.g., appropriate study designs to investigate the role of time that were already discussed in Section 7.2.2), Longitudinal Experience-Wide Association Studies should be characterized by (1) large samples to detect small effects, (2) diverse samples, (3) comprehensive assessments of the environment, and (4) attempts to strengthen causal inference. The studies included in this dissertation (and their limitations) allow conclusions on the relevance of these design requirements in research on the perception of major life events.

First, this dissertation illustrates the necessity of the recommendation to use large samples to detect small effects in research on the perception of major life events. It was a common theme of the empirical studies included in this dissertation that the effect sizes of perceived event characteristics to uncover individual differences in the reaction to major life events were *very small* or *small* (e.g., based on conventions by Funder & Ozer, 2019). For example, perceiving a major life event as 1.00 SD more positive than average was associated with a 0.02 SD change in agreeableness (Chapter 2), a 0.04 SD change in neuroticism (Chapter 2), a 0.05 SD change in affective well-being (Luhmann et al., 2021), and a 0.02 SD change in prosociality (Fassbender et al., 2022) over 3 months. Consequently, future research on the perception of major life events would require large samples to detect these effects with sufficient power. Furthermore, existing null findings regarding perceived event characteristics may at least partly be explained by a lack of power to detect such small effects (e.g., Chapter 3; but also, Dorfman et al., 2022; Fassbender et al., 2022). However, the question arises whether such small effect sizes are still practically relevant. To address this question, the conditions and mechanisms translating this statistical effect size into praxis need to be taken to account (Anvari et al., 2022). For perceived event characteristics, two mechanisms may accelerate the practical relevance of these small effects. As many people experience a range of different major life events throughout their life span (Bleidorn et al., 2018; Lüdtke et al., 2011; Tibubos et al., 2021), small effect sizes may become practically relevant as they can accumulate across many people and over the life span (Anvari et al., 2022). Furthermore, as perceived event characteristics seem to be associated with changes in personality traits, subjective well-being, and depression (see Chapter 2 and Chapter 4 as well as Luhmann et al., 2021; Schwaba et al., 2023; Vries et al., 2021), the observed effect

sizes may become relevant because changes in these outcome variables can trigger other downstream consequences (e.g., Bleidorn et al., 2019).

Second, the recommendation of Bleidorn and colleagues to use diverse samples points to an important limitation of the empirical studies included in this dissertation as they all relied on convenience samples recruited in Western countries. Furthermore, the scoping review presented in Chapter 4 illustrated that this limitation seems to be common in research on the perception of major life events as only 8% of the studies included in this review were conducted in non-Western countries. Thus, there is a need to diversify research on the perception of major life events. Just assuming that findings from Western countries generalize to all people ignores that most psychological phenomena seem to be impacted by cultural contexts (Henrich et al., 2010; Henrich et al., 2022). Testing whether findings from Western contexts apply to other cultural contexts as well allows for an evaluation of which aspects are human universals, and which are culturally specific (Henrich, 2021; van de Vijver, 2013). Regarding the perception of major life events, there are some reasons to assume that associations from Western countries might not generalize to other cultural contexts. For example, the normativity and frequency of major life events differs across cultural context which likely has implications on their perception (Church, 2016; Ngo & Le, 2007). Similarly, narratives about the own life story and experienced events seem to differ across cultures (McAdams, 2001; Wang & Leichtman, 2000).

Third, the recommendation of Bleidorn and colleagues to assess the environment comprehensively outlines the necessity to move beyond major life events. The present dissertation focused on the effects of major life events and individual differences in the reaction to major life events. However, other environmental features such as situations, daily events, and chronic stressors can have important implications for people's subjective well-being, personality traits, and mental health as well (Bleidorn et al., 2020; Luhmann et al., 2014; Wheaton et al., 2013). Furthermore, these different environmental experiences do not act in isolation, but they interact with each other (Cohen et al., 2019; Pillow et al., 1996; Wheaton et al., 2013). Thus, future research should aim for a comprehensive assessment of environmental experiences (including situations, daily events, chronic stressors, and major life events). Generally, this dissertation may be seen as one piece of this puzzle as it illustrates what a comprehensive assessment of one kind of environmental experiences (i.e., major life events) looks like. However, also new technological methods

such as mobile sensing are likely needed in future research as they can provide additional and (continuous) information on the environment without increasing participant burden (Harari et al., 2016; Harari et al., 2021).

Finally, the recommendation to strengthen causal inference highlights another important challenge in research on major life events. The empirical studies presented in this dissertation were based on observational, longitudinal datasets. Thus, they provided a better indication of the direction of effects than cross-sectional studies, but they cannot rule out the possibility that the observed effects are driven by unobserved confounding variables (Grosz et al., 2020). For example, the association between perceived valence and depression may be explained by pre-existing differences in other personal characteristics such as personality traits. However, as experimental studies are often not feasible in research on major life events (e.g., it would be unethically to assign people to the experience of certain events), other methods and strategies to strengthen causal inference are required (Bleidorn et al., 2020; Grosz et al., 2020). As one step into this direction, it has been recommended to spell out implicit causal assumptions existing in non-experimental research (Grosz et al., 2020). In line with this recommendation, Figure 7.1 outlined initial causal assumptions on the origins and relevance of perceived event characteristics based on the findings of this dissertation. These assumptions can and should be tested in future research. Apart from this, future research should use statistical procedures to strengthen causal inference (e.g., propensity score matching) and make use of natural experiments (Grosz et al., 2023; Luhmann et al., 2014).

In summary, the implications on study designs and samples of the studies included in this dissertation fit well to the framework of Longitudinal Experience-Wide Association Studies (Bleidorn et al., 2020). Generally, the research on the perception of major life events presented here represents one piece to gain a more complete understanding of person-environment transactions.

7.3.3   Statistical Approaches in Research on (the Perception of) Major Life Events

As a third part of the methodological recommendations, this dissertation allows conclusions regarding the relevance of robustness checks and two relatively new statistical methods (continuous time models and multilevel lasso regression).

First, the studies presented in this dissertation show the necessity of conducting robustness checks as the results on the perception of major life events differ across different analytical approaches. For instance, in Chapter 3, the results on moderators of personality trait changes differed between multilevel models with and without random slopes. Similarly, in the scoping review in Chapter 4, the use of different analytical methods and the inclusion of different covariates were identified as two reasons partly explaining the diverging results across studies. Finally, in Chapter 2, the results on the associations between perceived event characteristics and changes in agreeableness differed between the analytical models employed in the main analysis (a combination of latent change score models and multilevel models) and the models used in the exploratory analyses (multilevel models). Although the conclusion that different analytical approaches lead to different results is not new (e.g., Silberzahn et al., 2018; Wijngaards-de Meij et al., 2005), it is particularly important in research on the perception of major life events as small effects need to be detected reliably (see Section 7.3.2). Robustness checks or specification curve analyses (i.e., testing all valid model specifications for a certain research question in a systematic way; Simonsohn et al., 2020) can increase confidence in the obtained results.

Second, in this dissertation two relatively new statistical methods (continuous time models and multilevel lasso) were employed that might be used to address certain challenges in research on major life events. Continuous time models (as employed in Chapter 5) consider the temporal distance between measurement occasions and can help to identify the generating process of change (Driver & Voelkle, 2018; Voelkle et al., 2012). Consequently, this method allows to model how certain effects change over time (Voelkle et al., 2012; Voelkle et al., 2018). For example, in bivariate continuous time models, it is possible to uncover how cross-lagged and autoregressive effects change within the time frame of a study. Thus, continuous time models may be a suitable method to better understand the role of time in research on major life events (see Section 7.2.2; Voelkle et al., 2018). Furthermore, in Chapter 3, we used a multilevel lasso approach to deal with the situation that there were many effects to be tested and sample sizes were relatively low (Finch, 2018; Schelldorfer et al., 2011). Lasso estimation thereby belongs to a range of methods that have been developed in the last decades to deal with datasets of higher dimensionality (i.e., datasets where the number of variables approaches or exceeds the number of participants; James et al., 2021). For research on individual differences in the reaction to major life

events, these methods (e.g., lasso estimation, regression splines, or random forest; James et al., 2021) may become more important as single variables seem to have only weak effects. Thus, many variables should be tested simultaneously in a model to examine these individual differences in change (Bleidorn et al., 2020; van der Houwen et al., 2010). However, the studies included in this dissertation also show that more research on these relatively new methods may be needed as several convergence issues occurred and as applications of these methods to empirical data is still rare (Chapters 3 and 5).

Taken together, the studies presented in this dissertation illustrate that robustness checks should be routinely conducted in research on the perception of major life events. Furthermore, new statistical methods such as continuous time models could help to address challenges in research on (the perception of) major life events.

7.4   Practical Implications

The studies presented in this dissertation mainly addressed fundamental research questions. Although future research examining the translation of these findings to applied contexts is thus warranted, some first implications for public policy and psychotherapy can nonetheless be drawn.

7.4.1   Implications for Public Policy

As outlined in Section 1.3.4, people differ in their reaction to major life events (Blackie & Jayawickreme, 2022; Bleidorn et al., 2020; Jayawickreme et al., 2021; Luhmann et al., 2021). For example, after experiencing a negative life event some people show lasting declines in their subjective well-being whereas others do not (Lucas, 2007; Mancini et al., 2011). For public policy, it is of critical importance to understand why people differ in their reaction to major life events and who might be at risk for negative changes (e.g., a lasting decrease in their subjective well-being). Addressing these questions allows to allocate treatment resources and to provide targeted treatment or prevention offers.

The studies presented in this dissertation contribute to the understanding of why people differ in their reaction to major life events. Together, they indicate that individual differences in how people perceive major life events (Chapters 2, 3, and 4), how their perception changes over time (Chapter 6), and individual differences in preexisting personal characteristics (Chapters 3 and 4) at least partly explain why people change differently after major life events. For instance, people perceiving a major life event as

distressing, negative, and externally controlled seem to be at greater risk for an increase in their depressive symptoms and a decrease in their subjective well-being (Chapters 4 and 6; see also Luhmann et al., 2021). Thus, after for example a plant closure or a natural disaster, people who perceived these events in an unfavorable way could be invited to participate in a prevention measure to prevent unwanted changes in their mental health and subjective well-being. However, a careful empirical evaluation of such measures would be needed to detect potential negative effects (see results on one-session psychological debriefing; Rose et al., 2002)

7.4.2 *Implications for Psychotherapy*

Since major life events are important triggers of various mental disorders (e.g., Asselmann et al., 2015; Beards et al., 2013; Cohen et al., 2019), they are of central relevance for psychotherapy. In psychotherapeutic settings, not only the occurrence of major life events but also patients' perception of these events is routinely considered (Beck & Weishaar, 1989; Lorenzo-Luaces et al., 2015). For example, in cognitive-behavioral therapy, it is a common goal to alter patients' perception of negative events (e.g., by using cognitive bias modification trainings or cognitive restructuring; Lorenzo-Luaces et al., 2015; Woud & Hofmann, 2022). Thus, the general perspective on major life events put forth in this dissertation (i.e., assessing how people perceive major life events) is in line with this basic psychotherapeutic principle. The findings of this dissertation may (in the long run) help to further improve interventions addressing people's event perception.

First, this dissertation provides indications which perceived event characteristics may be particularly relevant for people's subjective well-being and mental health so that they could be targeted in psychotherapeutic interventions. For example, perceiving events as negative, distressing, and as a loss seems to be associated with changes in depressive symptoms (Chapter 4). Thus, these perceived event characteristics may be important candidates to be addressed in depression therapy.

Second, the ECQ could be a helpful tool for diagnostic purposes to understand how patients perceive a major life event and how their event perception changes during psychotherapy. However, before using this questionnaire in therapeutic settings, the ECQ possibly has to be modified since it was not developed and validated for an application in individual-level diagnostic (Luhmann et al., 2021). For example, individual-level diagnostic requires a

higher reliability of scales so that extended versions of the ECQ might be used in these settings (as longer scales typically have a higher reliability; Ebel, 1972; Moosbrugger & Kelava, 2012).

Third, the studies in this dissertation show that the dynamics between the perception of major life events and other variables (e.g., subjective well-being, personality traits, and depression) change over time (Chapters 2, 4, and 6). Thus, they highlight the relevance of adequately timed interventions as the effects of interventions targeting people's event perception may differ depending on the timing of these interventions (see also Currier et al., 2008). The optimal time point for an intervention likely depends on (1) the targeted outcome variable (e.g., depressive symptoms, subjective well-being, or personality traits) as different variables change on different time scales (Chapter 5; see also Anusic & Schimmack, 2016) and (2) on the experienced major life event as different life events lead to different change trajectories (e.g., Luhmann et al., 2012). Thus, better understanding the role of time in research on major life events (Section 7.2.2) is not only of central theoretical but also of central practical relevance.

In summary, the findings of this dissertation have implications for public policy (by providing indications on individual differences in the reaction to major life events) and psychotherapy (by shedding light on the relevance of the perception of major life events and the role of time).

7.5   General Conclusion and Directions for Future Research

In this dissertation, the recently developed taxonomy of perceived event characteristics by Luhmann et al. (2021) was applied. This taxonomy allows a dimensional assessment of the subjective perception of major life events. The studies included in this dissertation illustrated the utility of this dimensional approach to address important questions in research on major life events (e.g., individual differences in the reaction to these events). Furthermore, they provided information on basic properties of perceived event characteristics (e.g., their temporal stability and their nomological network). Based on these findings, four important avenues for future research on major life events can be identified:

(1) **Assess environmental experiences comprehensively**: Compared to simple occurrence-based approaches of assessing major life events (e.g., life event checklists), the assessment of perceived event characteristics provides a more

complete understanding of major life events. Thus, the ECQ can be one piece of a puzzle to gain a comprehensive understanding of people's environmental experiences. However, beyond major life events, future research additionally needs to include detailed assessments of other environmental experiences such as daily events, situations, and chronic stressors.

(2) **Examine individual differences in large-scale studies**: As illustrated in Figure 7.1, perceived event characteristics are relevant to explain individual differences in the reaction to major life events. However, other personal and environmental variables also contribute to these individual differences. As each variable likely explains only a small amount of variance, studies with large samples sizes, including a variety of different moderators, different outcomes, and different events are needed to gain a better understanding of these individual differences.

(3) **Consider the role of time:** Better understanding the time course of event-related changes is a major challenge in research on major life events. Therefore, studies comprising multiple measurement occasions with sufficiently short time lags between assessments over long time periods are needed. Furthermore, future research should explicitly examine differently scaled time variables in statistical models and compare results across constructs (i.e., comparative research approaches).

(4) **Examine event-outcome interactions:** Research on major life events is complicated by the fact that the effects may differ among events and outcomes. Existing theories and research usually either take an event-specific or an outcome-specific approach. For future research, these two perspectives need to be combined to understand the relevance of moderators and mediators of event-related changes for specific event-outcome combinations.

As illustrated by these avenues for future research, examining the effects of major life events is a challenging task. However, it is also an important task as major life events affect various important life outcomes. This dissertation demonstrated that considering how people perceive major life events is one piece of a puzzle to advance the understanding of major life events.

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8

Appendix

8. Appendix

8.1 List of Tables

8.2   List of Figures

8.3   Zusammenfassung in Deutscher Sprache

Bedeutende Lebensereignisse wie der Tod einer nahestehenden Person oder eine Trennung können zu Veränderungen des subjektiven Wohlbefindens, der psychischen Gesundheit und von Persönlichkeitseigenschaften führen. Die Auswirkungen bedeutender Lebensereignisse sind jedoch von Person zu Person unterschiedlich. Derzeit ist das Verständnis dieser individuellen Unterschiede dadurch eingeschränkt, dass in den meisten Studien bedeutende Lebensereignisse relativ einfach erfasst wurden (z. B. durch Checklisten). Diese Messungen konzentrieren sich auf die Frage, ob ein bedeutendes Lebensereignis aufgetreten ist oder nicht, aber sie liefern kein detailliertes Verständnis dafür, wie Personen das Ereignis subjektiv erlebt haben. Um dieser Limitation zu begegnen, wurde von verschiedenen Autoren vorgeschlagen zu untersuchen, wie Menschen bedeutende Lebensereignisse auf verschiedenen Dimensionen wahrnehmen (Erfassung von sogenannten *wahrgenommenen Ereignismerkmalen*).

In der vorliegenden Dissertation wurde eine kürzlich von Luhmann et al. (2021) entwickelte Taxonomie von neun wahrgenommenen Ereignismerkmalen verwendet, um zwei übergeordnete Forschungsfragen zu beantworten: (1) Können wahrgenommene Ereignismerkmale individuelle Unterschiede bei der Veränderung von Persönlichkeitseigenschaften und Depressionen nach bedeutenden Lebensereignissen erklären? (2) Verändert sich die Wahrnehmung von bedeutenden Lebensereignissen im Laufe der Zeit? Wenn ja, hängen solche Veränderungen in der Ereigniswahrnehmung mit Veränderungen des subjektiven Wohlbefindens zusammen?

Studie 1 untersuchte die Zusammenhänge zwischen der Wahrnehmung bedeutender Lebensereignisse und der Veränderung von Persönlichkeitseigenschaften mithilfe einer längsschnittlichen Onlineerhebung. Dabei wurden die Persönlichkeitseigenschaften junger Erwachsener zu fünf Messzeitpunkten über ein Jahr hinweg erfasst ($N = 433$). In dieser Studie wurden einige schwache Zusammenhänge zwischen wahrgenommenen Ereignismerkmalen und Veränderungen von Persönlichkeitseigenschaften festgestellt. Basierend auf diesen Ergebnissen wurden in Studie 2 Persönlichkeitsveränderungen bei Personen untersucht, die kürzlich ein negatives Lebensereignis wie den Tod einer nahestanden Menschen oder eine Trennung erlebt hatten ($N = 1,069$). Neben den wahrgenommenen Ereignismerkmalen wurden auch andere ereignisbezogene, persönliche und umweltbezogene Moderatoren untersucht, um individuelle Unterschiede

in den Persönlichkeitsveränderungen zu erklären. Allerdings wurden in den Hauptanalysen dieser Studie keine signifikanten Effekte gefunden, was darauf hindeutet, dass die untersuchten Moderatoren entweder nicht relevant sind, um Veränderungen in Persönlichkeitseigenschaften zu erklären, oder dass ihre Effekte (sehr) klein sind. Bei Studie 3 handelte es sich um ein Review zum Zusammenhang zwischen der Wahrnehmung bedeutender Lebensereignisse und Depressionen (276 Studien, $N_{gesamt} = 89,600$). Das Review zeigte verschiedene Limitationen und Forschungslücken in der vorhandenen Literatur zu diesem Thema. So wurde beispielsweise der Zusammenhang zwischen der Wahrnehmung bedeutender Lebensereignisse und Depressionen häufig nur in Studierendenstichproben und mit nicht validierten Fragebögen untersucht. Trotzdem konnten insgesamt überzeugende Belege für querschnittliche Zusammenhänge zwischen wahrgenommenen Ereignismerkmalen und Depressionen gefunden werden. Es sind jedoch weitere Längsschnittstudien erforderlich, um zu untersuchen, ob eine bestimmte Art der Wahrnehmung bedeutender Lebensereignisse das Auftreten von Depressionen längsschnittlich vorhersagen kann. In Studie 4 wurde dann die Frage adressiert, ob sich die wahrgenommenen Ereignismerkmale im Laufe der Zeit verändern. Diese Studie basierte auf einer Stichprobe junger Erwachsener, die ihre Persönlichkeitseigenschaften, ihr affektives Wohlbefinden und die wahrgenommenen Merkmale eines kürzlich erlebten bedeutenden Ereignisses zu fünf Messzeitpunkten über ein Jahr beurteilten ($N = 619$). Die Ergebnisse deuteten auf eine moderate Rangordnungsstabilität der wahrgenommenen Ereignismerkmale hin. Darüber hinaus wurden signifikante Mittelwertsveränderungen für zwei wahrgenommene Ereignismerkmale festgestellt: Ereignisse wurden im Laufe der Zeit als weniger außergewöhnlich und als stärker das eigene Weltbild verändernd wahrgenommen. Auf diesen Ergebnissen aufbauend wurde in Studie 5 schließlich die Frage untersucht, ob Veränderungen in der Wahrnehmung wichtiger Lebensereignisse mit Veränderungen des subjektiven Wohlbefindens zusammenhängen. In zwei Datensätzen ($N_{Studie1} = 619$; $N_{Studie2} = 691$) wurden verschiedene Zusammenhänge zwischen den Veränderungen in diesen Konstrukten festgestellt. Wurden Lebensereignisse beispielsweise mit der Zeit als stärker external kontrolliert und als stärker den sozialen Status bedrohend wahrgenommen, so hing dies mit einer Abnahme der Lebenszufriedenheit der Versuchspersonen zusammen.

Insgesamt verdeutlichen die fünf Studien dieser Dissertation, dass es wichtig ist zu untersuchen, wie Personen bedeutende Lebensereignisse wahrnehmen. So können wahrgenommene Ereignismerkmale als ein Puzzlestück für ein besseres Verständnis der Zusammenhänge zwischen Umwelterfahrungen und Veränderungen in wichtigen abhängigen Variablen gesehen werden. Darüber hinaus zeigt diese Dissertation, dass es wichtig ist die Rolle der Zeit bei der Untersuchung ereignisbezogener Veränderungen zu berücksichtigen, da sich die Wahrnehmung von bedeutenden Lebensereignisses im Laufe der Zeit ändern kann. Aufbauend auf diesen Erkenntnissen sollte künftige Forschung Umwelterfahrungen möglichst umfassend erheben, individuelle Unterschiede in der Reaktion auf bedeutende Lebensereignisse in groß angelegten Studien untersuchen und das Verständnis vom Zeitverlauf von ereignisbezogenen Veränderungen verbessern (z.B. durch die Nutzung von längsschnittlichen Studien mit kurzem Zeitabstand zwischen den Messzeitpunkten).

8.4 Curriculum Vitae

M. Sc. Peter Haehner

Personal Data

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Academic Positions

Since 10/2020	Research associate at the Psychological Methods Lab (Prof. Dr. Maike Luhmann), Ruhr-University Bochum, Germany
05/2022 - 07/2022	Visiting researcher at the Lab of Individual Differences and Assessment (Prof. Dr. Christopher Hopwood and Prof. Dr. Wiebke Bleidorn), University of Zurich, Switzerland
09/2018 - 12/2019	Lecturer for statistics at the University of Applied Sciences for Public Administration NRW, Germany
04/2018 - 09/2020	Research assistant at the Psychological Methods Lab, Ruhr-University Bochum, Germany
10/2016 - 08/2020	Teaching assistant for statistics, Ruhr-University Bochum, Germany
05/2016 - 03/2018	Research assistant at the Developmental Psychology Lab, Ruhr-University Bochum, Germany

Education

Since 01/2023	Training as psychotherapist, Academy for Behavioral Therapy Cologne, Germany
Since 10/2020	PhD Student at the Psychological Methods Lab, supervised by Prof. Dr. Maike Luhmann and Jun.-Prof. Dr. Marcella Woud, Ruhr-University Bochum, Germany
09/2020	Master of Science in Psychology with focus Clinical Psychology, Ruhr-University Bochum, Germany
09/2018	Bachelor of Science in Psychology, Ruhr-University Bochum, Germany

Awards, Grants, and Fellowships

09/2022	Research starting grant of the Institute for Health and Development (*Assessment of interpretation bias and perception of daily events*), Ruhr-University Bochum (1459€)
07/2022	Poster award (2nd Prize) at the European Conference of Personality (ECP20) in Madrid (300€)
12/2021	Travel grant to European Conference of Personality (ECP20) in Madrid and to the University of Zurich (7200€)
06/2020	Teaching assistant award by the Department of Psychology, Ruhr-University Bochum
06/2019	Teaching assistant award by the Department of Psychology, Ruhr-University Bochum
02/2018 - 08/2020	German National Academic Foundation Fellow (Studienstiftung des Deutschen Volkes)

Publications (Peer-Reviewed)

Haehner, P., Bleidorn, W., & Hopwood, C. J. (2023). Examining individual differences in personality trait changes after negative life events. *European Journal of Personality*. Advance online publication. https://doi.org/10.1177/08902070231156840

Haehner, P., Pfeifer, L. S., Fassbender, I., & Luhmann, M. (2023). Are changes in the perception of major life events associated with changes in subjective well-being? *Journal of Research in Personality, 102,* 104321. https://doi.org/10.1016/j.jrp.2022.104321

Fassbender, I., **Haehner, P.,** Buecker, S., & Luhmann, M. (2022). Perceived characteristics of life events—Short-term changes in prosociality and empathy? *European Journal of Personality, 36*(4), 529–542. https://doi.org/10.1177/08902070211031762

Haehner, P., Kritzler, S., Fassbender, I., & Luhmann, M. (2022). Stability and change of perceived characteristics of major life events. *Journal of Personality and Social Psychology, 122*(6), 1098-1116. https://doi.org/10.1037/pspp0000394

Haehner, P., Rakhshani, A., Fassbender, I., Lucas, R. E., Donnellan, M. B., & Luhmann, M. (2022). Perception of major life events and personality trait change. *European Journal of Personality*. Advance online publication. https://doi.org/10.1177/08902070221107973

Luhmann, M., Fassbender, I., Alcock, M., & **Haehner, P.** (2021). A dimensional taxonomy of perceived characteristics of major life events. *Journal of Personality and Social Psychology, 121*(3), 633–668. https://doi.org/10.1037/pspp0000291

Publications (Preprints)

Busch, J., **Haehner, P.**, Spierling S. K., Leyendecker, B. (2022). *Socio-emotional adjustment throughout the COVID-19 pandemic: A longitudinal study of elementary school-aged children from low-income neighborhoods.* PsyArXiv. https://doi.org/10.31234/osf.io/x5t78

Haehner, P., Pfeifer, L. S., Jahre, L. M., Luhmann, M., Wolf, O. T., Frach, L. (2022). *Validation of a German version of the Stress Overload Scale and comparison of different time frames in the instructions.* PsyArXiv. https://doi.org/10.31234/osf.io/2nyw4

Haehner, P., Würtz, F., Kritzler, S., Kunna, M., Luhmann, M., Woud, M. W. (2023). *The relationship between the perception of major life events and depression in adulthood: A scoping review.* PsyArXiv. https://doi.org/10.31234/osf.io/p3qzc

Kritzler, S., **Haehner, P.**, Krasko, J., Buecker, S. (2022). *How do you cook empathically? The (ir)relevance of personality states in everyday situations.* PsyArXiv. https://doi.org/10.31234/osf.io/v3e7n

Research Interests

- Life events
- Personality development
- Depression
- Subjective well-being
- Longitudinal data analysis

Organized Symposia and Invited Talks

Haehner, P. (2022, October). *Why do people react differently to negative life events?* Tilburg University, Netherlands (online).

Fliedner, K. & **Haehner, P.** (2022, September). *New developments in the measurement of contexts: Situations and major life events.* Symposium at the 52nd Congress of the German Psychological Society (DGPs), Hildesheim, Germany.

Conference Presentations

Haehner, P., Bleidorn, W., & Hopwood, C. J. (2023, February). *Examining individual differences in personality trait changes after negative life events.* Research spotlight presented at the 24th Annual Convention of the Society for Personality and Social Psychology (SPSP), Atlanta, US (online).

Busch, J., **Haehner, P.**, Spierling S. K., Leyendecker, B. (2022, September). *Socio-emotional adjustment throughout the COVID-19 pandemic: A longitudinal study of elementary school-aged children from low-income neighborhoods.* Talk presented at the 52nd Congress of the German Psychological Society (DGPs), Hildesheim, Germany.

Haehner, P., Kritzler, S., Luhmann, M. (2022, September). *Individual differences in event-related changes in subjective well-being*. Talk presented at the 52nd Congress of the German Psychological Society (DGPs), Hildesheim, Germany.

Haehner, P., Fassbender, I., Kritzler, S., Pfeifer, L. S., & Luhmann, M. (2022, July). *Changes in the perception of major life events*. Talk presented at the 20th European Conference of Personality (ECP), Madrid, Spain.

Haehner, P., Rakhshani, A., Fassbender, I., Lucas, R. E., Donnellan, M. B., & Luhmann, M. (2022, July). *Perception of major life events and personality trait change*. Poster presented at the 20th European Conference of Personality (ECP), Madrid, Spain.

Kritzler, S., **Haehner, P.**, Krasko, J., & Buecker, S. (2022, July). *How do you cook empathically? The (ir)relevance of personality states in everyday life*. Talk presented at the 20th European Conference of Personality (ECP), Madrid, Spain.

Haehner, P., Kritzler, S., & Luhmann, M. (2022, June). *Identifying robust predictors of event-related changes in subjective well-being using specification curve analysis*. Poster presented at the 1st Conference of the Institute for Health and Development, Bochum, Germany.

Haehner, P., Kritzler, S., Fassbender, I., & Luhmann, M. (2022, February). *Stability and change of perceived characteristics of major life events*. Poster presented at the 23rd Annual Convention of the Society for Personality and Social Psychology (SPSP), San Francisco, US (online).

Haehner, P., Kritzler, S., & Luhmann, M. (2022, February). *Using perceived event characteristics and objective event characteristics to predict changes in subjective well-being*. Talk presented at the Dynamics in Personality Development Preconference of the 23rd Annual Convention of the Society for Personality and Social Psychology (SPSP), San Francisco, US (online).

Kritzler, S., **Haehner, P.**, Krasko, J., & Buecker, S. (2022, February). *How do you cook empathically? The (ir)relevance of personality states in everyday life*. Talk presented at the Dynamics in Personality Development Preconference of the 23rd Annual Convention of the Society for Personality and Social Psychology (SPSP), San Francisco, US (online).

Haehner, P., Kritzler, S., Fassbender, I., & Luhmann, M. (2021, September). *Stability and change of perceived characteristics of major life events*. Talk presented at the 16th Biennial Conference of the German Psychological Society – Personality Psychology and Psychological Diagnostics Section (DPPD), Ulm, Germany (online).

Haehner, P., Kritzler, S., Fassbender, I., & Luhmann, M. (2021, July). *Stability and change of perceived characteristics of major life events*. Poster presented at the 7th Biennial Meeting of the Association for Research in Personality (ARP), US (online).

Teaching

2022	Seminar "Personality development in adulthood" (Bachelor level), Ruhr-University Bochum, Germany
2022	Seminar "Preparing a Bachelor thesis" (Bachelor level), Ruhr-University Bochum, Germany
2022	Seminar "Statistics and applied data analyses 1" (Bachelor level), Ruhr-University Bochum, Germany
2021	Seminar "Statistical analyses using R" (Master level), Ruhr-University Bochum, Germany
2021	Seminar "Statistics and applied data analyses 3" (Bachelor level), Ruhr-University Bochum, Germany
2021	Seminar "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2020	Seminar "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2020	Training "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2019	Training "Statistics and applied data analyses 1" (Bachelor level), Ruhr-University Bochum, Germany
2019	Lecture "Statistics" (Bachelor level), University of Applied Sciences for Public Administration NRW, Germany
2019	Training "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2018	Training "Statistics and applied data analyses 1" (Bachelor level), Ruhr-University Bochum, Germany
2018	Lecture "Statistics" (Bachelor level), University of Applied Sciences for Public Administration NRW, Germany
2018	Training "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2017	Training "Statistics and applied data analyses 1" (Bachelor level), Ruhr-University Bochum, Germany
2017	Training "Statistics and applied data analyses 2" (Bachelor level), Ruhr-University Bochum, Germany
2016	Training "Statistics and applied data analyses 1" (Bachelor level), Ruhr-University Bochum, Germany

Workshops and Trainings

09/2022	Workshop "Introduction to *formR*" (1 day), Hildesheim, Germany
07/2022	Workshop "R Applied to Personality Research" (1 day), Madrid, Spain
02/2022	Workshop "Introduction to network analysis" (2 days), Bochum, Germany
11/2021	Workshop "Presentation skills" (1 day), Bochum, Germany
07/2021	Workshop for PhD students of the Personality Psychology and Psychological Diagnostics Section of the German Psychological Society (3 days), online
07/2020	Training for conducting structured clinical interviews, Bochum, Germany

Ad-hoc Reviewer

Applied Psychology: Health and Well-Being

BMC Psychiatry

European Journal of Social Psychology

Health Psychology Open

Journal of Personality and Social Psychology

Personality and Individual Differences

Psychological Test Adaptation and Development

Psychology and Aging

Scientific Reports

Social Science and Medicine

Memberships of Scientific Societies

Association for Psychological Science (APS)

Association for Research in Personality (ARP)

European Association of Personality Psychology (EAPP)

German Psychological Society (Deutsche Gesellschaft für Psychologie, DGPs)

Society for Personality and Social Psychology (SPSP)

Service

08/2022 - 01/2023	Member of the Appeal Committee Personality Psychology, Ruhr-University Bochum, Germany
07/2021 - 11/2021	Substitute member of the Appeal Committee Neural Data Science, Ruhr-University Bochum, Germany
08/2018 - 09/2019	Substitute member of the Senate of the Ruhr-University Bochum, Germany
12/2017 - 09/2020	Member of the Student Parliament of the Ruhr-University Bochum, Germany

Mentoring Experiences

2022   Supervision of two research interns

Supervision of one Bachelor thesis:

- Orthorexia Nervosa - An exploratory study of central and bridge symptoms using network models

2021   Supervision of three research interns

Supervision of three Bachelor theses:

- Perceived valence and impact of the life event "entering a relationship" in relation to loneliness and life satisfaction
- Perceived valence and emotional significance of the life event "entering a relationship" in relation to self-esteem
- Anxiety and depression in relation to the perception of and the age at the parental separation

8.5   Eidesstattliche Erklärung

Ich versichere an Eides statt, dass ich die eingereichte Dissertation selbstständig und ohne unzulässige fremde Hilfe verfasst, andere als die in ihr angegebene Literatur nicht benutzt und dass ich alle ganz oder annähernd übernommenen Textstellen sowie verwendete Grafiken, Tabellen und Auswertungsprogramme kenntlich gemacht habe. Außerdem versichere ich, dass ich keine kommerzielle Vermittlung oder Beratung in Anspruch genommen habe und dass digitale Abbildungen nur die originalen Daten enthalten oder alternativ eine eindeutige Dokumentation von Art und Umfang der inhaltsverändernden Bildbearbeitung enthalten. Die Abhandlung wurde in dieser oder ähnlicher Form noch nicht anderweitig als Promotionsleistung vorgelegt und bewertet. Ich erkläre außerdem, dass die vorgelegte elektronische mit der schriftlichen Version der Dissertation übereinstimmt und dass es sich bei der eingereichten Dissertation um vier in Wort und Bild völlig übereinstimmende Exemplare handelt.

Bochum, den 20.02.2023   _____

                                                              Peter Hähner