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Selection or Socialization?
A Propensity Score Matched Study
of Personality and Life Events

by

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ABSTRACT

Socialization or selection? A propensity score matched study of personality and life events
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Across the lifespan, personality changes in normative ways, but the source of such change remains ambiguous. Life events may be one impetus of such change, but strong selection effects into such events makes it unclear whether such change is driven by already existing differences (selection) between people or socialization following life events. In a preregistered study, we test socialization and selection effects of the Big 5 and life events using a large (N = 19,627) representative sample of Germans and 12 life events (e.g. marriage, retirement) from the GSOEP. Using propensity score matching and Bayesian multilevel growth curve models, we demonstrate variability in selection and socialization effects of different traits and life events. When controlling for selection bias, nearly all socialization effects following life events disappear. We conclude by discussing the implications of the absence of life event socialization and emphasize the importance of studying selection effects.

1. Introduction

Personality traits are relatively stable, dispositional patterns that differentiate people from one another (Roberts, Wood, & Caspi, 2008). Despite their stability, personality traits show considerable change across the course of the lifespan. Much research has examined how and why personality changes, including how much change is expected (Donnellan & Lucas, 2008; e.g. Roberts, Walton, & Viechtbauer, 2006; Soto, John, Gosling, & Potter, 2011), when change occurs (Roberts & Mroczek, 2008; Robins, Fraley, Roberts, & Trzesniewski, 2001), and whether change is due to normative maturation (Roberts et al., 2006) or social roles (Lodi-Smith & Roberts, 2007; Roberts & Wood, 2006) and life experiences (Lüdtke, Roberts, Trautwein, & Nagy, 2011; Specht, Egloff, & Schmukle, 2011).

Despite evidence that roles and experience lead to changes in personality, most studies fail to disentangle how existing individual differences may confound observed change in personality traits (Jackson, Thoemmes, Jonkmann, Lüdtke, & Trautwein, 2012; van Scheppingen et al., 2016). For example, more Conscientious people are more to be successful at work (deemed selection; e.g. Barrick, Mount, & Judge, 2001), which is, in turn, associated with increases in Conscientiousness (deemed socialization; e.g. Roberts, Caspi, & Moffitt, 2003). Traditional methods for examining these selection and socialization effects cannot disentangle these two processes, which may explain why evidence for personality change following life events (i.e. socialization effects) has been mixed. In other words, people who experience these events may differ from those who do not in important ways that may also influence change that follows the event.

In the present study, we examine whether the experience of 12 life events that occur throughout the lifespan result in socialization effects of the Big 5 independently of selection effects. Previous work (Specht et al., 2011) has examined selection into and socialization of life events on the Big 5 using the same sample, but the present study (1) replicates past work examining socialization effects in the German Socioeconmic Panel Study (GSOEP) using an additional waves of personality data, (2) tests whether selection effects persist after accounting for background characteristics, and (3) investigates whether socialization exists after accounting for selection bias.

1.1 Selection Effects

Personality is reliable predictor of a number of outcomes, including major life events, such as marriage (Kelly & Conley, 1987; Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2010; Specht et al., 2011), life expectancy (Jackson, Connolly, Garrison, Leveille, & Connolly, 2015; Jokela et al., 2013; Martin, Friedman, & Schwartz, 2007; Turiano, Chapman, Gruenewald, & Mroczek, 2015), and health (Hampson, 2012; Weston, Hill, & Jackson, 2015). More Extraverted people are more likely to move in with a partner (Specht et al., 2011), to have children (van Scheppingen et al., 2016), and to enter into romantic relationships (Wagner, Becker, Lüdtke, & Trautwein, 2015), while more Agreeable people are more likely to become unemployed and less likely to separate from a partner (Specht et al., 2011) or to enter into military service (Jackson et al., 2012). Conscientiousness and Neuroticism, in particular, have been linked to health, both cross-sectionally (e.g. Hampson, 2012) and longitudinally (e.g. Weston et al., 2015). In one study, for example, Conscientiousness predicted the onset of high blood pressure, diabetes, stroke, and arthritis, with Conscientiousness serving as a protective factor against each of these health conditions (Weston et al., 2015).

But there are a number of reasons to interpret selection effects of personality and life

events and experiences with caution. First, most studies examine cross-sectional group differences among those who have or have not experienced events, making it impossible to tease apart whether personality predicts life events or life events predict personality (i.e. reverse causality). For example, people who are more Extraverted are more likely to have social and enterprising occupational interests (Barrick et al., 2001; Larson, Rottinghaus, & Borgen, 2002), have fewer cardiovascular problems (Miller, Smith, Turner, Guijarro, & Hallet, 1996), and to start romantic relationships (Wagner et al., 2015). But there is longitudinal evidence that work (e.g. Lüdtke et al., 2011), chronic illness (e.g. Mueller, Wagner, & Gerstorf, 2017), and romantic relationships (e.g. Mund & Neyer, 2014; Neyer, Mund, Zimmermann, & Wrzus, 2014) may influence personality, which calls into question whether personality influences who experiences life events or vice versa. Without understanding the direction of the relationship, reverse causality remains a possibility and personality-life event relationships are not selection effects (i.e. personality predicts experiences and is not simply associated with them).

Second, and perhaps most critically, almost no studies account for baseline factors that may influence both personality and the likelihood of experiencing an event. Personality has been linked to a number of demographic and background factors, including socioeconomic status (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007), cognitive ability (e.g. Moutafi, Furnham, & Paltiel, 2005), age (e.g. Donnellan & Lucas, 2008; Soto et al., 2011), parental education (e.g. Sutin, Luchetti, Stephan, Robins, & Terracciano, 2017), marital satisfaction (e.g. Kelly & Conley, 1987; Malouff et al., 2010), health (e.g. Hampson, 2012; Roberts et al., 2007), and geographic region (e.g. Rentfrow, Jokela, & Lamb, 2015), among others. Although most studies have controlled for a small number of these background characteristics, particularly age and gender (e.g. Specht et al., 2011), this does not account for selection bias based on other characteristics that personality has been linked to. Indeed, in the small number of studies that have accounted for broader ranges of background characteristics (Jackson et al., 2012; Nieß & Zacher, 2015; van Scheppingen et

al., 2016; Wagner et al., 2015), personality-related selection effects have been much more limited. In one study, for example, single young adults were less extraverted and had lower self-esteem than young adults who entered into romantic relationships (Wagner et al., 2015). After accounting for selection bias through matching, single young adults had higher mean self-esteem than those in relationships. In other words, matching individuals on background characteristics can greatly impact personality selection effects on life events. Without matching, selection effects that are seemingly driven by personality may be driven by the direct or indirect influence of other factors.

In the present study, we address these concerns by examining selection effects (1) in a broad array of life events (2) longitudinally (3) while accounting for more than 50 background characteristics. Doing so will allow us to more closely approximate personality's unique role in predicting relatively common life experiences and events, which we argue will push research toward better understanding the mechanisms through which personality influences the life course.

1.2 Socialization Effects

Normative change across the life course, including increases in Agreeableness, Conscientiousness, and Emotional Stability, has been termed "The Maturity Principle" because higher levels of these traits are associated with more positive life outcomes (Roberts et al., 2006). But why normative change occurs is not well understood. There is a considerable body of work suggesting that experiences throughout the life course underscore personality change (Jackson et al., 2012; Lüdtke et al., 2011; Schwaba, Luhmann, Denissen, Chung, & Bleidorn, 2017; Specht et al., 2011; van Scheppingen et al., 2016). Life events linked to personality change are quite heterogeneous, from common life events, like getting a first job (Lüdtke et al., 2011; Specht et al., 2011), to rarer events, like incarceration (Bollich, Beck, Hill, & Jackson, 2018). For example, starting a new job has

been linked increases in Neuroticism (Lüdtke et al., 2011), Openness (Specht et al., 2011), and Conscientiousness (Lüdtke et al., 2011; Specht et al., 2011), and incarceration in adolescence has been linked to increases in impulsivity (Bollich et al., 2018).

However, there are number of limitations to current work on the relationship between life events and personality trait change. First, much of the evidence of personality change following life events is inconclusive. For example, starting a relationship has been associated with increases in Emotional Stability and Extraversion in some studies (Neyer & Lehnart, 2007) but not others (Lüdtke et al., 2011). Moreover, although increases in Conscientiousness are consistently associated with starting a job (George, Helson, & John, 2011; Lüdtke et al., 2011; Specht et al., 2011), it is inconsistently associated with increases in Neuroticism in some (Lüdtke et al., 2011) but not other (Specht et al., 2011) studies. Finally, decreases in Conscientiousness following retirement (Specht et al., 2011) have not been found in other studies (Schwaba & Bleidorn, 2018).

Second, a bulk of the work on personality change and life events uses coarse measures of life events that simply demarcate the presence or absence of an event. Thus, the observation that life events that are associated with personality implies that change occurs in a top-down fashion, such that an event leads to immediate personality change that is reflected in the manifestation of personality in everyday life. But this ignores the influence of other background characteristics and experiences that may influence the likelihood of experiencing an event, one's response to that event, and any concomitant changes of experiencing an event (Bonanno, 2004).

Indeed, personality change following life events has been linked to many of the same events that personality prospectively predicts, obfuscating whether events do change personality in a top-down fashion or whether existing personality or background differences are responsible. In other words, selection effects of personality on life events confound inferences about socialization effects of them, and personality predicts how people respond to life events and role changes as well the experience of them. In the domain of health, for

example, higher Neuroticism predicts the onset of high blood pressure, lung disease, heart conditions, and arthritis. But personality also predicts how people respond to health events in both experimental (Weston & Jackson, 2016) and longitudinal studies (Turiano, Hill, Roberts, Spiro III, & Mroczek, 2012; Weston & Jackson, 2015). In a longitudinal study of older adults from the Health and Retirement Study, for example, a combination of high Neuroticism and high Conscientiousness predicted less smoking after diagnoses of a chronic illness, such as heart disease or lung disease (Weston & Jackson, 2015). In other words, so-called "healthy Neuroticism" was protective against negative health behaviors after the onset of disease that is predicted by some of the same traits that predict the event's onset – health events did not disrupt the relationship between personality and health behavior. In an experimental demonstration, Conscientiousness predicted more active forms of coping (e.g. seeking social support and changing behaviors) following health news (Weston & Jackson, 2016). Such prospective personality-health behavior relationships suggest that personality change following life events is transactional – their relationship does not begin with an event nor does it stop following one. Selection effects are persistent and influential. Thus, it is critical to control for selection bias in studying socialization effects of life events on personality in order to ensure that socialization effects do not reflect pre-existing individual differences that influence changes in personality.

In addition, it is important to consider the patterns of change that are observed. Change in personality has been related to mortality (Turiano et al., 2011), self-rated health (Mroczek & Spiro III, 2003), and life satisfaction (Mroczek & Spiro III, 2005). Thus, different patterns of change might have differentially positive and negative long-term impacts on individuals' lives, which makes it important to demarcate different patterns of change across life events.

When accounting for baseline differences in personality, we posit at least four different patterns of how life events might influence personality change (the slopes of individuals; see Figure 1.1).

1.2.1 Normative maturation

Once accounting for baseline characteristics, people may experience similar developmental trajectories regardless of whether they experienced a life event (i.e., no group differences in slopes). Evidence for this comes from longitudinal studies of the transition to parenthood (van Scheppingen et al., 2016) and military training (Jackson et al., 2012), showing minimal change in the Big 5 among people who did or did not experience these events.

1.2.2 Accelerated maturation

People who experience a life event may show steeper positive changes in personality than those who do not, regardless of whether they had baseline advantages over those who did not. This would provide evidence for the importance of social roles – those who take on roles sooner show change that resembles normative change but earlier in the life course. Evidence for this comes from cross-cultural research (Bleidorn et al., 2013) demonstrating that normative maturation was accelerated in countries in which work and family responsibilities were taken on sooner. Such change could have positive implications for a number of positive outcomes that are associated with higher levels of a trait, such as health (Hampson, 2012; Roberts et al., 2007; Weston et al., 2015) and longevity (Jackson et al., 2015; Jokela et al., 2013; Martin et al., 2007; Turiano et al., 2015).

1.2.3 Arrested development

People who experience a life event will show no change in personality, while those who did not will experience normative patterns of change. Evidence for arrested development comes from studies of incarceration in adolescence suggesting that adolescents who are incarcerated show minimal decreases in impulsivity relative to those who were not incarcerated (Bollich et al., 2018). Individuals who experience arrested development may be

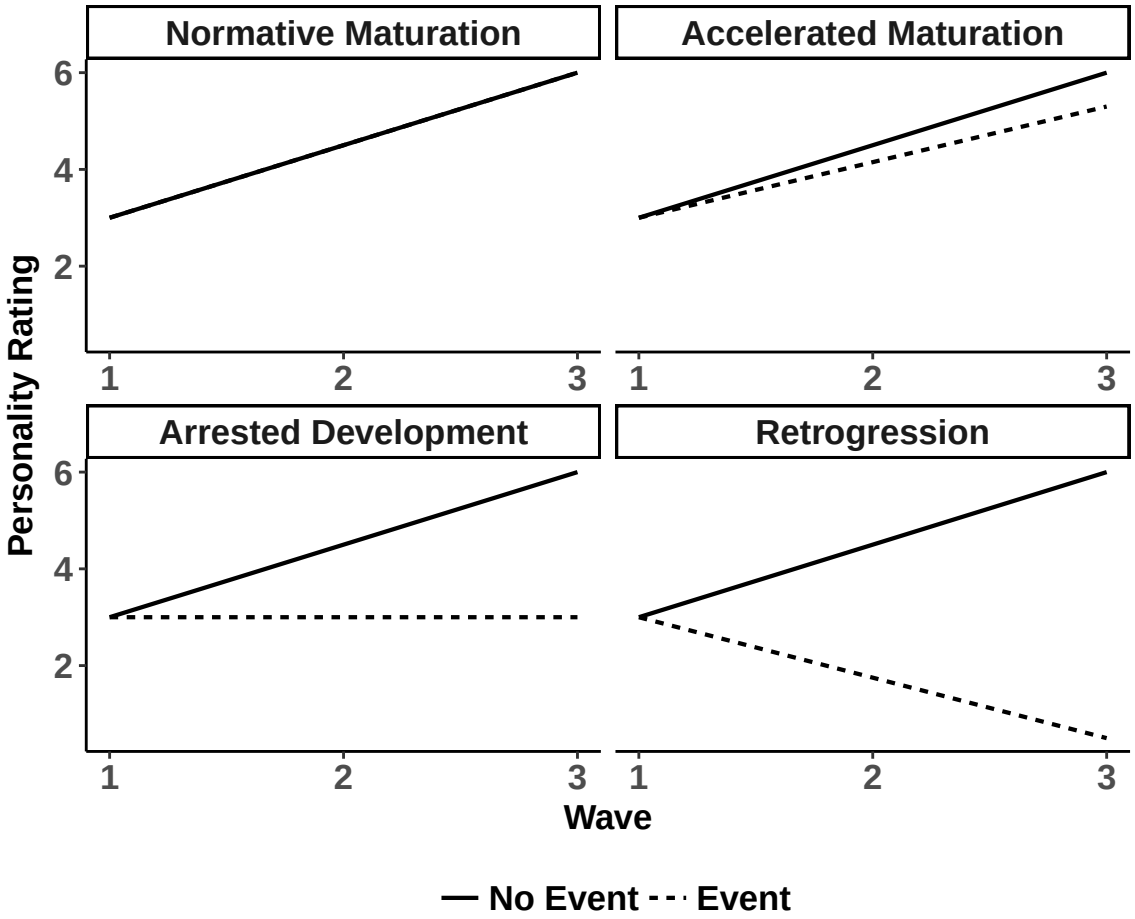

Figure 1.1: Hypothesized patterns of mean-level personality change following life events.

less likely to experience positive outcomes that are associated with higher levels of a trait.

1.2.4 Retrogression

Individuals who experience a life event will show non-normative declines in socially desirable personality traits, regardless of their baseline standing on a trait. Evidence for retrogression again comes from a longitudinal study of military training, in which individuals who joined the military decreased in Agreeableness after training, and such decreases persisted even after leaving the military (Jackson et al., 2012). Individuals who exhibit retrogression may be most vulnerable to negative impacts of personality change on later outcomes, given that lower levels of several traits are associated with negative health and social factors.

Given that life events cannot be experimentally manipulated and subjective evaluations of life events are often unavailable, research examining life events and personality change must use alternative methods to improve upon previous work. Given that personality both predicts who experiences specific events (e.g. Neyer & Lehnart, 2007; Specht et al., 2011) as well as behavioral responses to them (Turiano et al., 2012; Weston & Jackson, 2015, 2016), teasing apart these selection and socialization effects using propensity score matching may partially approximate teasing apart unique responses to events from their objective experience.

1.3 Psychological Processes of Personality Change

What life events are important for personality development? Social investment theory (SIT; Lodi-Smith & Roberts, 2007; Roberts & Wood, 2006) offered an early description of these personality-life event transactions and an alternative to top-down change. According to SIT, investment in social institutions is the primary vehicle through which people take on and invest in new roles. To the extent that a life event, like a chronic illness, changed one's social role, personality would be expected to change. It is only through an investment in a role that change will occur (Lodi-Smith & Roberts, 2007). For example, beginning starting a first job is likely to come with increased responsibilities and different constraints on an individuals' time in order to fulfill the role of an employee, while an internal promotion within a job may result in minimal role change and is less likely to impact personality. Indeed, greater investment in social roles is associated with higher Agreeableness, Conscientiousness, and Emotional Stability (Lodi-Smith & Roberts, 2007). Additional support for SIT comes from the observations of normative, or age-related, changes, both longitudinally (Roberts et al., 2006) and cross-sectionally (Beck, Condon, & Jackson, 2018; Soto et al., 2011; Specht et al., 2011). Moreover, longitudinal trait changes correlate with longitudinal state changes in personality (Beck & Jackson, 2018b), and

periods of change mirror periods in the lifespan in which young adults take on new social roles, such as starting a first job, beginning a relationship, or having children (Bleidorn et al., 2013).

Social investment theory has a number of shortcomings. Most notably, it fails to account for life events, such as incarceration (Bollich et al., 2018), that involve role changes individuals are unlikely to invest in. Building on these shortcomings, the TESSERA framework posits more general mechanisms for the processes through which life events and/or social roles change personality (Wrzus & Roberts, 2017). The TESSERA is a bottom-up, rather than top-down, perspective on personality change. In other words, short-term states and processes repeated over time accumulate to persistent, long-term change. The short-term processes include sequences of *T*riggering situations, *E*xpectancies, *S*tates/*S*tate *E*xpression, and *Re*A*c*tions (Wrzus & Roberts, 2017). From this perspective, life events, such as marriage and divorce, are triggering situations that change motivations (*E*xpectancy) that guide which *S*tates (thoughts, feelings, and behavior) follow a *T*riggering situation. *S*tates elicit responses from oneself, others, and the broader context that reinforce the link between the *T*riggering situation and *S*tate *E*xpression, making the expression of that state more likely in the future. This creates a cycle in which states are repeatedly expressed and reinforced. In one demonstration of the importance of short term processes in socialization and selection, goals predicted which majors incoming college students would select into, and majors predicted goal change (Hill et al., 2016) although goals were a stronger predictor of major than vice versa. Thus, lower-level processes, like goals, may be important factors to consider in examining socialization and selection effects between personality and life events.

Given the presence of both selection effects (e.g. Specht et al., 2011; Wagner et al., 2015; Weston et al., 2015) and reciprocal processes in personality development (e.g. Bollich et al., 2018; Lüdtke et al., 2011; Schwaba & Bleidorn, 2018; Specht et al., 2011), it is clear that people select into life events and roles that align with their personality characteristics.

For example, Conscientiousness predicts job attainment and success (Judge, Higgins, Thoresen, & Barrick, 1999; Roberts, Jackson, Duckworth, & Von Culin, 2011). These achievements are likely to come with substantial challenges, which Conscientious people, who are willing to work longer hours and persist in the face of failure (Jackson et al., 2010), are ready to meet, which may make them more Conscientious and lead to further advancement. The relationship between personality and life events is cyclical, which highlights a key issue in the examination of personality change. If people select into life events that also appear to change them, how do we tease apart change that may be due existing personality differences that bring about an event (selection) from change that is due purely to the event (socialization)?

Because individuals cannot be randomly assigned to encounter life events, a limited body of research has addressed this question using propensity score matching to equate individuals on a number of theoretically meaningful background characteristics (see Bollich et al., 2018; Jackson et al., 2012; Schwaba & Bleidorn, 2018; van Scheppingen et al., 2016; Wagner et al., 2015 for exceptions). Studies accounting for selection bias sometimes show fewer socialization effects. For example, in unmatched samples, women who become parents increase less in Conscientiousness than non-parents, and men who become parents decrease more in Extraversion than non-parents (van Scheppingen et al., 2016). Both of these effects disappear when matched samples are used. In another demonstration, incarcerated youth increased in sensation-seeking and impulsivity and decreased in self-esteem relative to non-incarcerated adolescents, but only socialization effects of incarceration on impulsivity persist after groups are equated (Bollich et al., 2018). However, there is also evidence that socialization effects persist when accounting for selection effects. Relationship experience moderates change in Extraversion and Neuroticism both with (Wagner et al., 2015) and without (Neyer & Lehnart, 2007) matching.

1.4 The Present Study

Together, the aforementioned evidence suggests that socialization and selection effects are not independent – that is, baseline differences may masquerade as socialization or selection effects of a personality trait, when in fact, these effects are explained by other variables. However, it also suggests that some socialization effects persist when controlling for selection effects. Given the large number of events we are examining and somewhat limited conclusive evidence of their influence on personality, we proposed four possibilities – normative development, arrested development, retrogression, and accelerated maturation – for how life events may affect personality change (see above).

We are atheoretical about our predictions for differences among people who did or did not experience different life events. We expect differences to be different across life events – that is, parenthood may change personality differently from beginning one's first job and retirement might impact personality differently than losing a child. Moreover, we do not expect our results to align with Specht et al. (2011)'s findings using two waves of personality and life event data from the same sample because we expect that propensity score matching will partially explain some socialization effects they observed.

2. Method

2.1 Participants

This study uses the German Socioeconomic Panel Study (GSOEP) data. These data were collected by the German Institute of Economic Research (DIW Berlin) and are available, through application, at https://www.diw.de/soep. Participants were recruited from more than 11,000 households and data have been collected annually since 1985. The latest data release includes data up to 2015. On average, 20,000 individuals are sampled each year. In short, the GSOEP is a nationally representative sample of private German households. It is critical to note that the GSOEP samples households, not individuals, and the households consist of individuals "living in both the 'old' and 'new' federal states (the former West and East Germany), foreigners, and recent immigrants to Germany."

Sample size varies by year, ranging from approximately 10,000 (1989) to 31,000 (2013). This provides 99% power to detect a zero-order correlation effect size of approximately .06, using a two-tailed test and an alpha level of .05.

As documented in our preregistration (https://osf.io/vdazq/), participants who do not have at least one wave measurement of matching variables (used for multiple imputation and propensity score matching), grouping variables (life event data), and outcome variables (personality measures) will be excluded from analyses.

2.2 Measures

2.2.1 Matching variables

Matching variables were those used in the propensity score analysis to match those who did or did not experience different life events. A full list is available in Appendix A but can be roughly broken down into eight categories: demographics (e.g. sex), activities (e.g. volunteering), financial (e.g. gross wages), household (e.g. number of household members), health (e.g. BMI), psychological (e.g. life satisfaction), relationship (e.g. relationship with father), and social (e.g. visits to friends). In order to construct more reliable measures and not exclude participants who did not respond to surveys in 2005, matching variables were pooled across time, using all available data from 1984 to 2005 for each person. The full details of the construction of these variables are available in the Supplementary Materials on GitHub (https://github.com/emoriebeck/life_events) and the Open Science Framework (OSF; https://osf.io/g52hz/).

2.2.2 Life events

We investigated bidirectional effects of 12 life events and personality / personality change. A full list of life events, as well as sample size and gender breakdowns for each, can be seen in Table 2.1. Information on the occurrence of these life events were collected annually. The life events chosen are identical to those used in a previous study (Specht et al., 2011). For each life event, participants reported whether a life event had occurred in the survey year or the year prior. Responses were coded as "1" for that event if participants reported experiencing it anytime between 2006 to 2015 and "0" otherwise.

2.2.3 Personality

The analyses for this project were conducted in `R` (R Core Team, 2017) and preregistered on the Open Science Framework (https://osf.io/vdazq/), and all data and

Table 2.1: Descriptive Statistics of Individuals Who Experienced a Specific Major Life Event

			Age in 2005					
	Frequency		M		SD		% women	
Life Event	Matched	Raw	Matched	Raw	Matched	Raw	Matched	Raw
Marriage	965 (4453)	1002 (14132)	33.36	33.35	11.04	10.96	51.40	51.30
Moved in with Partner	885 (4898)	952 (14131)	31.55	31.38	10.76	10.82	53.11	52.94
Divorce	362 (1805)	378 (14133)	40.73	40.81	8.43	8.49	58.84	58.20
Separation from Partner	947 (4528)	1006 (14127)	35.62	35.69	11.36	11.45	56.60	56.26
Death of Partner/Spouse	390 (1926)	411 (14136)	64.08	64.20	11.74	11.62	70.26	70.56
Leaving Parental Home	374 (1529)	396 (14133)	23.88	23.96	7.88	7.88	50.80	49.49
Child Leaves Home	1814 (7757)	1991 (14124)	48.37	48.35	8.11	7.96	55.35	55.20
Birth of Child	1116 (4352)	1154 (14132)	31.04	31.00	7.73	7.68	53.85	53.73
Death of Parent	1633 (10614)	1710 (14131)	46.78	46.84	10.63	10.62	52.54	52.11
Unemployment	1910 (7501)	2065 (14122)	38.45	38.05	12.68	12.76	51.94	51.96
Retirement	1166 (3892)	4696 (14113)	60.55	64.90	10.79	8.98	54.03	52.00
First Job	375 (1123)	449 (14134)	22.11	22.19	3.84	4.84	52.27	54.12

Note:
M = mean age in 2005; SD = standard deviation of age in 2005.

materials are available on OSF (https://osf.io/g52hz/) and GitHub (https://github.com/emoriebeck/life_events).

The analysis phase will consist of four main parts,[1] with interim steps to link these together: multiple imputation, propensity score matching, tests of selection effects using Bayesian logistic regression models, and tests of socialization effects using Bayesian multilevel growth curve modeling.

First, we will use multiple imputation to impute missing data for the matching variables. Before doing so, we first create composites of our matching variables prior to 2005. We elected to use composites rather than survey responses from 2005 due to irregularities in survey construction and responses that would severely restrict the number of observations. To ensure transparency, we conduct all analyses using the raw data imported directly from the raw data files obtained from the SOEP website, and all steps in creating the composites are documented in a spreadsheet containing the item lists, text, and scales. Moreover, all steps are documented in the Supplementary Materials. The composite matching variables were then used in multiple imputation and propensity score matching, which requires completely non-missing data. After opting to use the `brms`

[1]Our preregistered analysis plan included five parts: the four steps outlined in the analysis plan in this paper and an additional step to check longitudinal measurement invariance of our measurement model.

package(Bürkner, 2017),[2] which relies on STAN, to implement tests of socialization effects, we additionally elected to use the imputed data for the growth curve models because STAN requires non-missing data. Multiple imputation will be conducted using the `mi` package in `R` (Gelman & Hill, 2011). Because the package attempts to automatically detect the scale of measurement, we manually set all variables with ranges of at least 3 to continuous. We imputed 10 data sets.

Second, we used the multiply imputed data to calculate propensity scores for each of the multiply imputed data sets for each life event separately. The propensity score matching procedure attempts to equate those who did or did not experience a life event by assigning each person a risk score based on a number of background factors. Then each person who experienced the event is matched with someone else in the control group who had a similar "risk" of experiencing the event. Matching was done using the `matchit` packages in `R` (Ho, Imai, King, & Stuart, 2011). Because the sample sizes of the groups of people who experience specific life events are much smaller than the individuals who did not experience them, we choose to use propensity score matching. We began by using "nearest neighbor" matching and a ratio of 4 to 1 and a caliper width of $.25\sigma$ (Guo & Fraser, 2015) and iteratively updated the ratio for life events that were not balanced using these criteria. 8 of the 12 life events were successfully matched using a 4 to 1 ratio, while four life events (Child Moves Out, Parent Dies, Retirement, and Unemployment) required an 8 to 1 ratio to balance. Even when changing the ratio, five events (Moving in with a Partner, Separating from a Partner, First Job, Retirement, and Unemployment) remained unbalanced, so we reduced the caliper width to $.05\sigma$ (Separating from a Partner, First Job, Retirement, and Unemployment) or $.01\sigma$ (Moving in with a Partner). To illustrate the outcome of this procedure, Figure 2.1 presents standardized mean differences between

[2] In the preregistration of this project, we planned to use the `blavaan` package in `R` to estimate second-order Bayesian latent growth curve models. However, after attempting to run the preregistered models, it became apparent that `blavaan` was not yet optimized for the complex models utilized herein. Rather than implementing frequentist second-order latent growth curve models, we opted to use Bayesian multilevel growth curve models using the `brms` package.

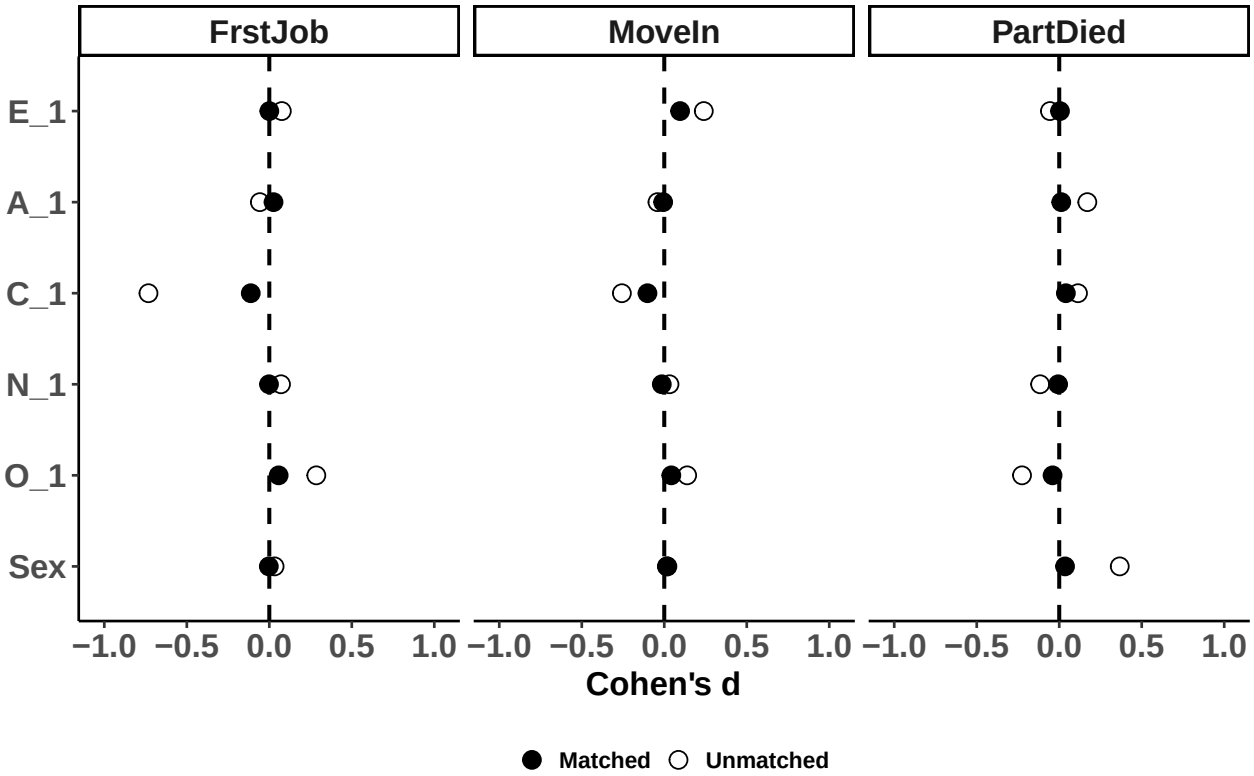

Figure 2.1: Standardized mean differences on a subset of matching variables before (open) and after (solid) the matching procedure for those who did or did not experience three events during the study period. Variables were measured in 2005.

those started a first job, experienced the death of a partner, or moved in with a partner for the Big 5 and Gender before and after matching. The full set of standardized mean differences across all matched variables and life events are available in the supplementary web app (https://emoriebeck.shinyapps.io/life_events/).

Third, we tested for selection effects using a series of Bayesian logistic regression models. Using unmatched data sets and matched data sets that did not account for personality in 2005, we predicted life events from personality in 2005.[3] We did not include additional covariates (e.g. age, gender) in these models because these should be effectively controlled for in the propensity score matching procedure. In all models, the "no life event" group will be considered the reference group. Each of the Bayesian logistic regression

[3]We preregistered only tests of selection effects using data matched on variables that did not include personality. However, we decided that a more informative test showed both this putatively "pure" test of personality selection and a "murkier" unmatched test that did not separate background characteristics and personality.

models were implemented using the `rstanarm` package in `R` (Stan Development Team, 2016) and pooled using the `rstan` package (Stan Development Team, 2018).

Fourth, we merged the matched data sets with the outcome (personality) data for use in growth curve models.[4] We implemented the Bayesian multilevel growth curve models using the `brms` package in R. Wave was centered at the first wave (2005) and subsequent waves were labeled 1 (2009) and 2 (2013). Again, we will not include additional covariates on which participants were already matched in the propensity score matching procedure, and the "no life event" group will be considered the reference group. The basic model of the multilevel growth curve model with random slopes and intercept is as follows:

Level 1:

$$Y_{ij} = \beta_{0j} + \beta_{1j} * (wave - 1) + \epsilon_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * le.group + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} * le.group + u_{1j}$$

The critical term in these models to test socialization effects is the cross-level interaction between measurement wave and life-event groups, which indicates whether the personalities of those who experienced a life event changed differently than those who did not, on average. The life event main effect tests the efficacy of the propensity score matching procedure. If participants were effectively matched, we should see no group differences in intercepts (personality in 2005).

We fitted growth curve models for each of the predictors for each of the multiply

[4] After running the models, a small set of the models showed divergent transitions in the Hamiltonian Monte Carlo Markov Chain sampling procedure. The divergent transitions primarily affected the Level 1 and Level 2 residual variances rather than the fixed effect estimates. For those models (Openness-Unemployment, Agreeableness-Child leaves home, Agreeableness-Move in with partner, Agreeableness-Divorce, Conscientiousness-Retirement, Extraversion-Parent Died, Extraversion-Divorce; all models for the death of a partner and starting a first job), we increased the number of warmup iterations from 1000 to 2000, increased the number of post-warmup iterations from 2000 to 4000, increased the maximum treedepth from 10 to 15, and set the priors of the Level 2 variances to a half-cauchy distribution with the location parameter x_0 set to zero and the scale parameter λ set to 10. After doing so, the models converged normally, and all Rhats were less than 1.02. The posterior distribution of the terms are visually represented in the Supplementary web app (https://emoriebeck.shinyapps.io/life_events/).

imputed data sets. We use the default priors, which are "uninformative" priors meant to regularize the models. However, given the sample sizes in the present model, the data are likely to overwhelm these priors. The matching sets for each imputation were based on the propensity score matching for the first imputed data set for each trait-event combination. This departure from our preregistered analyses was necessary because to combine models using methods implemented in `brms` and `rstan` (Stan Development Team, 2018) for combining STAN models, the parameters (including person-level random effects), must be identical. Once models are fitted, we will use Rubin's Rules (Rosenbaum & Rubin, 1983) to combine the parameters.

3. Results

3.1 Selection Effects

First, we tested whether personality in 2005 predicted whether people would experience life events in the near future (1-10 years later), both in the full sample and the propensity score matched samples for each event. Table 2 presents the mean odds ratio and 95% uncertainty interval. Visual representations of the posterior distributions for each model are available in the Supplementary web app.

In the unmatched sample, Conscientiousness predicted higher odds of a child leaving a parent's home (OR = 1.16, 95% UI [1.10, 1.23]), the death of a partner (OR = 1.14, 95% UI [1.02, 1.29]), and retirement (OR = 1.11, 95% UI [1.07, 1.16]), and lower odds of the birth of a child (OR = 0.85, 95% UI [0.80, 0.91]), starting a first job (OR = 0.53, 95% UI [0.48, 0.58]), moving out of one's parents' home (OR = 0.60, 95% UI [0.54, 0.66]), marriage (OR = 0.84, 95% UI [0.78, 0.90]), moving in with a partner (OR = 0.77, 95% UI [0.72, 0.83]), separating from a partner (OR = 0.85, 95% UI [0.79, 0.91]), and become unemployed (OR = 0.88, 95% UI [0.83, 0.92]). In the matched sample, only four selection effects remained. Higher Conscientiousness predicted higher odds of a child moving out of a parents' home (OR = 1.08, 95% UI [1.02, 1.15]) but lower odds of starting a first job (OR = 0.87, 95% UI [0.77, 0.97]), moving in with a partner (OR = 0.89, 95% UI [0.83, 0.96]), or becoming unemployed (OR = 0.94, 95% UI [0.89, 0.99]).

Extraversion predicted higher odds of separating (OR = 1.16, 95% UI [1.09, 1.23]) or

divorcing (OR = 1.13, 95% UI [1.03, 1.24]) from a partner and marrying (OR = 1.15, 95% UI [1.09, 1.22]) or moving in (OR = 1.25, 95% UI [1.17, 1.33]) with a partner, but lower odds of retiring (OR = 0.91, 95% UI [0.88, 0.94]). In the matched sample, Extraversion only predicted higher odds of moving in (OR = 1.16, 95% UI [1.09, 1.24]) or marrying (OR = 1.07, 95% UI [1.01, 1.14]) a partner and separating (OR = 1.08, 95% UI [1.02, 1.15]) but not divorcing (OR = 1.08, 95% UI [0.98, 1.20]) a partner.

Neuroticism predicted lower odds separating (OR = 0.95, 95% UI [0.90, 1]) or divorcing (OR = 0.90, 95% UI [0.82, 0.97]) from a partner, the death of a partner (OR = 0.91, 95% UI [0.84, 0.99]), retiring (OR = 0.91, 95% UI [0.89, 0.94]), and becoming unemployed (OR = 0.92, 95% UI [0.88, 0.95]). In the matched sample, Neuroticism predicted lower odds of retirement (OR = 0.95, 95% UI [0.90, 1]), unemployment (OR = 0.93, 95% UI [0.89, 0.97]), and leaving one's parents' home (OR = 0.87, 95% UI [0.79, 0.96]).

Openness predicted higher odds of moving in (OR = 1.12, 95% UI [1.06, 1.19]) or marrying (OR = 1.12, 95% UI [1.06, 1.19]) a partner, separating (OR = 1.13, 95% UI [1.07, 1.19]) but not divorcing (OR = 1.06, 95% UI [0.97, 1.15]) a partner, leaving one's parents' home (OR = 1.14, 95% UI [1.04, 1.24]), starting a first job (OR = 1.28, 95% UI [1.18, 1.39]), and becoming unemployed (OR = 1.06, 95% UI [1.02, 1.11]), but lower odds of the death of a partner (OR = 0.83, 95% UI [0.77, 0.90]) and retirement (OR = 0.95, 95% UI [0.92, 0.97]). In the matched sample, in contrast, Openness predicted higher odds of moving in with a partner (OR = 1.06, 95% UI [1, 1.13]), separating from a partner (OR = 1.07, 95% UI [1.01, 1.14]), and becoming unemployed (OR = 1.08, 95% UI [1.04, 1.13]).

Agreeableness predicted lower odds of marrying (OR = 0.90, 95% UI [0.84, 0.96]), separating from a partner (OR = 0.86, 95% UI [0.80, 0.91]), and becoming unemployed (OR = 0.95, 95% UI [0.90, 0.99]), but higher odds of retirement (OR = 1.11, 95% UI [1.07, 1.16]) and the death of a partner (OR = 1.20, 95% UI [1.08, 1.33]). In the matched sample, Agreeableness predicted higher odds of retirement (OR = 1.13, 95% UI [1.06, 1.21]) and

lower odds of separating from a partner (OR = 0.90, 95% UI [0.84, 0.97]).

Table 3.1: Matched and Unmatched Effects of Baseline Personality on the Probability of Experiencing Specific Life Events

	E		A		C		N		O	
	Matched	Unmatched	Matched	Unmatched	Matched	Unmatched	Matched	Unmatched	Matched	Unmatched
	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]	OR [UI]
Marriage	**1.07 [1.01, 1.14]**	**1.15 [1.09, 1.22]**	0.98 [0.91, 1.06]	**0.90 [0.84, 0.96]**	1.02 [0.94, 1.09]	**0.84 [0.78, 0.90]**	0.98 [0.93, 1.04]	1.03 [0.98, 1.09]	1.05 [0.99, 1.11]	**1.12 [1.06, 1.19]**
Moved in with Partner	**1.16 [1.09, 1.24]**	**1.25 [1.17, 1.33]**	1.04 [0.96, 1.12]	0.96 [0.90, 1.03]	**0.89 [0.83, 0.96]**	**0.77 [0.72, 0.83]**	0.99 [0.94, 1.05]	1.03 [0.97, 1.08]	**1.06 [1.00, 1.13]**	**1.12 [1.06, 1.19]**
Divorce	1.08 [0.98, 1.20]	**1.13 [1.03, 1.24]**	0.95 [0.84, 1.07]	0.91 [0.82, 1.02]	1.02 [0.89, 1.16]	1.01 [0.90, 1.14]	0.94 [0.86, 1.03]	**0.90 [0.82, 0.97]**	1.06 [0.96, 1.17]	1.06 [0.97, 1.15]
Separation from Partner	**1.08 [1.02, 1.15]**	**1.16 [1.09, 1.23]**	**0.90 [0.84, 0.97]**	**0.86 [0.80, 0.91]**	0.96 [0.89, 1.04]	**0.85 [0.79, 0.91]**	0.95 [0.90, 1.01]	**0.95 [0.90, 1.00]**	**1.07 [1.01, 1.14]**	**1.13 [1.07, 1.19]**
Death of Partner/Spouse	1.01 [0.91, 1.12]	0.95 [0.87, 1.04]	1.03 [0.92, 1.15]	**1.20 [1.08, 1.33]**	1.05 [0.93, 1.19]	**1.14 [1.02, 1.29]**	1.02 [0.93, 1.11]	**0.91 [0.84, 0.99]**	0.93 [0.85, 1.02]	**0.83 [0.77, 0.90]**
Leaving Parental Home	0.98 [0.89, 1.09]	1.08 [0.99, 1.19]	1.00 [0.89, 1.13]	0.90 [0.82, 1.00]	0.95 [0.84, 1.06]	**0.60 [0.54, 0.66]**	**0.87 [0.79, 0.96]**	0.96 [0.88, 1.04]	1.01 [0.91, 1.12]	**1.14 [1.04, 1.24]**
Child Leaves Home	1.03 [0.98, 1.08]	1.04 [1.00, 1.09]	1.02 [0.97, 1.08]	1.02 [0.97, 1.07]	**1.08 [1.02, 1.15]**	**1.16 [1.10, 1.23]**	1.01 [0.97, 1.05]	0.99 [0.96, 1.03]	1.03 [0.98, 1.08]	1.02 [0.98, 1.07]
Birth of Child	1.02 [0.96, 1.08]	**1.08 [1.02, 1.14]**	1.04 [0.96, 1.11]	0.94 [0.89, 1.00]	1.04 [0.97, 1.12]	**0.85 [0.80, 0.91]**	0.98 [0.93, 1.04]	1.04 [0.99, 1.10]	0.95 [0.90, 1.01]	0.99 [0.94, 1.04]
Death of Parent	0.99 [0.94, 1.04]	1.00 [0.96, 1.05]	0.99 [0.94, 1.05]	0.96 [0.91, 1.01]	1.03 [0.97, 1.09]	1.04 [0.98, 1.10]	0.99 [0.94, 1.03]	0.97 [0.93, 1.02]	1.00 [0.96, 1.05]	1.02 [0.97, 1.06]
Unemployment	1.01 [0.97, 1.06]	1.04 [0.99, 1.08]	0.99 [0.94, 1.05]	**0.95 [0.90, 0.99]**	**0.94 [0.89, 0.99]**	**0.88 [0.83, 0.92]**	**0.93 [0.89, 0.97]**	**0.92 [0.88, 0.95]**	**1.08 [1.04, 1.13]**	**1.06 [1.02, 1.11]**
Retirement	0.98 [0.92, 1.04]	**0.91 [0.88, 0.94]**	**1.13 [1.06, 1.21]**	**1.11 [1.07, 1.16]**	0.99 [0.92, 1.07]	**1.11 [1.07, 1.16]**	**0.95 [0.90, 1.00]**	**0.91 [0.89, 0.94]**	1.01 [0.96, 1.07]	**0.95 [0.92, 0.97]**
First Job	1.00 [0.90, 1.11]	1.07 [0.98, 1.17]	1.02 [0.90, 1.16]	0.94 [0.86, 1.04]	**0.87 [0.77, 0.97]**	**0.53 [0.48, 0.58]**	0.99 [0.90, 1.09]	1.06 [0.98, 1.15]	1.08 [0.97, 1.20]	**1.28 [1.18, 1.39]**

Note:
OR = odds ratios of Bayesian logistic regression predicting life events from personality in 2005.
UI = uncertainty interval. Bolded values represent estimated odds ratios whose 95% UI's do not overlap with 0.

3.2 Mean-Level Change

Mean-level personality can be seen in Table 3.2, and mean-level personality change can be seen in Table 3.3. The models for each personality domain fit the data well (Rhats < 1.02). A sample trace plot of the Monte Carlo Markov Chains procedure is presented in Figure 3.1. The clear stationarity (stable means) and good mixing (low autocorrelation across iterations) indicate that the estimation was successful (McElreath, 2016).

Table 3.2 presents mean-level change in each personality domain. There were mean-level decreases across the sample in Agreeableness (b = -0.06, 95% UI [-0.07, -0.05]) and Conscientiousness (b = -0.05, 95% UI [-0.05, -0.04]) and mean-level increases in Neuroticism (b = 0.09, 95% UI [0.07, 0.10]). As is clear in the spaghetti plot of the random effects with the mean-level trends in Figure 3.2, there were also considerable individual differences in individual-level slopes and intercepts.

3.3 Socialization Effects

As can be seen in Table 3.2, the use of propensity score matching was effective. Baseline personality differences among people did or did not experience life events were almost completely eliminated, with a few exceptions. People who who moved in with their partners were slightly less Conscientious (b = -0.09, 95% UI [-0.15, -0.02], d = -0.15)[1] and slightly more Extraverted (b = 0.11, 95% UI [0.03, 0.19], d = 0.13) than those who did not. Retirees were also slightly more Agreeable (b = 0.09, 95% UI [0.03, 0.16], d = 0.14) and less Neurotic (b = -0.11, 95% UI [-0.19, -0.02], d = -0.13) than non-retirees. Individuals who became unemployed (b = -0.06, 95% UI [-0.11, -0.02], d = -0.11) were slightly less Conscientious than those who did not.

[1] Cohen's *d* for group differences in intercepts and slope was calculated by dividing the estimated difference by the standard deviation of the pooled random intercepts of the control group for that model.

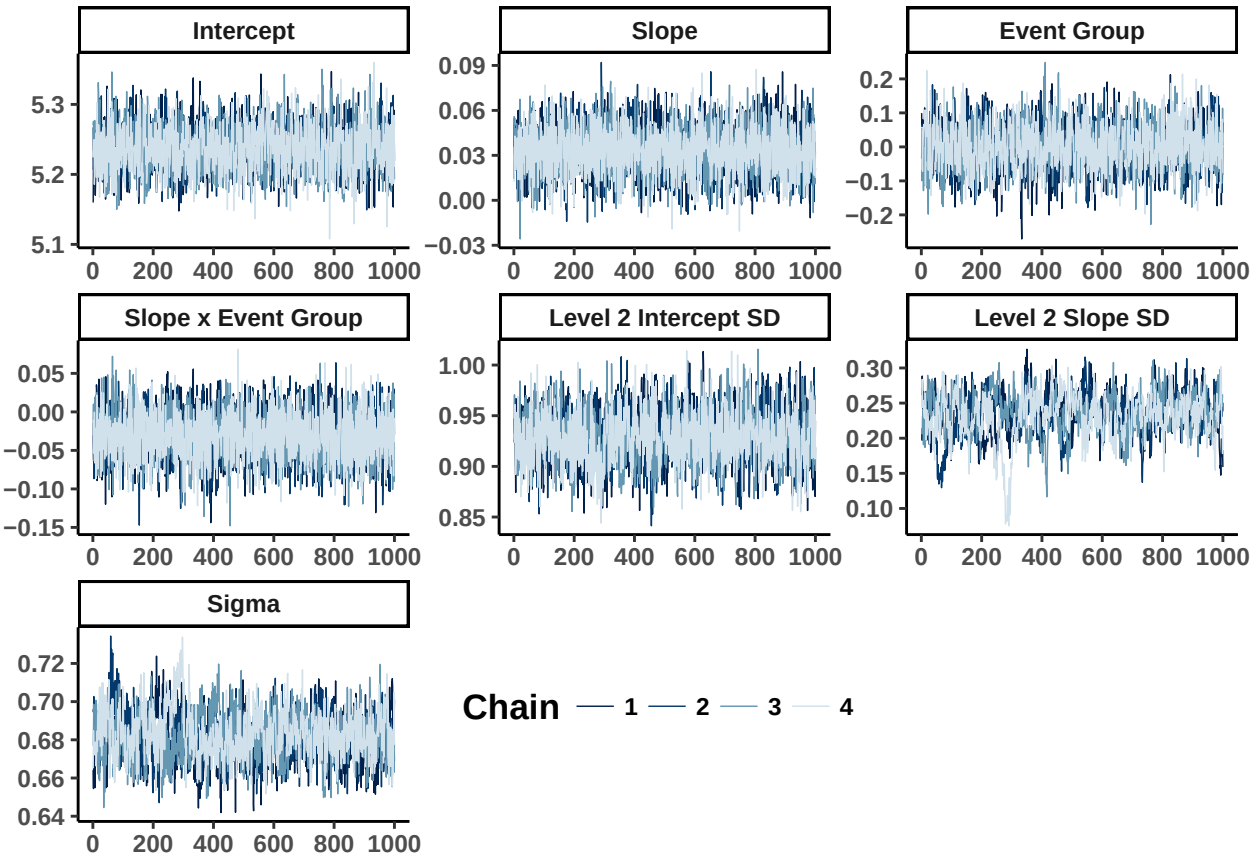

Figure 3.1: Trace plot of the Hamiltonian Monte Carlo Markov Chain (MCMC) from one multiply imputed Bayseian multilevel growth model. In this sample, the examined trait was Extraversion, and the life event was the a moving out of one's parents' home. This is a healthy MCMC chain that exhibits both stationarity and well-mixing. The iterations represent only post-warmup samples.

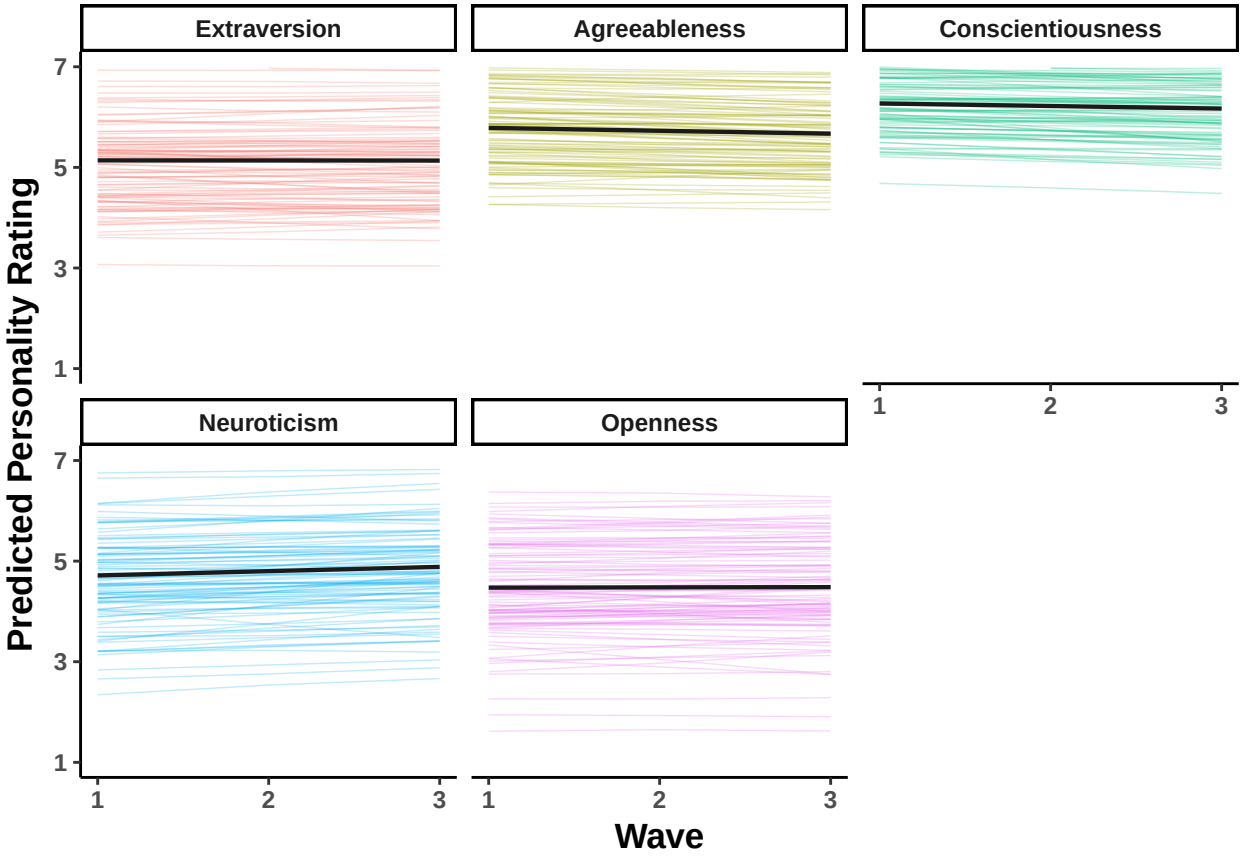

Figure 3.2: Change trajectories for each of the Big 5 from 2005 (wave 1) to 2013 (wave 3). Thick lines represent mean-level change across the full sample, while thinner lines represent 100 randomly selected individual trajectories estimated from Level 2 random slope and intercept estimates.

Table 3.2: Effects of Specific Events on the Mean-Level (Intercept) of Personality Based on Multilevel Growth Models

	A			C			E			N			O		
	b	UI	d	b	UI	d	b	UI	d	b	UI	d	b	UI	d
Mean															
No Event	5.78	[5.76, 5.79]		6.26	[6.24, 6.27]		5.15	[5.13, 5.17]		4.72	[4.70, 4.74]		4.48	[4.46, 4.50]	
Marriage															
Event	5.67	[5.61, 5.73]	-0.04	6.12	[6.07, 6.18]	-0.00	5.31	[5.24, 5.38]	0.08	4.74	[4.67, 4.82]	-0.05	4.62	[4.54, 4.69]	0.02
No Event	5.70	[5.67, 5.73]		6.13	[6.10, 6.16]		5.24	[5.21, 5.28]		4.79	[4.75, 4.83]		4.60	[4.57, 4.64]	
Moved in with Partner															
Event	5.74	[5.68, 5.80]	0.02	6.08	[6.02, 6.14]	**-0.15**	5.39	[5.31, 5.46]	**0.13**	4.74	[4.67, 4.82]	-0.06	4.66	[4.58, 4.73]	0.09
No Event	5.73	[5.70, 5.76]		6.16	[6.14, 6.19]		5.28	[5.24, 5.31]		4.79	[4.75, 4.83]		4.58	[4.55, 4.62]	
Divorce															
Event	5.71	[5.61, 5.81]	0.01	6.29	[6.21, 6.38]	0.05	5.29	[5.18, 5.40]	0.03	4.53	[4.41, 4.66]	-0.06	4.57	[4.46, 4.69]	0.01
No Event	5.70	[5.65, 5.75]		6.26	[6.22, 6.31]		5.27	[5.22, 5.32]		4.58	[4.52, 4.64]		4.56	[4.51, 4.62]	
Separation from Partner															
Event	5.64	[5.58, 5.70]	-0.03	6.14	[6.09, 6.20]	-0.04	5.32	[5.25, 5.39]	0.05	4.64	[4.57, 4.72]	-0.04	4.64	[4.57, 4.71]	0.03
No Event	5.66	[5.63, 5.69]		6.17	[6.14, 6.19]		5.28	[5.24, 5.31]		4.68	[4.64, 4.71]		4.62	[4.58, 4.65]	
Death of spouse															
Event	5.93	[5.84, 6.03]	0.03	6.35	[6.26, 6.44]	0.03	5.07	[4.96, 5.17]	-0.01	4.56	[4.45, 4.68]	-0.06	4.22	[4.10, 4.34]	-0.10
No Event	5.92	[5.87, 5.97]		6.33	[6.29, 6.37]		5.08	[5.02, 5.13]		4.61	[4.55, 4.67]		4.30	[4.24, 4.36]	
Leaving Parental Home															
Event	5.67	[5.58, 5.76]	-0.01	5.78	[5.68, 5.88]	-0.08	5.25	[5.14, 5.36]	-0.00	4.66	[4.54, 4.77]	-0.13	4.64	[4.52, 4.75]	0.00
No Event	5.68	[5.62, 5.73]		5.84	[5.78, 5.89]		5.25	[5.19, 5.31]		4.76	[4.69, 4.82]		4.64	[4.57, 4.70]	
Child Leaves Home															
Event	5.79	[5.75, 5.83]	0.02	6.36	[6.32, 6.40]	0.06	5.19	[5.15, 5.24]	0.03	4.69	[4.63, 4.74]	0.01	4.50	[4.45, 4.55]	0.02
No Event	5.78	[5.75, 5.80]		6.33	[6.31, 6.35]		5.17	[5.14, 5.20]		4.68	[4.65, 4.71]		4.48	[4.46, 4.51]	
Birth of Child															
Event	5.72	[5.66, 5.77]	0.03	6.14	[6.08, 6.19]	0.00	5.23	[5.16, 5.29]	0.03	4.77	[4.70, 4.84]	-0.02	4.48	[4.41, 4.54]	-0.04
No Event	5.70	[5.67, 5.73]		6.14	[6.11, 6.17]		5.20	[5.16, 5.24]		4.78	[4.74, 4.82]		4.51	[4.47, 4.54]	
Death of Parent															
Event	5.73	[5.69, 5.78]	-0.03	6.29	[6.24, 6.33]	0.01	5.14	[5.09, 5.19]	-0.03	4.68	[4.62, 4.73]	-0.02	4.50	[4.44, 4.55]	-0.00
No Event	5.75	[5.74, 5.77]		6.28	[6.26, 6.30]		5.16	[5.13, 5.18]		4.69	[4.67, 4.72]		4.50	[4.48, 4.52]	
Unemployment															
Event	5.72	[5.68, 5.77]	-0.02	6.18	[6.14, 6.22]	**-0.11**	5.19	[5.14, 5.24]	0.00	4.62	[4.57, 4.67]	-0.07	4.54	[4.49, 4.59]	0.02
No Event	5.73	[5.71, 5.76]		6.24	[6.22, 6.26]		5.19	[5.16, 5.22]		4.68	[4.65, 4.71]		4.53	[4.50, 4.56]	
Retirement															
Event	5.86	[5.80, 5.91]	**0.14**	6.34	[6.29, 6.39]	-0.02	5.03	[4.97, 5.09]	-0.09	4.58	[4.51, 4.65]	**-0.13**	4.43	[4.36, 4.50]	-0.05
No Event	5.77	[5.73, 5.80]		6.35	[6.32, 6.39]		5.10	[5.06, 5.14]		4.69	[4.64, 4.73]		4.47	[4.43, 4.52]	
First Job															
Event	5.72	[5.62, 5.81]	0.09	5.70	[5.59, 5.80]	-0.10	5.25	[5.14, 5.37]	0.02	4.81	[4.69, 4.93]	0.05	4.79	[4.68, 4.91]	0.07
No Event	5.67	[5.60, 5.73]		5.76	[5.69, 5.84]		5.24	[5.16, 5.32]		4.77	[4.69, 4.85]		4.74	[4.66, 4.82]	

Note:
Cohen's d is calculated by dividing the difference in mean personality between groups in 2005 by the standard deviation of the random intercepts of personality scores in 2005 of the control group. UI = uncertainty interval. Bolded values represent estimated mean differences between groups whose 95% UI's do not overlap with 0.

Using the matched samples, we tested if personality changes following the experience of life events over eight years. The slopes for the matched groups of those who did or did not experience life events are presented in Table 3.3, and group differences in slopes of Extraversion as well as the distribution of random slopes around the group estimate is displayed in Figure 3.3. Mean-level trajectories, posterior distributions, and group differences in slopes with distributions of random effects for all trait-event combinations are available in the Supplementary web app. As is clear in the table there were relatively few socialization effects in the matched samples overall.

When participants were matched on baseline characteristics, including personality in 2005, socialization effects were almost completely eliminated, with two exceptions (see Figure 3.4). After matching, only two socialization effects remained. Those who separated from their partners (b = 0.05, 95% UI [0.01, 0.09], d = 0.08) increased in Agreeableness relative to those who did not. In other words, people who separated from their partners (b = 0.01, 95% UI [-0.02, 0.05]) showed almost no change in Agreeableness, while those who did not separate from their partners (b = -0.04, 95% UI [-0.05, -0.02]) decreased in Agreeableness. In addition, parents of children who moved out (b = -0.03, 95% UI [-0.06, 0], d = -0.04) differed in Extraversion change, with empty nesters (b = -0.05, 95% UI [-0.07, -0.02]) decreasing in Extraversion while parents with children living at home showed almost no change (b = -0.02, 95% UI [-0.03, 0]).

The observation that there were relatively few group differences in mean-level change between those who did or not did not experience life events does not mean that no individuals reported personality change after experiencing them. Thus, we next considered interindividual differences in intraindividual change, or whether there were individual differences in change following life events. These random slopes and intercepts represent the Level 2 residuals, or variance in individual level trends that are not explained by life events. If life events explain these differences, there would be little residual variance at Level 2. In line with previous research, there were individual differences in random

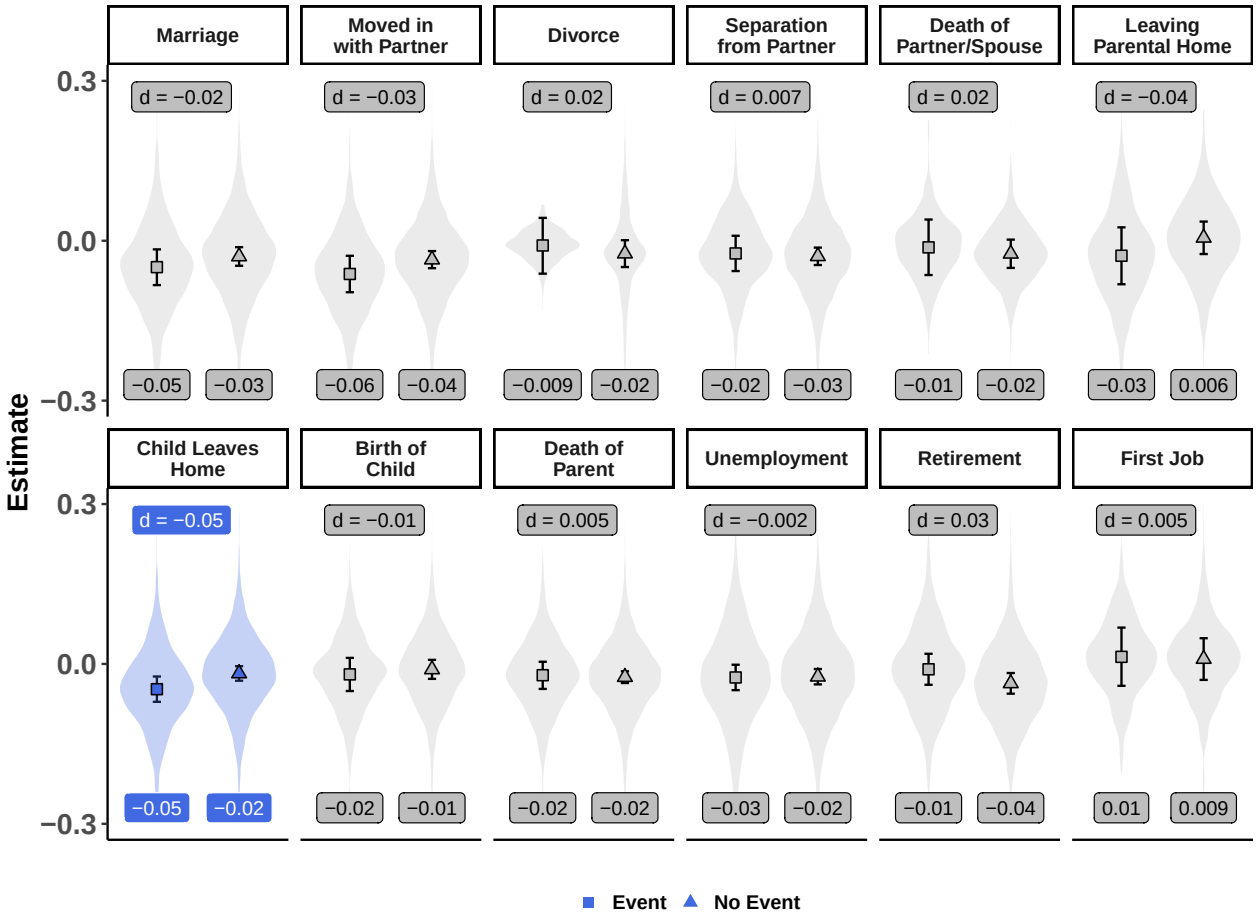

Figure 3.3: Forest plot of group differences in mean-level Extraversion change. Error bars represent the 95% uncertainty interval (UI) of the Bayesian estimates. Shaded background images represent the density of the random slopes for each group.

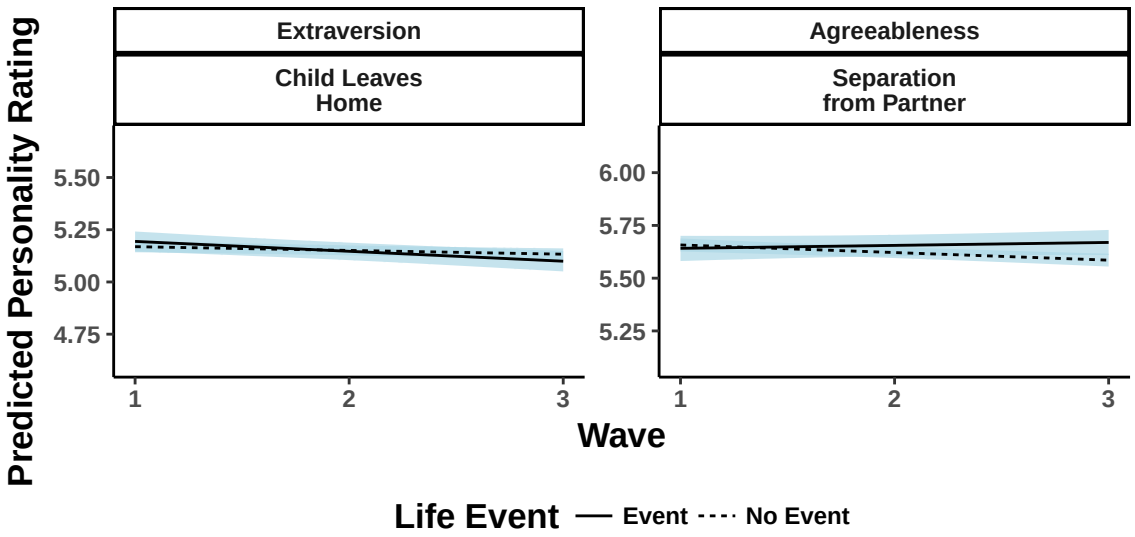

Figure 3.4: Changes in personality traits as a function of experiencing versus not experiencing a specific major life event. Shaded areas represent the uncertainty interval of the estimate. See Table 3.3 for the exact values underlying the graphs.

intercepts for all combinations of life events and the Big 5, suggesting that life events do not explain individual differences in personality at baseline.

Table 3.3: Effects of Specific Events on the Mean-Level Change (Slope) of Personality Based on Multilevel Growth Models

	A			C			E			N			O		
	b	UI	d	b	UI	d	b	UI	d	b	UI	d	b	UI	d
Mean															
No Event	-0.06	[-0.07, -0.05]		-0.05	[-0.05, -0.04]		-0.00	[-0.01, 0.01]		0.09	[0.07, 0.10]		0.00	[-0.01, 0.01]	
Marriage															
Event	-0.06	[-0.09, -0.03]	-0.02	0.01	[-0.03, 0.04]	0.02	-0.05	[-0.08, -0.02]	-0.02	0.08	[0.04, 0.12]	-0.02	-0.04	[-0.07, -0.00]	-0.02
No Event	-0.04	[-0.06, -0.03]		-0.00	[-0.02, 0.01]		-0.03	[-0.05, -0.01]		0.09	[0.07, 0.11]		-0.02	[-0.04, -0.00]	
Moved in with Partner															
Event	-0.05	[-0.09, -0.02]	0.01	-0.01	[-0.04, 0.02]	-0.01	-0.06	[-0.10, -0.03]	-0.03	0.11	[0.07, 0.15]	0.04	-0.03	[-0.07, 0.01]	-0.01
No Event	-0.06	[-0.08, -0.05]		-0.00	[-0.02, 0.01]		-0.04	[-0.05, -0.02]		0.08	[0.06, 0.09]		-0.02	[-0.03, -0.00]	
Divorce															
Event	0.01	[-0.04, 0.06]	0.08	-0.02	[-0.07, 0.02]	-0.00	-0.01	[-0.06, 0.04]	0.02	0.13	[0.07, 0.19]	0.04	0.02	[-0.04, 0.07]	0.02
No Event	-0.04	[-0.06, -0.01]		-0.02	[-0.05, 0.00]		-0.02	[-0.05, 0.00]		0.09	[0.06, 0.13]		0.00	[-0.02, 0.03]	
Separation from Partner															
Event	0.01	[-0.02, 0.05]	**0.08**	0.01	[-0.02, 0.04]	0.02	-0.02	[-0.06, 0.01]	0.01	0.12	[0.08, 0.16]	0.03	-0.01	[-0.04, 0.03]	0.03
No Event	-0.04	[-0.05, -0.02]		-0.01	[-0.02, 0.01]		-0.03	[-0.05, -0.01]		0.10	[0.08, 0.12]		-0.03	[-0.05, -0.01]	
Death of spouse															
Event	-0.02	[-0.07, 0.03]	0.08	-0.09	[-0.14, -0.04]	-0.07	-0.01	[-0.06, 0.04]	0.02	0.11	[0.05, 0.17]	0.05	0.01	[-0.05, 0.07]	-0.01
No Event	-0.06	[-0.09, -0.04]		-0.06	[-0.08, -0.03]		-0.02	[-0.05, 0.00]		0.06	[0.03, 0.09]		0.02	[-0.01, 0.05]	
Leaving Parental Home															
Event	-0.01	[-0.06, 0.03]	0.04	0.06	[0.01, 0.11]	-0.05	-0.03	[-0.08, 0.03]	-0.04	0.10	[0.04, 0.16]	-0.02	-0.04	[-0.10, 0.02]	-0.01
No Event	-0.04	[-0.06, -0.01]		0.09	[0.06, 0.12]		0.01	[-0.02, 0.04]		0.11	[0.08, 0.15]		-0.03	[-0.06, 0.00]	
Child Leaves Home															
Event	-0.05	[-0.07, -0.02]	0.01	-0.07	[-0.09, -0.05]	-0.04	-0.05	[-0.07, -0.02]	**-0.04**	0.09	[0.06, 0.12]	-0.01	-0.00	[-0.03, 0.02]	-0.00
No Event	-0.05	[-0.06, -0.04]		-0.05	[-0.06, -0.03]		-0.02	[-0.03, -0.00]		0.10	[0.08, 0.11]		-0.00	[-0.02, 0.01]	
Birth of Child															
Event	-0.05	[-0.08, -0.02]	-0.00	-0.01	[-0.04, 0.02]	-0.02	-0.02	[-0.05, 0.01]	-0.01	0.06	[0.03, 0.10]	-0.03	0.00	[-0.03, 0.04]	0.01
No Event	-0.05	[-0.07, -0.03]		0.01	[-0.01, 0.02]		-0.01	[-0.03, 0.01]		0.09	[0.07, 0.11]		-0.01	[-0.02, 0.01]	
Death of Parent															
Event	-0.04	[-0.06, -0.01]	0.02	-0.05	[-0.07, -0.02]	-0.01	-0.02	[-0.05, 0.00]	0.00	0.12	[0.09, 0.15]	0.04	0.01	[-0.02, 0.04]	0.02
No Event	-0.05	[-0.06, -0.04]		-0.04	[-0.05, -0.03]		-0.02	[-0.04, -0.01]		0.09	[0.08, 0.10]		-0.01	[-0.02, 0.01]	
Unemployment															
Event	-0.04	[-0.06, -0.01]	0.04	-0.02	[-0.04, 0.00]	0.02	-0.03	[-0.05, -0.00]	-0.00	0.09	[0.06, 0.12]	-0.00	-0.03	[-0.06, -0.00]	-0.01
No Event	-0.06	[-0.07, -0.05]		-0.03	[-0.04, -0.01]		-0.02	[-0.04, -0.01]		0.09	[0.08, 0.11]		-0.02	[-0.04, -0.00]	
Retirement															
Event	-0.04	[-0.07, -0.01]	0.01	-0.09	[-0.11, -0.06]	-0.05	-0.01	[-0.04, 0.02]	0.03	0.08	[0.05, 0.12]	-0.02	-0.02	[-0.05, 0.01]	-0.03
No Event	-0.05	[-0.07, -0.03]		-0.06	[-0.07, -0.04]		-0.04	[-0.06, -0.02]		0.10	[0.08, 0.12]		0.00	[-0.02, 0.03]	
First Job															
Event	-0.04	[-0.09, 0.01]	0.00	0.12	[0.07, 0.17]	0.03	0.01	[-0.04, 0.07]	0.01	0.09	[0.03, 0.15]	-0.00	-0.03	[-0.09, 0.02]	0.01
No Event	-0.04	[-0.08, -0.01]		0.09	[0.06, 0.13]		0.01	[-0.03, 0.05]		0.09	[0.05, 0.14]		-0.05	[-0.09, -0.01]	

Note:
Cohen's d is calculated by dividing the difference in mean slope between groups by the standard deviation of the random intercepts of personality scores in 2005 of the control group. UI = uncertainty interval. Bolded values represent estimated mean differences in change between groups whose 95% UI's do not overlap with 0.

Table 3.4: Effects of Specific Events on the Mean-Level Change (Slope) of Personality Based on Multilevel Growth Models

A		C		E		N		O	
b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d
Marriage									
-0.02 [-0.06, 0.02]	-0.02	-0.01 [-0.05, 0.02]	-0.02	0.01 [-0.02, 0.04]	0.02	-0.01 [-0.06, 0.03]	-0.02	-0.01 [-0.05, 0.03]	-0.02
Moved in with Partner									
-0.03 [-0.06, 0.01]	-0.03	0.01 [-0.03, 0.04]	0.01	-0.00 [-0.04, 0.03]	-0.01	0.03 [-0.01, 0.07]	0.04	-0.01 [-0.05, 0.03]	-0.01
Divorce									
0.02 [-0.04, 0.07]	0.02	0.05 [-0.01, 0.10]	0.08	-0.00 [-0.05, 0.05]	-0.00	0.03 [-0.03, 0.10]	0.04	0.01 [-0.05, 0.07]	0.02
Separation from Partner									
0.01 [-0.03, 0.04]	0.01	**0.05 [0.01, 0.09]**	**0.08**	0.01 [-0.02, 0.05]	0.02	0.03 [-0.02, 0.07]	0.03	0.03 [-0.01, 0.07]	0.03
Death of spouse									
0.01 [-0.05, 0.07]	0.02	0.05 [-0.01, 0.10]	0.08	-0.04 [-0.09, 0.02]	-0.07	0.04 [-0.03, 0.11]	0.05	-0.01 [-0.08, 0.06]	-0.01
Leaving Parental Home									
-0.03 [-0.10, 0.03]	-0.04	0.02 [-0.03, 0.08]	0.04	-0.03 [-0.09, 0.03]	-0.05	-0.01 [-0.08, 0.06]	-0.02	-0.01 [-0.08, 0.05]	-0.01
Child Leaves Home									
-0.03 [-0.06, -0.00]	**-0.04**	0.01 [-0.02, 0.03]	0.01	-0.02 [-0.05, 0.00]	-0.04	-0.01 [-0.04, 0.03]	-0.01	-0.00 [-0.04, 0.03]	-0.00
Birth of Child									
-0.01 [-0.05, 0.03]	-0.01	-0.00 [-0.03, 0.03]	-0.00	-0.02 [-0.05, 0.02]	-0.02	-0.02 [-0.07, 0.02]	-0.03	0.01 [-0.03, 0.05]	0.01
Death of Parent									
0.00 [-0.02, 0.03]	0.00	0.01 [-0.02, 0.04]	0.02	-0.01 [-0.03, 0.02]	-0.01	0.03 [-0.01, 0.06]	0.04	0.02 [-0.01, 0.05]	0.02
Unemployment									
-0.00 [-0.03, 0.03]	-0.00	0.02 [-0.00, 0.05]	0.04	0.01 [-0.01, 0.04]	0.02	-0.00 [-0.03, 0.03]	-0.00	-0.01 [-0.04, 0.02]	-0.01
Retirement									
0.03 [-0.01, 0.06]	0.03	0.01 [-0.03, 0.04]	0.01	-0.03 [-0.06, 0.00]	-0.05	-0.02 [-0.06, 0.03]	-0.02	-0.02 [-0.06, 0.02]	-0.03
First Job									
0.00 [-0.06, 0.07]	0.01	0.00 [-0.06, 0.06]	0.00	0.02 [-0.04, 0.08]	0.03	-0.00 [-0.08, 0.08]	-0.00	0.01 [-0.06, 0.08]	0.01

Note:
Cohen's d is calculated by dividing the difference in mean personality between groups in 2005 by the standard deviation of the random intercepts of personality scores in 2005 of the control group. UI = uncertainty interval. Bolded values represent estimated mean differences between groups whose 95% UI's do not overlap with 0.

Table 3.5: Effects of Specific Events on the Mean-Level Personality Based on Multilevel Growth Models

A		C		E		N		O	
b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d
Marriage									
0.06 [-0.01, 0.14]	0.08	-0.02 [-0.09, 0.04]	-0.04	-0.00 [-0.07, 0.06]	-0.00	-0.04 [-0.13, 0.04]	-0.05	0.01 [-0.07, 0.10]	0.02
Moved in with Partner									
0.11 [0.03, 0.19]	**0.13**	0.01 [-0.05, 0.08]	0.02	**-0.09 [-0.15, -0.02]**	**-0.15**	-0.05 [-0.13, 0.04]	-0.06	0.07 [-0.01, 0.16]	0.09
Divorce									
0.02 [-0.10, 0.14]	0.03	0.01 [-0.10, 0.11]	0.01	0.03 [-0.07, 0.13]	0.05	-0.05 [-0.19, 0.09]	-0.06	0.01 [-0.12, 0.14]	0.01
Separation from Partner									
0.04 [-0.04, 0.12]	0.05	-0.02 [-0.08, 0.05]	-0.03	-0.02 [-0.09, 0.04]	-0.04	-0.03 [-0.12, 0.05]	-0.04	0.02 [-0.06, 0.10]	0.03
Death of spouse									
-0.01 [-0.13, 0.11]	-0.01	0.02 [-0.09, 0.12]	0.03	0.02 [-0.08, 0.12]	0.03	-0.05 [-0.18, 0.08]	-0.06	-0.08 [-0.22, 0.05]	-0.10
Leaving Parental Home									
-0.00 [-0.13, 0.13]	-0.00	-0.00 [-0.11, 0.10]	-0.01	-0.05 [-0.17, 0.06]	-0.08	-0.10 [-0.23, 0.04]	-0.13	0.00 [-0.13, 0.14]	0.00
Child Leaves Home									
0.03 [-0.03, 0.08]	0.03	0.01 [-0.04, 0.06]	0.02	0.03 [-0.01, 0.08]	0.06	0.01 [-0.06, 0.07]	0.01	0.02 [-0.04, 0.08]	0.02
Birth of Child									
0.03 [-0.05, 0.10]	0.03	0.02 [-0.05, 0.08]	0.03	0.00 [-0.06, 0.06]	0.00	-0.02 [-0.09, 0.06]	-0.02	-0.03 [-0.11, 0.04]	-0.04
Death of Parent									
-0.02 [-0.08, 0.04]	-0.03	-0.02 [-0.07, 0.03]	-0.03	0.01 [-0.04, 0.05]	0.01	-0.01 [-0.07, 0.05]	-0.02	-0.00 [-0.06, 0.06]	-0.00
Unemployment									
0.00 [-0.06, 0.06]	0.00	-0.01 [-0.06, 0.04]	-0.02	**-0.06 [-0.11, -0.02]**	**-0.11**	-0.05 [-0.11, 0.01]	-0.07	0.02 [-0.04, 0.07]	0.02
Retirement									
-0.07 [-0.15, 0.00]	-0.09	**0.09 [0.03, 0.16]**	**0.14**	-0.01 [-0.07, 0.05]	-0.02	**-0.11 [-0.19, -0.02]**	**-0.13**	-0.04 [-0.12, 0.04]	-0.05
First Job									
0.02 [-0.12, 0.15]	0.02	0.05 [-0.06, 0.17]	0.09	-0.07 [-0.19, 0.05]	-0.10	0.04 [-0.10, 0.19]	0.05	0.05 [-0.08, 0.19]	0.07

Note:
Cohen's d is calculated by dividing the difference in mean personality change between groups in 2005 by the standard deviation of the random intercepts of personality scores in 2005 of the control group. UI = uncertainty interval.
Bolded values represent estimated mean differences between groups whose 95% UI's do not overlap with 0.

Table 3.6: Variance Terms

	A		C		E		N		O	
	b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d	b [UI]	d
Mean										
τ_{01}	-0.24	[-0.28, -0.20]	-0.25	[-0.30, -0.20]	-0.17	[-0.22, -0.11]	-0.27	[-0.31, -0.23]	-0.20	[-0.24, -0.15]
τ_{00}	0.79	[0.77, 0.82]	0.49	[0.47, 0.50]	0.44	[0.42, 0.46]	0.84	[0.81, 0.87]	0.87	[0.84, 0.90]
τ_{11}	0.04	[0.03, 0.05]	0.03	[0.02, 0.04]	0.03	[0.02, 0.03]	0.06	[0.05, 0.07]	0.04	[0.04, 0.05]
σ^2	0.46	[0.45, 0.47]	0.45	[0.44, 0.46]	0.39	[0.38, 0.39]	0.59	[0.58, 0.61]	0.57	[0.56, 0.59]
Marriage										
σ^2	0.46	[0.44, 0.52]	0.45	[0.43, 0.46]	0.40	[0.37, 0.45]	0.60	[0.57, 0.67]	0.55	[0.53, 0.57]
τ_{00}	0.82	[0.73, 0.90]	0.50	[0.46, 0.53]	0.49	[0.40, 0.55]	0.87	[0.77, 0.96]	0.83	[0.79, 0.88]
τ_{01}	0.05	[0.03, 0.07]	0.02	[0.01, 0.03]	0.03	[0.02, 0.05]	0.07	[0.05, 0.09]	0.03	[0.02, 0.05]
τ_{11}	-0.21	[-0.33, -0.12]	-0.21	[-0.35, -0.03]	-0.28	[-0.39, -0.20]	-0.27	[-0.37, -0.19]	-0.14	[-0.23, -0.02]
Moved in with Partner										
σ^2	0.45	[0.44, 0.47]	0.44	[0.42, 0.48]	0.39	[0.37, 0.43]	0.59	[0.57, 0.61]	0.55	[0.53, 0.57]
τ_{00}	0.82	[0.78, 0.87]	0.47	[0.41, 0.52]	0.49	[0.43, 0.54]	0.90	[0.85, 0.94]	0.83	[0.79, 0.88]
τ_{01}	0.04	[0.03, 0.05]	0.03	[0.01, 0.05]	0.03	[0.02, 0.05]	0.06	[0.04, 0.07]	0.04	[0.03, 0.06]
τ_{11}	-0.15	[-0.22, -0.07]	-0.21	[-0.34, -0.10]	-0.28	[-0.39, -0.20]	-0.25	[-0.31, -0.18]	-0.18	[-0.26, -0.09]
Divorce										
σ^2	0.49	[0.46, 0.55]	0.44	[0.41, 0.46]	0.36	[0.34, 0.38]	0.57	[0.54, 0.61]	0.54	[0.51, 0.56]
τ_{00}	0.71	[0.60, 0.79]	0.52	[0.47, 0.57]	0.42	[0.38, 0.46]	0.97	[0.89, 1.06]	0.77	[0.71, 0.84]
τ_{01}	0.01	[0.00, 0.05]	0.01	[0.00, 0.03]	0.03	[0.01, 0.04]	0.06	[0.04, 0.09]	0.01	[0.00, 0.03]
τ_{11}	0.03	[-0.37, 0.61]	-0.11	[-0.47, 0.41]	-0.13	[-0.28, 0.10]	-0.26	[-0.36, -0.14]	0.17	[-0.24, 0.75]
Separation from Partner										
σ^2	0.46	[0.45, 0.48]	0.45	[0.43, 0.46]	0.39	[0.38, 0.40]	0.62	[0.58, 0.73]	0.55	[0.52, 0.60]
τ_{00}	0.84	[0.80, 0.89]	0.51	[0.48, 0.54]	0.48	[0.45, 0.51]	0.82	[0.67, 0.93]	0.79	[0.71, 0.86]
τ_{01}	0.04	[0.02, 0.05]	0.02	[0.01, 0.03]	0.03	[0.02, 0.04]	0.06	[0.04, 0.10]	0.04	[0.02, 0.07]
τ_{11}	-0.16	[-0.24, -0.08]	-0.25	[-0.39, -0.10]	-0.26	[-0.33, -0.17]	-0.25	[-0.40, -0.15]	-0.11	[-0.20, 0.00]
Death of Spouse										
σ^2	0.50	[0.47, 0.53]	0.50	[0.48, 0.53]	0.43	[0.41, 0.45]	0.61	[0.58, 0.64]	0.65	[0.62, 0.69]
τ_{00}	0.74	[0.67, 0.81]	0.50	[0.45, 0.55]	0.41	[0.37, 0.45]	0.91	[0.83, 1.00]	0.95	[0.87, 1.04]
τ_{01}	0.03	[0.01, 0.05]	0.01	[0.00, 0.03]	0.01	[0.00, 0.03]	0.06	[0.03, 0.09]	0.05	[0.02, 0.08]
τ_{11}	-0.31	[-0.48, -0.15]	-0.20	[-0.65, 0.34]	-0.02	[-0.32, 0.47]	-0.31	[-0.43, -0.20]	-0.30	[-0.42, -0.17]
Leaving Parental Home										
σ^2	0.47	[0.44, 0.50]	0.44	[0.42, 0.47]	0.41	[0.38, 0.43]	0.62	[0.59, 0.66]	0.57	[0.54, 0.61]
τ_{00}	0.86	[0.78, 0.94]	0.45	[0.40, 0.50]	0.61	[0.55, 0.68]	0.84	[0.75, 0.93]	0.81	[0.73, 0.89]
τ_{01}	0.04	[0.02, 0.07]	0.01	[0.00, 0.03]	0.04	[0.02, 0.06]	0.06	[0.03, 0.09]	0.02	[0.00, 0.05]
τ_{11}	-0.21	[-0.33, -0.07]	-0.07	[-0.53, 0.58]	-0.39	[-0.49, -0.28]	-0.16	[-0.31, 0.06]	-0.11	[-0.43, 0.37]
Child Leaves Home										
σ^2	0.48	[0.44, 0.55]	0.44	[0.43, 0.46]	0.37	[0.36, 0.38]	0.58	[0.56, 0.59]	0.59	[0.54, 0.72]
τ_{00}	0.70	[0.59, 0.81]	0.51	[0.49, 0.54]	0.41	[0.39, 0.43]	0.89	[0.85, 0.93]	0.78	[0.58, 0.91]
τ_{01}	0.05	[0.03, 0.07]	0.03	[0.02, 0.04]	0.03	[0.02, 0.04]	0.07	[0.06, 0.08]	0.05	[0.03, 0.10]
τ_{11}	-0.22	[-0.35, -0.15]	-0.22	[-0.28, -0.15]	-0.13	[-0.21, -0.03]	-0.27	[-0.31, -0.22]	-0.23	[-0.38, -0.15]
Birth of Child										
σ^2	0.47	[0.45, 0.53]	0.46	[0.44, 0.48]	0.38	[0.36, 0.39]	0.60	[0.56, 0.70]	0.54	[0.51, 0.60]
τ_{00}	0.83	[0.72, 0.89]	0.47	[0.43, 0.50]	0.51	[0.48, 0.54]	0.82	[0.66, 0.93]	0.79	[0.70, 0.87]
τ_{01}	0.04	[0.03, 0.07]	0.01	[0.00, 0.02]	0.03	[0.02, 0.04]	0.07	[0.05, 0.10]	0.05	[0.03, 0.08]
τ_{11}	-0.17	[-0.25, -0.08]	-0.02	[-0.28, 0.43]	-0.30	[-0.37, -0.22]	-0.28	[-0.42, -0.20]	-0.20	[-0.33, -0.10]
Death of Parent										
σ^2	0.47	[0.44, 0.55]	0.45	[0.43, 0.51]	0.40	[0.37, 0.46]	0.63	[0.57, 0.81]	0.57	[0.55, 0.62]
τ_{00}	0.76	[0.65, 0.83]	0.48	[0.40, 0.54]	0.37	[0.30, 0.45]	0.76	[0.52, 0.93]	0.83	[0.74, 0.89]
τ_{01}	0.04	[0.03, 0.07]	0.03	[0.02, 0.05]	0.03	[0.02, 0.05]	0.07	[0.05, 0.12]	0.04	[0.03, 0.07]
τ_{11}	-0.22	[-0.32, -0.16]	-0.23	[-0.32, -0.15]	-0.20	[-0.36, -0.09]	-0.27	[-0.43, -0.21]	-0.19	[-0.26, -0.13]
Unemployment										
σ^2	0.48	[0.44, 0.55]	0.46	[0.45, 0.47]	0.41	[0.38, 0.46]	0.63	[0.59, 0.72]	0.57	[0.54, 0.67]
τ_{00}	0.78	[0.67, 0.86]	0.51	[0.48, 0.53]	0.43	[0.37, 0.50]	0.78	[0.64, 0.88]	0.77	[0.65, 0.89]
τ_{01}	0.05	[0.04, 0.09]	0.02	[0.01, 0.03]	0.03	[0.02, 0.05]	0.06	[0.04, 0.10]	0.06	[0.04, 0.09]
τ_{11}	-0.22	[-0.32, -0.14]	-0.23	[-0.31, -0.12]	-0.27	[-0.43, -0.17]	-0.24	[-0.36, -0.16]	-0.22	[-0.38, -0.12]
Retirement										
σ^2	0.44	[0.43, 0.46]	0.45	[0.43, 0.46]	0.39	[0.37, 0.40]	0.62	[0.59, 0.68]	0.58	[0.56, 0.60]
τ_{00}	0.83	[0.78, 0.88]	0.57	[0.53, 0.61]	0.43	[0.40, 0.46]	0.93	[0.83, 1.02]	0.97	[0.91, 1.03]
τ_{01}	0.04	[0.03, 0.06]	0.02	[0.01, 0.04]	0.03	[0.01, 0.04]	0.07	[0.05, 0.09]	0.04	[0.03, 0.06]
τ_{11}	-0.31	[-0.37, -0.24]	-0.28	[-0.38, -0.16]	-0.13	[-0.23, 0.01]	-0.30	[-0.37, -0.23]	-0.27	[-0.35, -0.19]
First Job										
σ^2	0.50	[0.46, 0.54]	0.44	[0.41, 0.48]	0.43	[0.40, 0.47]	0.64	[0.59, 0.69]	0.55	[0.51, 0.59]
τ_{00}	0.84	[0.75, 0.93]	0.48	[0.41, 0.54]	0.62	[0.55, 0.70]	0.85	[0.75, 0.96]	0.76	[0.68, 0.86]
τ_{01}	0.04	[0.01, 0.07]	0.02	[0.00, 0.05]	0.04	[0.01, 0.06]	0.06	[0.02, 0.10]	0.03	[0.00, 0.06]
τ_{11}	-0.14	[-0.32, 0.13]	-0.23	[-0.51, 0.18]	-0.35	[-0.51, -0.18]	-0.17	[-0.34, 0.08]	0.02	[-0.24, 0.50]

4. Discussion

We set out to examine the relationship between personality and life events by teasing apart selection and socialization processes. We applied one of the broadest and most rigorous tests of the bi-directional influence of personality and life events by using a well-matched control group to account for selection biases and reverse causality. The results paint a more optimistic picture for personality's influence on life events than life events' power on personality. When using matched samples, some selection effects and nearly all socialization effects are attenuated – personality's predictive power is reduced and life events' influence on personality is almost eliminated. We found only a relatively small number of selection and an even smaller number of socialization effects, including greater Agreeableness predicting separating from a partner when controlling for background characteristics and separating from a partner predicting greater increases in Agreeableness when controlling for both background characteristics and baseline personality.

4.1 Personality-Life Event Selection

Consistent with previous research (e.g. Lehnart & Neyer, 2006; Lüdtke et al., 2011; Specht et al., 2011; Wagner et al., 2015), we found selection effects. Importantly, these were not cross-sectional, concurrent selection effects but longitudinal effects. Moreover, we examined whether personality predicted life events while controlling for a large number of background characteristics that also relate to personality and personality development.

Personality predicted the experience of life events at later time points, even when matched on a large set of covariates. In the unmatched sample, at least one personality domain predicted each of the 12 life events except the death of a parent. But 22 of the 36 selection effects in the unmatched sample were attenuated when the samples were matched on background characteristics. However, despite this attenuation, in the matched sample, personality still exhibited 15 selection effects (one effect, Neuroticism predicting lower odds of participants moving out of their parents' homes, was present only in the matched sample) and predicted all events except divorce, the birth of a child, the death of a parent, and the death of a partner.

In line with previous research, Extraversion predicted moving in with and marrying a partner (Specht et al., 2011). These selection effects held in both the matched and unmatched sample. Intriguingly, contrary to evidence suggesting that Extraversion is tied to relationship maintenance (Mund & Neyer, 2014; Neyer & Lehnart, 2007; Wilson, Harris, & Vazire, 2015) and closeness (Dyrenforth, Kashy, Donnellan, & Lucas, 2010; Malouff et al., 2010), Extraversion also predicted separating from one's partner, suggesting that more Extraverted people are more likely to both start and maintain relationships as well as to end them.

It is not clear, however, whether features of separation may influence the process through which Extraversion influences both the likelihood of relationship maintenance and termination. Different facets of Extraversion might relate to separation depending on whether who initiated the separation. The social dominance facet of Extraversion, for example, might lead to relationship conflict that results in being broken up with, while risk-taking and assertiveness facets of Extraversion might lead to initiating break-ups with a partner. The same could be said for Extraversion's association with relationship maintenance. The sociability facet may predict the likelihood of meeting potential partners in the first place, while positive affect components might help to maintain the relationship. Future research should investigate how (1) facets of personality relate to events and how

(2) different roles in those events may be differentially related to personality.

In some cases, attenuated selection effects may have been the result qualitative differences among those who did or did not experience events that matching could not account for. Indeed, several of the attenuated effects are inconsistent with past evidence. In contrast to previous research (Jokela, Kivimäki, Elovainio, & Keltikangas-Järvinen, 2009; van Scheppingen et al., 2016), for example, we found that Conscientiousness predicted lower odds of having a child, but that this effect disappeared when using matched samples. Moreover, in line with some (Specht et al., 2011) but not most previous research (Roberts et al., 2003), Conscientiousness was negatively associated with starting a first job in both samples, although the magnitude was attenuated significantly in the matched sample. This finding may be a side effect of aspects of the data collection process. Participants entered the study at a minimum of 18 years old, at which point many were likely to have work experience, perhaps particularly those higher in Conscientiousness (Bleidorn et al., 2013). Thus, Conscientious people could have been very unlikely to start a first job while participating in the study because they may already have had their first jobs prior to entering the study. This could have created differences between those classified as having started their first job between 2006 and 2013 that could not be accounted for using the propensity matching score procedure. Indeed, of all events, achieving balance for matching those who had or had not started first jobs required greatly reducing the caliper width for propensity score matching to create balance among those who had or had not started their first job on both Conscientiousness and Openness to Experience.

There are several possible explanations for the attenuation of selection effects following matching. First, in the absence of accounting for background characteristics, research on selection effects between personality and life events may greatly over-exaggerate personality's influence. On the whole, the attenuation of selection effects when using matched samples highlights the importance of accounting for demographics – such as age, gender, socioeconomic status, and parental characteristics – in studying

personality's influence across the lifespan (Roberts et al., 2007) to reduce over-exaggeration of its unique predictive power.

On the other hand, over-controlling for baseline differences may be just as problematic as under-controlling for them. By matching participants on more than 50 background characteristics, we may have "over-controlled" for baseline differences. In the present study, many of the background characteristics have been posited as mechanisms of personality's influence on different outcomes (Hampson, Goldberg, Vogt, & Dubanoski, 2007). For example, people who are higher in Conscientiousness tend to be more educated (Hampson et al., 2007), have better jobs (Judge et al., 1999; Roberts et al., 2011), and more access to healthcare (B. Friedman, Veazie, Chapman, Manning, & Duberstein, 2013) in part because education provides access to jobs that often provide better healthcare programs (e.g. Adler & Newman, 2002). Thus, controlling for education may actually attenuate Conscientiousness's prediction of health outcomes, like heart disease. As such, we may have "overcontrolled" for some variables in accounting for selection bias, making our results represent a conservative test of selection effects of personality and life events. Clearly personality does uniquely predict some events, even when possibly "overcontrolling" for background characteristics.

The paucity of lifespan personality and life event data warrants a search for other methodological techniques that may help to disentangle whether the matching procedure over- or under-exaggerates personality's influence on life events. Although we demonstrate that accounting for a number of background covariates is important, we did not address which background characteristics were most predictive of different life events in the matching procedure. New machine learning techniques that maximize prediction, minimize overfitting, and retain only key predictors – such as regularization, random forests, and support vector machines – offer new pathways for investigating how such characteristics predict personality (e.g. Kosinski, Wang, Lakkaraju, & Leskovec, 2016; Yarkoni & Westfall, 2017). Utilizing such techniques in the study of personality and life event selection may

yield important insights about the processes through which selection effects occur.
In sum, failing to account to baseline differences that are also associated with personality may over- or under-exaggerate its unique predictive power. However, despite the fact that selection effects were attenuated, the fact that nearly half of the selection effects remained after matching should not be ignored and suggests that personality's power is real, strong, and persistent.

4.2 Life Event-Personality Socialization

To examine if personality changes after the experience of life events when controlling for selection bias, we compared personality change between those who did or did not experience events over 10 years. We anticipated four possible trajectories of change (normative development, arrested development, retrogression, and accelerated maturation) that might have different implications throughout the lifespan. As a whole, the pattern of results supports the normative development hypothesis. The personalities of those who experienced life events did not change differently than those who did not. Indeed, with matching, only two socialization effects remained: separating from a partner predicted Agreeableness change and a child leaving home predicted Extraversion change. Of the two, only the Agreeableness-separation link converges with prior research (Specht et al., 2011). Relative to those who did not separate from their partners, people who did showed arrested development: non-separated individuals showed significant declines in Agreeableness, while separated individuals showed virtually none. On the other hand, a child leaving home showed a small retrogressive effect: empty nesters decreased in Extraversion over eight years while others showed almost no change in Extraversion (the expected normative pattern of change).

Because the present work was observational and additional information about characteristic features of the events were largely absent from the GSOEP, we can only

speculate as to why these socialization effects appeared. One possible interpretation of the relationship between separating from one's partner and Agreeableness is that the period prior to separating from one's partner is marked by conflict that may make someone see him/herself as less Agreeable. After the relationship terminates and the fights end, s/he sees him/herself as more Agreeable. The link between having a child move out and Extraversion, in contrast, may be due to changes in obligations associated with child rearing. Family-oriented activities are often a key feature of parenthood. Once children move out of the house, the activities and obligations are reduced, and parents may become less Extraverted (e.g. Nema & Bansal, 2015).

More broadly, there are several possible interpretations of why only two of the 60 socialization effects appeared. First, life events, which are often thought to be the driver of normative change and personality change, may not influence personality. Instead, personality may be stable and extremely difficult to change (c.f. Costa & McCrae, 1988). Given evidence of interindividual differences in personality change (Mroczek & Spiro III, 2003) and mounting evidence of the importance of personality change on other outcomes, such as mortality (Turiano et al., 2011), self-rated health (Mroczek & Spiro III, 2003), and life satisfaction (Mroczek & Spiro III, 2005), concluding that personality is not greatly affected by significant life events seems unsatisfactory.

A more satisfying explanation of the lack of socialization effects after matching concerns issues of the measurement of life events, to which the bulk of the work on personality change and life events pays little attention to defining in a nuanced way. In most cases, life events are defined as checkbox items from a large, national, longitudinal study. These surveys emphasize broad, population-level patterns and are rarely designed to study the effect of life events on the psychology of an individual. As such, most lack additional information about the participants' subjective responses to or evaluations of the events. Understanding subjective responses to life events is desirable and important because life events cannot be experimentally manipulated in a laboratory but must be

observed over time. Indeed, evidence from the study of resilience suggests that subjective interpretation does matter. Subjective evaluations of traumatic events influence "recovery" across follow-ups. In one longitudinal study of memory of traumatic experiences of 9/11, recovering and resilient individuals showed changes in their recollection of 9/11, such that their memories of the trauma became more benign over time (Dekel & Bonanno, 2013). Individuals who experienced more post-traumatic distress that remained chronic showed stably traumatic memory recollection over time. Such evidence highlights the importance of collecting subjective evaluations of events. All of the individuals in the study would have been characterized as "9/11 survivors" using the criteria we used in this study to define life events, despite the fact that there were distinct differences in their responses to the event that had significance for their lives.

Memory differences among those on different resilience trajectories additionally highlights the importance of examining trajectories of change. In the present study, we examined linear change between groups who had or had not experienced life events during the study period. We did not account for the interval between the measurement of personality and the experience of a life event, despite evidence that change following life events may not only be curvilinear (e.g. Specht et al., 2011) but also non-linear (e.g. Schwaba & Bleidorn, 2018), and that linearity may not be the same across different traits (Schwaba & Bleidorn, 2018) or events (Roberts et al., 2017).

The study of resilience offers due cause to test for non-linear change following events. In response to traumatic life events, non-linear change (e.g. immediate disruption following an event) is not only expected but also considered a key predictor of long-term change (Bonanno, 2004). Moreover, depending on the type of event, different degrees and direction of change may be healthier than others, which some resilience research breaks down into four response pathways following interpersonal loss or potentially traumatic events: chronic, delayed, recovery, and resilience pathways (Bonanno, 2004). These pathways are differentiated both by the magnitude of the person's initial disruption following the life

event (non-linear change), as well as the degree and direction of change in that disruption over time (linear or non-linear). For example, someone on a recovery pathway is initially very disrupted following an event but shows steady declines over time. Someone on a delayed pathway, in contrast, shows almost no initial disruption with increasing disruption over time. If measuring individual differences in change by only accounting for whether an event was experienced or not, it is impossible to distinguish among the four trajectories, despite the fact that the social and psychological mechanisms underlying each are different.

To further clarify why this may be the case, consider the three fictional trajectories of change in Figure 4.1. The left panel shows each individuals' average linear change trajectory over time, while the right panel shows the non-linear change trajectories of the same centered at the time at which the event occurred. In the left panel, the three individuals appear to be on quite different change trajectories. Indeed, each individual's personality changes in different directions, on average. In the left panel, in contrast, centering on the timing of the event makes it clear that they are on similar trajectories. The measured outcome decreases before an event and increases after. Although this example is fictional, it highlights how non-linear patterns can be masked, which, in turn, has strong implications for our understanding of the relationship between personality change and life events.

4.3 Change Processes

Understanding the processes through which personality changes and develops may help to elucidate the reduction in the number of socialization effects present when matched samples are used. For example, in the context of bereavement, factors such as relationship length and quality and the circumstances surrounding the loss greatly influence the "health" of different patterns of change (e.g.; Safer, Bonanno, & Field, 2001). In personality, personality change is clearly influenced by a variety of factors, including

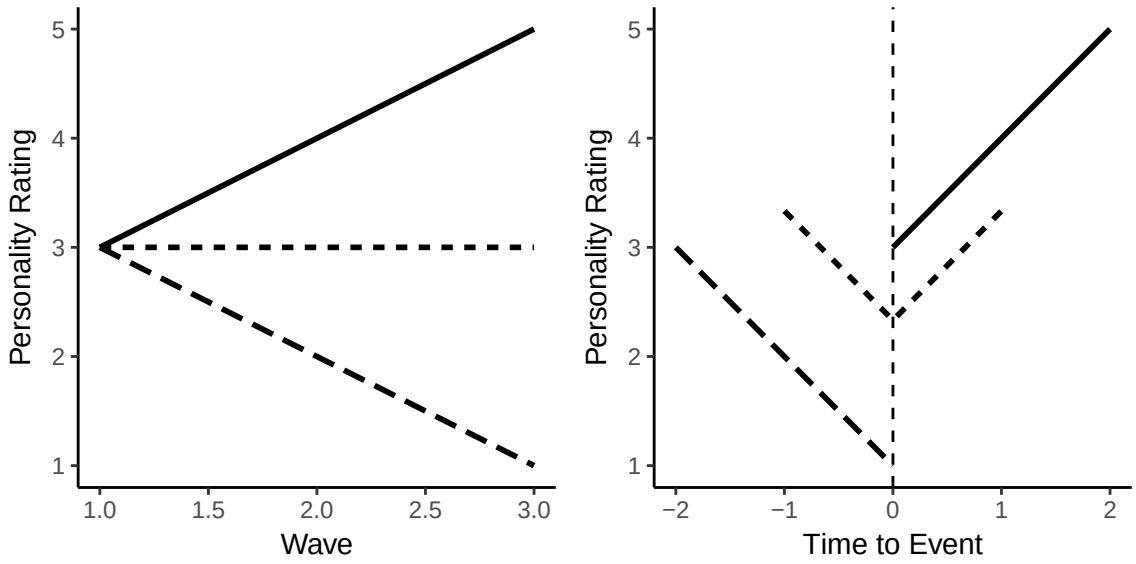

Figure 4.1: Hypothetical estimated intraindividual change estimates for a linear model centered on the first wave (left panel) and a piecewise linear model centered on the timing of an event (right panel).

personality itself (e.g. Kandler et al., 2010), which likely influences both the pattern of observed change and its implications for the individual.

We found little evidence that life events influence personality in a top-down manner. When controlling for background characteristics and selection biases, nearly all socialization effects of life events on personality are attenuated. This may suggest that life events influence personality in a more bottom-up manner that is not captured in the present study (e.g. Wrzus & Roberts, 2017). From the perspective of the TESSERA framework, life events are only one (*T*riggering situations) of the short-term processes that may trigger long-term personality change. But this leaves three other processes (*E*xpectancies, *S*tates/*S*tate *E*xpressions, and *Re*A*c*tions) that might clarify the relationship between life events and personality.

Examination of *E*xpectancies, *S*tates/*S*tate *E*xpressions, and *Re*A*c*tions may help to identify processes that influence personality similarly across events in a bottom-up manner. For example, *Re*A*c*tions provide reinforcement of *S*tates/*S*tate *E*xpressions, making them more likely in the future (Wrzus & Roberts, 2017). If individuals encounter differing

responses to their state expressions following the occurrence of a life event, this may lead to very different trajectories. In the present study, we found little evidence of the influence of the death of a loved one (i.e. parent, partner) as a *T*riggering situation of personality change. But the influence of *ReA*ctions on dispositional change have been thoroughly studied in the context of bereavement (e.g Bonanno, 2008; Bonanno & Kaltman, 1999) and suggests that others' reactions are critical. In western, industrialized nations, most believe that "grief work" needs to be done following the death of loved one (M. Stroebe & Stroebe, 1991). Those who do not engage in grief work are likely to experience negative *ReA*ctions to their behavior, which may encourage grief work. But there is little research supporting the efficacy of grief work for bereaved individuals (e.g. Wortman & Silver, 1989), and even some evidence that it may be harmful for some (Bonanno & Kaltman, 1999). Thus, change following the death of a loved one may depend on the reactions of others to the bereaved's use of grief work. In sum, although *T*riggering situations appear to have limited influence on personality change, *E*xpectancies, *S*tates/*S*tate *E*xpressions, and *ReA*ctions are important areas for future investigations of personality change.

4.4 Implications and Limitations

The attenuation of selection and socialization effects when accounting for background characteristics has strong implications for the study of personality and personality development, which fall into roughly three categories: considerations of pragmatics, measurement, and time.

First, and most pragmatically, researchers need to account for background characteristics when examining the relationship between personality and life events. For selection effects, for example, we saw that 22 of 36 selection effects were eliminated but only 1 selection effect appeared that was not also in the unmatched sample. This suggests that much of the work linking personality with different events and outcomes may greatly

over-exaggerate personality's role in the likelihood of experiencing events (Roberts et al., 2007). In other words, our results can be seen as a lesson in prediction - we cannot rely on a single predictor (personality) to predict who will experience a life event. Instead, we need to rely on a model that accounts for many predictors while not sacrificing power or generalizability (Tibshirani, 1996; Yarkoni & Westfall, 2017).

Second, change may have been masked in retrospective reports. Despite that bottom-up behavioral change may be a key process of personality change, personality was measured through retrospective self-reports in which participants indicated their behavior on average. In other words, "real" behavior in-situ was not measured. Recent research examining longitudinal patterns of change in state (behavioral) averages of personality relative to trait (dispositional) reports of personality suggest that state measures may capture change missed in broad, retrospective reports of personality (Beck & Jackson, 2018b). Moreover, additional evidence using idiographic networks of personality suggests that personality structure of multivariate time series may vary greatly at the individual level (Beck & Jackson, 2018a) and that individual differences in network structure predict consequential outcomes, like GPA (Beck & Jackson, 2018c) and life satisfaction (Cheung, Beck, & Jackson, 2018), above and beyond traditional measures. Thus, the present study might have failed to capture patterns of change on the behavioral level by relying on retrospective self-reports. In addition, state assessments in which people directly report their behavior would be particularly well-suited to capturing whether behavioral change actually follows an event and mediates the relationship between life events and personality change (c.f. Leemput et al., 2014).

Third, change may have been non-linear. In the present study, we did not account for spacing between personality measurement and life events experiences. But given evidence of both curvilinear (e.g. Specht et al., 2011) and non-linear (e.g. Schwaba & Bleidorn, 2018) change, future research should investigate nonlinear and curvilinear patterns of change to better understand possible mechanisms through which life events may influence personality.

Fourth, the measurement of life events in the GSOEP is limited in a number of ways. Our operationalization of life events experience merely assessed the presence or absence of events in individuals' lives. It did not capture either their personal responses – positive or negative – to them (Bonanno, 2004; Dekel & Bonanno, 2013) or their subjective interpretation of how much the event influenced their personalities and behavior (Allemand, Gomez, & Jackson, 2010). Given evidence that subjective evaluations of an event over time are related to both characteristics of memories of it and resilience trajectories (Dekel & Bonanno, 2013) measuring such psychological characteristics of other life events might help to elucidate the relationship between life events and personality change.

Moreover, we did not measure individuals in context or account for other aspects of their individual experiences. For example, several of the events under examination are not independent. Individuals who move in together may choose to get married, and married individuals are more likely to have children (Jokela et al., 2009). Each of these events may have some unique influence on personality, but their cumulative effect might be quite different than for someone who only experienced one of these events in this study (Roberts & Caspi, 2008; e.g. Kandler et al., 2010). Because we only accounted for background characteristics prior to 2005, the matching procedure does not account for the number of life events individuals in the sample experienced during the period under examination, which may influence patterns of change in unpredictable ways. Events may also mask each others' influence. For example, individuals who move in together before marriage may make fewer lifestyle and behavioral changes after marriage than those who do not (Willoughby, Carroll, & Busby, 2012).

4.5 Conclusions

Researchers have paid much attention to life events as impetuses of personality change, but there have been few large-scale investigations of relationships among

personality and life events. Among such investigations of selection and socialization effects between personality and life events, almost none have controlled for selection bias and reverse causality in examining socialization effects. The present study highlights the importance of accounting for selection bias in studying the bidirectional relationships between personality and life events. When accounting for selection bias and reverse causality, personality predicts a number of life events, but life events have almost no impact on personality change, suggesting that personality is an important predictor of life experiences that is quite stable and difficult to change.

A. Matching Variables

Below is a list of the variables used in the propensity score matching procedure. These variable names correspond to the names of the composited variables used in the matching procedure and available in the "match.dat.wide" data frame in the data.RData file included in the Supplementary Materials.

Category	Item	Item Text
Procedural	PROC_SID	Never Changing Person ID
Demographics	Dem_DOB	Year of Birth
Demographics	Dem_Sex	Sex
Procedural	PROC_household	household ID
Activities	Act_Volunteer	perform volunteer work
Background	Bkgr_DadPres	Father Present
Background	Bkgr_DisabStat	Disability Status of Individual
Background	Bkgr_Edu	Type of tertiary degree
Background	Bkgr_MarStat	Marital Status of individual
Background	Bkgr_MomPres	Mother Present

(continued)

Category	Item	Item Text
Background	Bkgr_PGovIncome	Pre-Government Income
Background	Bkgr_UrbOrRur	Spatial category by BBSR
Demographics	Dem_Race	Race of individual
Financial	Fnc_GrossSlry	Gross Amount Of Wages, Salary Prev. Yr
Financial	Fnc_HouseAssist	Housing Assistance
Financial	Fnc_StudGrnt	Student Grant
Financial	Fnc_UnempBen	unemployment benefit
Household	HH_BrothPres	Brother Present
Household	HH_ClnHlp	Cleaning Or Household Help In Household
Household	HH_CndHouse	Condition Of House
Household	HH_ColTV	Household Has Color Television
Household	HH_NumPer	Number Of Persons In Household
Household	HH_NumPer15to18	Number of hh members age 15-18
Household	HH_NumPerBel14	Number of hh members age 0-14
Household	HH_SisPres	Sister Present
Health	Hlth_BMI	Body Mass Index
Health	Hlth_BodPain	Bodily Pain (NBS)
Health	Hlth_EmoRole	Role Emotional (NBS)

(continued)

Category	Item	Item Text
Health	Hlth_GenHlth	General Health (NBS)
Health	Hlth_HeightCM	Body Height in cm
Health	Hlth_HlthInsr	Type Of Health Insurance
Health	Hlth_MntlHlth	Mental Health (NBS)
Health	Hlth_MntlSum	MCS: Summary Scale Mental (NBS)
Health	Hlth_NumDrVisits	Number of annual doctor visits
Health	Hlth_PhysFunc	Phyiscal Functioning (NBS)
Health	Hlth_PhysHlth	PCS: Summary Scale Physical
Health	Hlth_PhysProb	Accomplished Less Due To Physical Problems
Health	Hlth_PhysRole	Role Physical (NBS)
Health	Hlth_SocFunc	Social Functioning (NBS)
Health	Hlth_Vitality	Vitality (NBS)
Health	Hlth_WeightKG	Weight in kg
Psychological	Psych_LifeSat	Overall Life Satisfaction
Psychological	Psych_OthWorr	Other Worries
Psychological	Psych_SatFam	Satisfaction With Family Life
Psychological	Psych_SatHealth	Satisfaction with Health

(continued)

Category	Item	Item Text
Psychological	Psych_SatIncome	Satisfaction With Household Income
Psychological	Psych_SatSchool	Satisfaction With School Education and Vocational Retraining
Psychological	Psych_WorrCrm	Worried About Crime
Relationships	Rel_RelDad	Nature Of Relationship To Father
Relationships	Rel_RelMom	Nature Of Relationship To Mother
Social	Soc_SocGath	Attend Social Gatherings
Social	Soc_VisFam	Visit Family Members
Social	Soc_VisNghbr	Visit Neighbors, Friends

B. Big 5 Inventory-S

Below is a list of the personality variables used in the multiple imputation, propensity score matching, logistic regression, and multilevel growth curve modeling procedures.

Category	Item	Item Text
Big 5	BF_C1	Thorough Worker
Big 5	BF_E1	Am communicative
Big 5	BF_A1	Am sometimes too coarse with others
Big 5	BF_O1	Am original
Big 5	BF_N1	Worry a lot
Big 5	BF_A2	Able to forgive
Big 5	BF_C2	Tend to be lazy
Big 5	BF_E2	Am sociable
Big 5	BF_O2	Value artistic experiences
Big 5	BF_N2	Somewhat nervous
Big 5	BF_C3	Carry out tasks efficiently
Big 5	BF_E3	Reserved

(continued)

Category	Item	Item Text
Big 5	BF_A3	Friendly with others
Big 5	BF_O3	Have a lively imagination
Big 5	BF_N3	Deal well with stress

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